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GAP ANALYSIS OF CUSTOMER PERCEPTION AND SERVICE QUALITY USING SERVQUAL SCALE *A STUDY WITH SPECIFIC REFERENCE TO AMRITA INSTITUTE OF MEDICAL SCIENCES*

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Abstract

Health care industry is gaining much importance in the present world. Every human being, at least once in his lifetime has to visit a health care center. Even if the hospitals do not provide standard services, the customers (patients) are forced to avail them. So it is the prime duty of the service providers to make sure that the services provided by them are suitable and are as per the expectations of the customers (patients).

This study is done in one of the best hospitals of India, that is Amrita Institute of Medical Sciences. The study focuses on identifying the level of customer satisfaction attained by the services provided by the hospital and also there by finding the areas if any where the staff is required to be given training. In hospitals, the first interaction that a customer (patient) has is with the front office staff so the attitude and behavior of them should be very much customer friendly. This is the prior part that makes a person to either continue or discontinue availing the services provided by the hospital. When a customer visits an institution he has certain expectation and after the visit he creates a perception regarding them. In this study the gap between the customer expectation and perception would generate an idea regarding the satisfaction level. Lower the gap higher would be the satisfaction level and vice versa. And by deriving the gap it would be reliable and easy to determine the area where training is to be provided to the staff.

Objective of the study:

- To find, if the customer satisfaction is dependent on the five dimensions of SERVQUAL scale namely Reliability, Responsiveness, Assurance, Empathy, and Tangibles.
- To identify the gap between patient (customer) expectations and patient (customer) perceptions regarding the quality of services provided by the employees of Amrita Institute of Medical Sciences
- To identify the customer expectations and customer perceptions under five service quality dimensions of SERVQUAL scale ie Reliability, Responsiveness, Assurance, Empathy, Tangibles
- To identify the dimensions where improvement is required and also suggest some training recommendations required for the employees to minimize the service quality gap between customer expectation and perception at Amrita Institute of Medical Sciences.

Servqual scale:

Valarie A. Zeithaml, A Parasuraman, and Leonard L. Berry developed SERVQUAL scale in 1988 to judge an organization's service and quality performance against customer service quality needs. The SERVQUAL scale includes five dimensions. Within each dimension are several items measured on a seven point scale from strongly agree to strongly disagree. It is an instrument for assessing customer perceptions of service quality in service and retailing organizations. According to the above conception, perceived service quality can be expressed as follows:

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Perceived service quality = perceived service (P) – expected service (E)

Dimensions of SERVQUAL scale:

1) **Reliability**: Ability to perform the promised service dependably and accurately.
2) **Responsiveness**: Willingness to help customers and to provide prompt service.
3) **Assurance:** Employee's knowledge and courtesy and their ability to inspire trust and confidence.
4) **Empathy**: Caring and individualizing attention that firm provides to its customers.
5) **Tangibles**: Physical facilities, equipments and appearance of the personnel.

Usage of SERVQUAL Applications

- SERVQUAL is widely used within service industries to understand the perceptions of target customers regarding their service needs. And to provide a measurement of the service quality of the organization.
- SERVQUAL may also be applied internally to understand employees' perceptions of service quality, with the objective of achieving service improvement.

Model of Service Quality Gaps

There are seven major gaps in the service quality concept, which are shown in Figure 1. The model is an extension of Parasuraman SERVQUAL scale. According to the following explanation Gap1, Gap5 and Gap6 are the ones that organization has to measure, manage & minimize and since they have a direct relationship with customers.

Gap1: Customers' expectations versus management perceptions: as a result of the lack of a marketing research orientation, inadequate upward communication and too many layers of management.

Gap2: Management perceptions versus service specifications: as a result of inadequate commitment to service quality, a perception of unfeasibility, inadequate task standardization and an absence of goal setting.

Gap3: Service specifications versus service delivery: as a result of role ambiguity and conflict, poor employee-job fit and poor technology-job fit, inappropriate supervisory control systems, lack of perceived control and lack of teamwork.

Gap4: Service delivery versus external communication: as a result of inadequate horizontal communications and propensity to over-promise.

Gap5: The discrepancy between customer expectations and their perceptions of the service delivered: as a result of the influences exerted from the customer side and the shortfalls (gaps) on the part of the service provider. In this case, customer expectations are influenced by the extent of personal needs, word of mouth recommendation and past service experiences.

Gap6: The discrepancy between customer expectations and employees' perceptions: as a result of the differences in the understanding of customer expectations by front-line service providers.

Gap7: The discrepancy between employee's perceptions and management perceptions: as a result of the differences in the understanding of customer expectations between managers and service providers.

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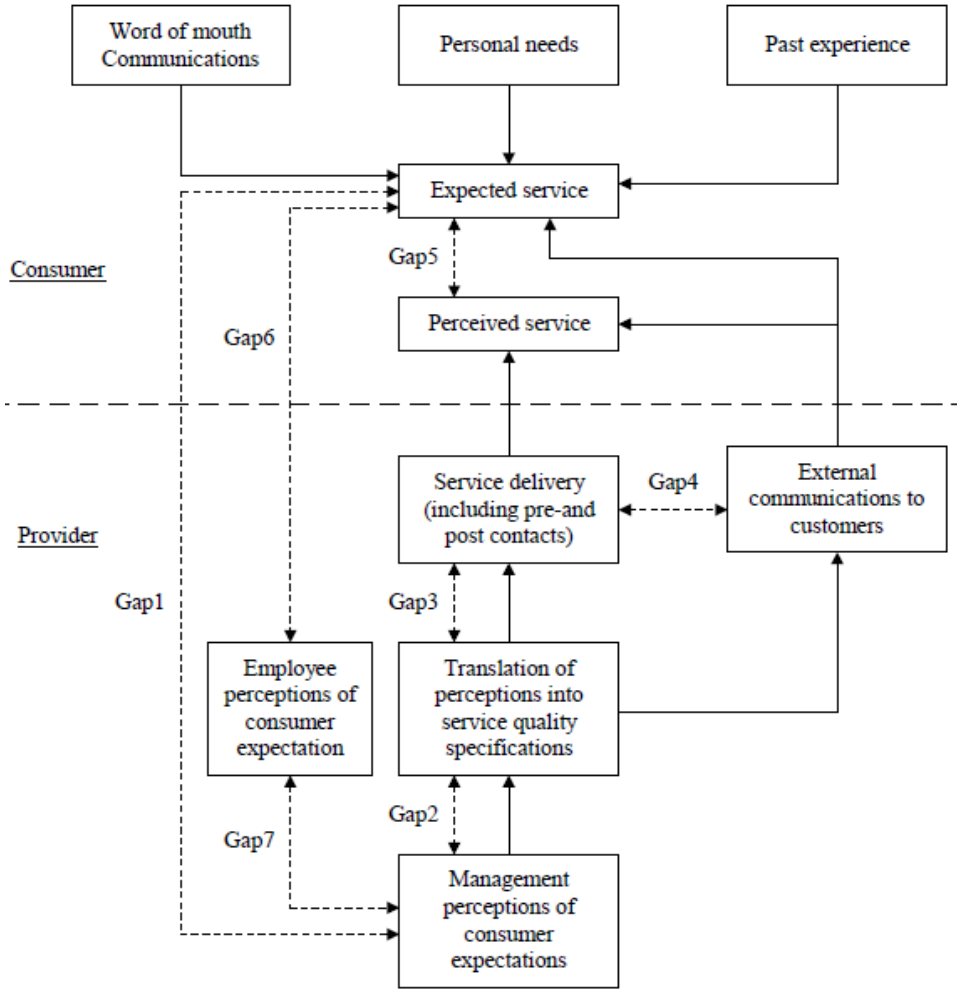

Figure: 1 Model of service quality gaps (Parasuraman et al., 1985: Curry, 1999; Luk and Layton, 2002)

Important concepts:

Customer Satisfaction:

Organizations need to retain existing customers while targeting non-customers. Measuring customer satisfaction provides an indication of how successful the organization is at providing products and/or services to the marketplace.

Customer satisfaction is an abstract concept and the actual manifestation of the state of satisfaction will vary from person to person and product/ service to product/service. The state of satisfaction depends on a number of both psychological and physical variables which correlate with satisfaction behaviors such as return and recommend rate. The level of satisfaction can also vary depending on other factors such as other products against which the customer can compare the organization's products.

Customer expectation:

The needs, wants and pre conceived ideas of a customer about a product or service. Customer expectation will be influenced by a customer perception of the product or service and can be created by previous experience, advertising, hearsay, awareness of competitors and brand image. The level of customer service is also a factor and a customer might expect to encounter efficiency, helpfulness, reliability, confidence in the staff, and personal interest in his or her patronage. If customer expectations are met, then it results in customer satisfaction.

Customer perception:

Perception is the process by which organisms interpret and organize sensation to produce a meaningful experience of the world. Sensation usually refers to the immediate, relatively unprocessed result of stimulation of sensory receptors in the eyes, ears, nose, tongue, or skin. Perception, on the other hand, better describes one's ultimate experience of the world and typically involves further processing of sensory input. In practice, sensation and perception are virtually impossible to separate, because they are part of one continuous process

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Methodology:

In order to accomplish the objectives of this study both primary and secondary data are collected. With regard to a hospital it is the service provided that is of prime importance so the customers (patients) of the hospitals are selected randomly belonging to all classes of the society and irrespective of caste and creed. A sample of 200 respondents that included the patients and guardian of the patients , both male and female respondents participated in the study. Primary data was collected using a structured questionnaire which focused on the five dimensions in the SERVQUAL scale. The items under each dimension were presented in a seven point Likert response format with the anchors rating from "strongly agree" to "strongly disagree" .The data was collected using simple random sampling across the five departments.

The following hypothesis were proposed for the study

Hypothesis I - Customer Satisfaction is independent of Reliability dimension in customer service

Hypothesis I1 - Customer Satisfaction is independent of Responsiveness dimension in customer service

Hypothesis I11 - Customer Satisfaction is independent of assurance dimension in customer service

Hypothesis IV - Customer Satisfaction is independent of empathy dimension in customer service

Hypothesis V - Customer Satisfaction is independent of tangibles dimension in customer service

The study was done primarily to determine whether the customer satisfaction is dependent upon the five dimensions of the SERVQUAL scale. That is Reliability, Responsiveness, Assurance, Empathy, Tangibles. And hence

identify the gap that exists between perceived service and perceived quality and thereafter find the steps to be taken for the improvement of the quality of services provided by the employees of Amrita Institute of Medical Sciences.

Data Analysis

To find out the gap between perceived score and expected score various items under the SERVQUAL dimensions were identified (See Figure: 2) which indicates the items under each dimension .

1	**RELIABILITY DIMENSION**
	• Providing services as promised. • Dependability in handling customer's service problems. • Providing services at the promised time
2	**RESPONSIVENESS:**
	• Prompt service to customers. • Willingness to help customers. • Readiness to respond to customer's requests
3	**ASSURANCE DIMENSION**
	• Making customers feel safe in transactions. • Employees who are continuously courteous. • Employees who have the knowledge to answer customer queries
4	**EMPATHY DIMENSION**
	• Giving customers individual attention. • Employees who deal with customers in caring fashion. • Employees who understand the needs of customers.
5	**TANGIBLES DIMENSION**
	• Modern equipment. • Visually appealing facilities. • Employees have neat, professional appearance. • Convenient business hours.

Figure: 2 Dimensions of SERVQUAL scale defined for the study

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Data was analyzed using SPSS version 18. The output for the first dimension namely **Reliability** is shown in Table 1.1 and table 1.2. Table 1.3 shows the chi square results for the dependency between customer satisfaction and reliability. Since the calculated chi-square value (P) =0.000 is less than the standard value 0.05 the Null Hypothesis may be Rejected Hence, Customer Satisfaction is dependent on Reliability dimension.

Table 1.1: Case Processing Summary

	Cases					
	Valid		**Missing**		**Total**	
	N	**Percent**	**N**	**Percent**	**N**	**Percent**
CustSatis * Reliabilty	200	100.0%	0	.0%	200	100.0%

(Source: Primary using SPSS18.0)

Table 1.2: Cust Satis * Reliabilty Crosstabulation

			Reliabilty					**Total**
			3	**4**	**5**	**6**	**7**	
Cust Satis	2	Count	0	0	0	1	0	1
		% of Total	.0%	.0%	.0%	.5%	.0%	.5%
	4	Count	0	0	6	0	0	6
		% of Total	.0%	.0%	3.0%	.0%	.0%	3.0%
	5	Count	1	0	3	3	0	7
		% of Total	.5%	.0%	1.5%	1.5%	.0%	3.5%
	6	Count	1	8	72	64	0	145
		% of Total	.5%	4.0%	36.0%	32.0%	.0%	72.5%
	7	Count	0	0	15	13	13	41
		% of Total	.0%	.0%	7.5%	6.5%	6.5%	20.5%
Total		Count	2	8	96	81	13	200
		% of Total	1.0%	4.0%	48.0%	40.5%	6.5%	100.0%

(Source: Primary using SPSS18.0)

Table 1.3: Chi-Square Tests for customer satisfaction and reliability

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	76.089[a]	16	.000
Likelihood Ratio	62.581	16	.000
Linear-by-Linear Association	14.365	1	.000
N of Valid Cases	200		

Table 2.1 & 2.2 shows the output for the **responsiveness** dimension used in the Scale. Table 2.3 shows the chi square results for the dependency between customer satisfaction and responsiveness. Since the calculated chi-square value (P) =0.001 is less than the standard value 0.05, the Null Hypothesis is Rejected. Hence, Customer Satisfaction is dependent on Responsiveness dimension.

Table 2.1: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CS * responsvns	200	100.0%	0	.0%	200	100.0%

(Source: Primary using SPSS18.0)

Table 2.2 CS: * responsvns Crosstabulation

			Responsvns						Total
			1	2	4	5	6	7	
CS	2	Count	0	0	0	0	1	0	1
		% of Total	.0%	.0%	.0%	.0%	.5%	.0%	.5%
	4	Count	0	0	3	2	1	0	6
		% of Total	.0%	.0%	1.5%	1.0%	.5%	.0%	3.0%
	5	Count	0	2	0	2	2	1	7
		% of Total	.0%	1.0%	.0%	1.0%	1.0%	.5%	3.5%
	6	Count	1	5	54	19	61	5	145
		% of Total	.5%	2.5%	27.0%	9.5%	30.5%	2.5%	72.5%
	7	Count	4	2	6	6	15	8	41
		% of Total	2.0%	1.0%	3.0%	3.0%	7.5%	4.0%	20.5%
Total		Count	5	9	63	29	80	14	200
		% of Total	2.5%	4.5%	31.5%	14.5%	40.0%	7.0%	100.0%

(Source: Primary using SPSS18.0)

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Table 2.3: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	46.763[a]	20	.001
Likelihood Ratio	40.291	20	.005
Linear-by-Linear Association	.172	1	.679
N of Valid Cases	200		
a. 22 cells (73.3%) have expected count less than 5. The minimum expected count is .03.			

Chi square test were done to find the dependency between the customer satisfaction and **assurance** dimension. Table 3.1 & 3.2 shows the SPSS output for the same. Table 3.3 shows the chi square test results. . Here the calculated chi-square value (P) =0.000 I.e. calculated value 0.000< standard value 0.05 therefore the Null Hypothesis Customer Satisfaction is not dependent on Assurance dimension is Rejected.

Hence, Customer Satisfaction is dependent on Assurance dimension.

Table 3.1: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CS * ASSURANC	200	100.0%	0	.0%	200	100.0%

(Source: Primary using SPSS18.0)

Table 3.2: CS * ASSURANC Crosstabulation

			ASSURANC				Total
			4.00000000	5.00000000	6.00000000	7.00000000	
CS	2	Count	0	0	1	0	1
		% of Total	.0%	.0%	.5%	.0%	.5%
	4	Count	0	3	3	0	6
		% of Total	.0%	1.5%	1.5%	.0%	3.0%
	5	Count	1	0	5	1	7
		% of Total	.5%	.0%	2.5%	.5%	3.5%
	6	Count	5	24	108	8	145
		% of Total	2.5%	12.0%	54.0%	4.0%	72.5%
	7	Count	0	4	23	14	41
		% of Total	.0%	2.0%	11.5%	7.0%	20.5%
Total		Count	6	31	140	23	200
		% of Total	3.0%	15.5%	70.0%	11.5%	100.0%

(Source: Primary using SPSS18.0)

Table 3.3: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.004[a]	12	.000
Likelihood Ratio	32.263	12	.001
Linear-by-Linear Association	10.714	1	.001
N of Valid Cases	200		
a. 15 cells (75.0%) have expected count less than 5. The minimum expected count is .03.			

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The output for the fourth dimension namely **Empathy** is shown in Table 4.1 and table 4.2.

Table 4.1: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CustSatis * Empathy	200	100.0%	0	.0%	200	100.0%

(Source: Primary using SPSS18.0)

Table 4.2: CustSatis * Empathy Crosstabulation

			Empathy					Total
			2	4	5	6	7	
Cust Satis	2	Count	0	0	0	1	0	1
		% of Total	.0%	.0%	.0%	.5%	.0%	.5%
	4	Count	0	3	1	2	0	6
		% of Total	.0%	1.5%	.5%	1.0%	.0%	3.0%
	5	Count	1	1	0	5	0	7
		% of Total	.5%	.5%	.0%	2.5%	.0%	3.5%
	6	Count	3	23	35	80	4	145
		% of Total	1.5%	11.5%	17.5%	40.0%	2.0%	72.5%
	7	Count	0	8	4	16	13	41
		% of Total	.0%	4.0%	2.0%	8.0%	6.5%	20.5%
Total		Count	4	35	40	104	17	200
		% of Total	2.0%	17.5%	20.0%	52.0%	8.5%	100.0%

(Source: Primary using SPSS18.0)

Table 4.3: Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	51.180[a]	16	.000
Likelihood Ratio	42.525	16	.000
Linear-by-Linear Association	5.946	1	.015
N of Valid Cases	200		
a. 18 cells (72.0%) have expected count less than 5. The minimum expected count is .02.			

Table 4.3 shows the chi square results for the dependency between customer satisfaction and empathy. Since the calculated chi-square value (P) =0.000 is less than the standard value 0.05 the Null Hypothesis may be Rejected. Hence Customer Satisfaction is dependent on Empathy dimension

The fifth dimension identified in the SERVQUAL scale is **tangibles**. The statistical output for the chi square test done for the tangible dimension is shown in table 5.1 & 5.2 as follows. Table 5.3 shows the chi square results for the dependency between customer satisfaction and tangibles. Since the calculated chi-square value (P) =0.000 is less than the standard value 0.05 the Null Hypothesis may be Rejected

Therefore it may be concluded that Customer Satisfaction is dependent on tangible dimension

Table 5.1: Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CustSatis * Tangibles	200	100.0%	0	.0%	200	100.0%

(Source: Primary using SPSS18.0)

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Table 5.2: CustSatis * Tangibles Crosstabulation

			Tangibles						Total
			1	**2**	**4**	**5**	**6**	**7**	
Cust Satis	2	Count	0	0	0	0	1	0	1
		% of Total	.0%	.0%	.0%	.0%	.5%	.0%	.5%
	4	Count	0	1	2	0	3	0	6
		% of Total	.0%	.5%	1.0%	.0%	1.5%	.0%	3.0%
	5	Count	0	1	1	1	4	0	7
		% of Total	.0%	.5%	.5%	.5%	2.0%	.0%	3.5%
	6	Count	1	7	5	16	112	4	145
		% of Total	.5%	3.5%	2.5%	8.0%	56.0%	2.0%	72.5%
	7	Count	0	3	2	5	10	21	41
		% of Total	.0%	1.5%	1.0%	2.5%	5.0%	10.5%	20.5%
Total		Count	1	12	10	22	130	25	200
		% of Total	.5%	6.0%	5.0%	11.0%	65.0%	12.5%	100.0%

(Source: Primary using SPSS18.0)

Table 5.3: Chi-Square Tests

	Value	**df**	**Asymp. Sig. (2-sided)**
Pearson Chi-Square	91.450[a]	20	.000
Likelihood Ratio	74.548	20	.000
Linear-by-Linear Association	7.076	1	.008
N of Valid Cases	200		

a. 23 cells (76.7%) have expected count less than 5. The minimum expected count is .01.

Gap analysis in the study:

The customer expectation and perception rating were taken on a 7 point rating Likert scale. The scores were plotted based on the seven degrees of choices that is ranging from strongly agree to strongly disagree. Some of the dimensions about which the customers were not aware of were rated as neutral that is undecided. The questionnaire was designed basically with an intention of getting the perceived scores of the customers. In the study the expectation of customers was taken as seven that is the maximum rating that a respondent could give. Service quality is measured on the basis of the difference scores by subtracting expectation scores from the corresponding perception scores.

Thus the gap between the expectation and perception is calculated on the five dimensions mentioned in Figure: 2 .The dimensions that have the highest gap is the area where training is to be provided for the staff and improvement is required. SERVQUAL also provides hospital administrators with a tool for the measurement of functional quality in their own organizations. Deficient scores on one or more SERVQUAL dimensions will normally signal the existence of a deeper underlying problem in the organization. For example, assume that SERVQUAL indicates that patients do not perceive hospital employees as being willing to help.

The low score on this aspect of quality may be symptomatic of deeper problems that center on the organization's ability to hire and retain high-quality employees, to evaluate and reward superior performance, or to provide adequate training. Therefore, one of SERVQUAL's major contributions to the health care industry will be its ability to identify symptoms and to provide a starting point for the examination of underlying problems that inhibit the provision of quality services.

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Table 6.1: Factors Affecting Customer Perception under Reliability Dimension

Perception of customers under reliability dimension	Average Score
1. Hospital treatment is satisfactory	6.09
2. Keen interest is shown by the staff	5.845
3. Speciality doctors are always available	5.65
4. Staff does not keep you waiting for long hours	4.325
5. Records are kept safely	6.215
6. Queries are well answered by the staff	5.775
7. Staff provides explanation regarding treatment provided	5.4

(Source: primary)

Table 6.1 that are based on reliability dimensions of judgment of service quality regarding customer perception. The customers are highly satisfied with the safety of the records maintained at the hospital. But customers are dissatisfied as they have to wait too long for their appointments.

Table 6.2: Factors Affecting Customer Perception under Responsiveness Dimension

Perception of customers under responsiveness dimension	Average Score
1. Hospital provides prompt service.	5.62
2. Staff are always willing to help	5.75
3. Staff are never too busy to respond	4.805
4. Staff shows respect and are courteous to the customer	5.735
5. Appointments and queries are done through telephone	5.535
6. Staff are available during night hours	4.585
7. Faster admission and discharge procedure	4.99

(Source: primary)

From the Table 6.2, the customers are highly satisfied with the factor that the hospital staff is always willing to help them. But customers are dissatisfied with the point that the staffs are too busy and take longer time to respond to their queries also they are not available during night hours.

Table 6.3: Factors Affecting Customer Perception under **Assurance** Dimension

Perception of customers under assurance dimension	**Average Score**
1.Employees have professionalism	5.535
2.Employees have knowledge to answer the queries	5.775
3.Transaction with the hospital is safe	6.04
4.Employees are continuously courteous	5.565
5.Customer complaints are given attention	4.885

(Source: primary)

From Table 6.3 the highest rank is given for the safety in transactions provided by the hospital. But customers are dissatisfied with the point that the staff do not give much attention to their complaints.

Table 6.4: Factors Affecting Customer Perception under **Empathy** Dimension

Perception of customers under empathy dimension	**Average Score**
1. Hospital gives customer individual attention	4.96
2. Hospital has convenient working hours	5.68
3. Hospital understand your need and do requirement	5.32
4. Measures are taken when you are in pain	4.79
5. A helping hand is always available when you need it	5.455

(Source: primary)

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Table 6.4 shows that customers perceive the working hours of the hospital as convenient The customers are highly satisfied with the helping attitude of the staff and the convenient working hours of the hospital. But customers are dissatisfied as the staffs do not provide them with individual attention when they are in pain.

Table 6.5: Factors Affecting Customer Perception under Tangibles Dimension

Perception of customers under tangibles dimension	Average Score
1. Hospital has updated technology and equipments	6.205
2. Physical facilities are visually appealing	6.115
3. Hospital employees appear neat	6.08
4. Cleanliness is always maintained	5.75
5. During night hours silence is maintained	4.74
6. There are enough beds and sitting arrangements	5.54

(Source: primary)

Table 6.5 shows that factors under the tangibles dimension that helps in judging the perceived service quality. The customers are satisfied with the updated and latest equipments and technology that is used in the treatment provided to them. But they feel that there are not enough seating facilities and proper silence is not maintained, and that is a matter of concern

Table 6.6: SERVQUAL scale Mean Scores for Amritha Hospital

Amritha Hospital	Customer Expected Score	Customer Perceived Score	Gap Score
Reliability	7.0	6.215	0.785
Responsiveness	7.0	5.75	1.25
Assurance	7.0	6.04	0.96
Empathy	7.0	5.68	1.32
Tangibles	7.0	6.205	0.795

(Source: Primary)

Table 6.6 reveals that as per the expectation of the service for the customers the highest gap is found in Empathy dimension of service quality measurement.

Discussion and implications

Because of the ever stronger emphasis on cost containment, changing consumer attitudes, and stiff competition, many of the successful hospitals of the next decade will position themselves as "high-quality" health care providers. Even those hospitals that do not seek a high quality position will find it necessary to define, monitor, and improve the quality of the services they provide. Technical quality alone, however, will not lead to increased revenues and customer delight. Also patients always are not able to assess the technical quality. To them the primary determinant of a patients quality perception is the way in which service is delivered to the customer There is growing evidence to suggest that this perceived quality is the single most important variable influencing consumers' value perceptions.and in turn decide their intention to use or buy the product/Service

These results indicate that the scales can be successfully used to assess the magnitude of the gap between patient perceptions and expectations. For this particular purpose, the modified SERVQUAL appears to be a concise and practical instrument useful for monitoring expectations and perceptions.

The measurement of patient expectations as well as perceptions provides a valuable dimension of insight into the process by which the quality of health care service is evaluated. Administrators should understand the areas in which expectations are particularly high so that the service delivery process can be tailored to meet those expectations.

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Conclusion

From the study it can be understood that for the healthcare industry it is very important to maintain the customer satisfaction with regard to the quality of services provided them. The customers when they visit a hospital they primarily deal with the front office staff and so, the response from the employees at the front office is very important in adding onto the quality of service provided by the hospital. And so by using the SERVQUAL scale the various factors affecting the satisfaction level is determined and the chi-square test shows that there is a very positive relation between the factors of SERVQUAL scale and the satisfaction level of customers. So the employees at the front office staff are to be given training in the respective areas to improve the level of services provided and thereby attract and retain more loyal customer

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A PAPER ON
COMPARATIVE ANALYSIS OF COMMODITY DERIVATIVES

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Abstract

Commodities actually offer immense potential to become a separate asset class for investors, arbitrageurs and speculators. Retail investors, who claim to understand the equity markets, may find commodities an affordable market. The commodity derivatives trading mechanism is new concept for investors especially for common investors, as an equity market commodity futures also involvement of risk and returns, but the risk involved in commodity derivatives is less compared to equity market. So every investor can accommodate derivatives as one of the components in their efficient portfolio diversification.

In Indian commodity market, a variety of commodities such as agro, precious & non precious metals, energy of various natures are trading. The data related to magnitude of risk variation of price with reference to the spot market, rate of return, factors influencing the commodity market are scanty and also not accessible to the every retail investors.

The relationship between GDP and commodity derivative turnover, equity derivative turnover and stock market turnover are directly proportional to each other. The risk and return relationship of various metals is insignificant due to low correlation coefficient between them. The price variations of various metals in commodity market moves on par with spot market.

Commodity market boosts up minimum price of commodity and reveals realistic demand in the future. It is a good plat form for investment for farmers and investors. The farmers can make decision to select which type of crop to be grown in their field in order to gain huge profits and they can make decisions to buy or sell the commodities. The investor can gain knowledge about the price of commodities and they can invest in the commodities from which they can gain profits.

The study mainly focused on

- The role of commodity market in Indian economy.
- Comparison of price variations of commodity market with realistic market.
- The calculation of risk and returns of aluminium, copper, nickel, lead, zinc.
- The magnitude of risk involved in variation of commodity market.
- The relationship between spot and commodity indexes.
- The role of participants in commodity market

Introduction

The capital market is a market for financial assets which have a long or indefinite maturity. Generally, it deals with long term securities which have a period of above one year. In the widest sense, it consists of a series of channels through which the savings of the community are made available for industrial and commercial enterprises and public authorities. As a whole, capital market facilitates rising of capital.

The major functions performed by a capital market are:

1) Mobilization of financial resources on a nation-wide scale.
2) Securing the foreign capital and know-how to fill up deficit in the required resources for economic growth at a faster rate.
3) Effective allocation of the mobilized financial resources, by directing the same to projects yielding highest yield or to the projects needed to promote balanced economic development.

Indian markets have recently thrown open a new avenue for retail investors and traders to participate in commodity derivatives. For those who want to diversify their portfolios beyond shares, bonds and real estate are the best options.

The retail investors could have done very little to actually invest in the commodity market with the setting up of three multi-commodity exchanges in the country, retail investors can now trade in commodity futures without having physical stocks.

Commodities actually offer immense potential to become a separate asset class for market arbitrageurs and speculators. Retail investors, who claim to understand the equity markets, may find commodities market. But

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commodities are easy to understand as far as fundamentals of demand and supply are concerned. Retail investors should understand the risks and advantages of trading in commodities futures before taking a leap. Historically, pricing in commodity market has been less volatile compared with equity and bonds, thus providing an efficient portfolio diversification option.

Like any other market, the one for commodity market plays a valuable role in information pooling and risk sharing. The market mediates between buyers and sellers of commodities, and facilitates decisions related to storage and consumption of commodities. In the process, they make the underlying market more liquidity.

Need of the study:

India's economic growth in the coming years will be commodity-intensive. The major growth sectors and infrastructure as well as energy are all essentially commodity sectors and energy products.

So, it is necessary that commodity markets receive focused attention of policymakers to ensure that production, distribution and consumption of commodities take place in a conducive and competitive environment.

By their nature, commodity markets are volatile. Price fluctuations often hurt stakeholders, especially those who take trading positions for forward months. In view of the above facts, an attempt has been made to study commodity market performance with reference to risk-return, spot market, growth and participation.

Objecives of the study:

- To study the role of commodity market in Indian economy.
- To compare the commodity price with realistic market.

- To find the risk return relation for various commodities for last 2 years.
- To find the magnitude of risk involved in variations of commodity market.
- To find the relationship between commodity spot and futures indexes.
- To find role of participants for growth of commodity market.

Methodology:

Collection of the data:

- In this study, secondary data was used to achieve the designated
- Objectives. The sources of the secondary data are various websites, magazines, journals and financial newspapers.

Role of Commodity Market in Indian Economy:

- The parameters such as GDP, stock market turnover, equity derivatives turnover and commodity derivatives turnover for 5 years have taken to forecast role of commodity market in Indian economy.
- The data related to the above parameters are shown from Fig 4.1.1to 4.1.3and presented from table 4.1.1 to 4.1.3.
- The interpretation results are discussed with reference to available data. The inferences from interpretation were presented in item 4.1 of chapter IV.

Comparison of Commodity Market Price with Realistic Price:

- For comparison of commodity market price with realistic price, the commodity market prices and spot market prices for aluminium, copper, lead, nickel and zinc have taken.
- The results are interpreted and conclusions are drawn presented in 4.2.1 to 4.2.5.

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- The interpretation results are discussed with reference to available data. The inferences from interpretation were presented in item 4.2 of chapter.

Risk and Return of Commodities for Last 2 Years:

- The return of commodities can be known using following formula,
  Return(R) = (close price – open price/open price) *100
- The average return is known using following formula,
  Avg Return=total return/N
  N= number of trading days
- The risk is calculated using following formula,
  S.D (⌐) =√∑(R-R')2/N-1
  R = actual return
  R'= average return
  N=number of trading days.
- The graphs were drawn to find out the relationship between the Risk and return of commodities.
- The results are interpreted and conclusions are drawn presented in 4.3.1 to 4.3.5.
- The data related to above parameters are presented in table form and shown in graphical form. The relationship of risk and return was established using regression analysis. Coefficient of correlation was calculated between risk and return to establish magnitude of risk relationship.

Magnitude of Risk Involved in Variations of Commodity Market:

- The magnitude of risk involved in variations of commodity market, the parameters are risk for various metals and risk in capital market.

- The results are interpreted and discussed are presented in 4.4.1.

Relationship Between Spot Indexes and Commodity Indexes:

- The commodity indexes and spot indexes prices for last 5 years were collected from various sources.
- The results are interpreted and discussed are presented in 4.5.
- The data related to above are presented in table form and shown in graphical form.

Role of Participants for Growth of Commodity Market:

- The traded contracts of commodities related to agriculture, energy products and non-precious metals are taken. The variation of participants with time is shown in line diagrams from 4.6.1 to 4.6.3 presented in table form 4.6.1 to 4.6.2.
- The results are interpreted and discussions are presented in 4.6 of chapter IV

Data analysis:

The secondary data was analysed using the statistical techniques and the obtained results were presented in the form of graphs and tables.

The obtained results were discussed with the help of existing literature and the expert opinion.

Role of Commodity Market in Indian Economy:

The Role of commodity market in Indian economy is presented in the table form from 4.1.1 to 4.1.3 and presented in the graphical form from figure 4.1.1 to 4.1.3.

Table: 4.1.1 variation of commodity derivative turnover and GDP with time:

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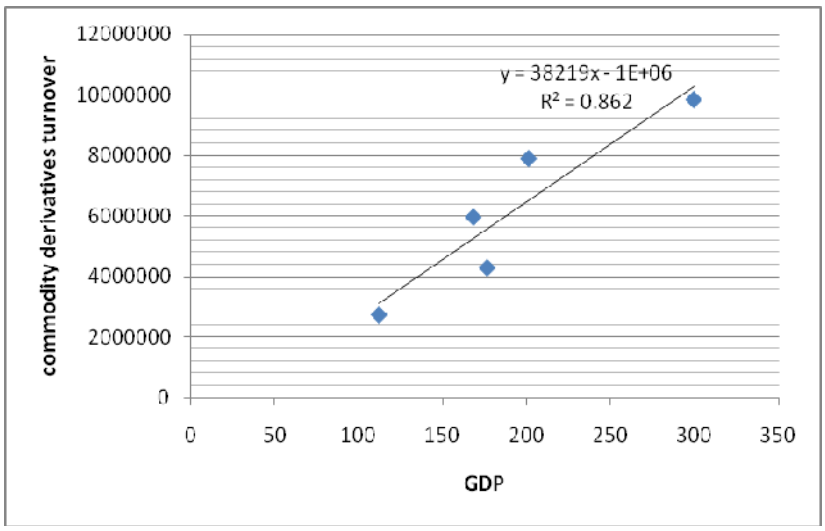

Fig. 4.1.1 variation of commodity turnover and GDP with time

Interpretation:

The relation between commodity derivates turnover and GDP are present in graphical and table form. From the Fig4.1.1 it is observed that the relationship between GDP and commodity derivatives turnover directly proportional and linear trend. This indicates that GDP increases commodity derivatives also increase because GDP indicates economic growth of the country. Higher GDP attract the domestic and foreign investors towards the commodity market for higher returns. The relationship between the GDP and commodity derivatives turnover can express in mathematical equation Y=38219x-1E+06 and correlation coefficient R= 0.9284.this indicates a strong relationship between commodity derivatives and GDP.Based on above discussion, it is concluded that GDP growth is always favorable for boosting the investment and industrial economy. Hence governments have to make necessary policies to improve the GDP in order to provide employeement and more economic activity.

Table 4.1.2: variation of equity derivatives turnover and GDP with time:

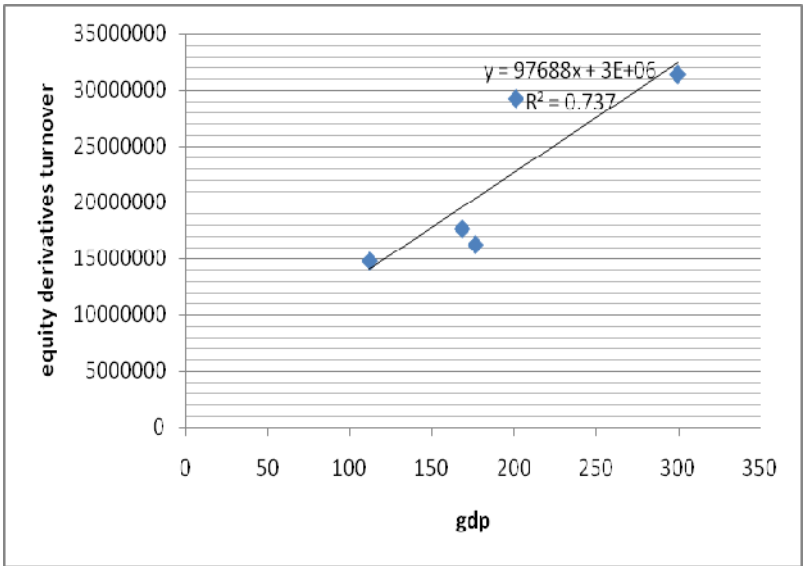

Fig. 4.1.2: variation of equity derivatives turnover and GDP with time

Interpretation

The relation between equity derivates turnover and GDP are present in graphical and table form. From the Fig. 4.1.2 it is observed that the relationship between GDP and equity derivatives turnover directly proportional and linear trend. This indicates that GDP increases equity derivatives also increase because GDP indicates economic growth of the country. Higher GDP attract the domestic and foreign investors towards the equity market for higher returns. The relationship between the GDP and equity derivatives turnover can express in mathematical equation Y=97688x+3E+06 and correlation coefficient R= 0.8584.this indicates a strong relationship between equity derivatives and GDP.Based on above discussion, it is concluded that GDP growth is always favorable for boosting the investment and industrial economy. Hence governments have to make necessary policies to improve the GDP in order to provide employeement and more economic activity.

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Table 4.1.3 variation of stock market turnover and GDP with time:

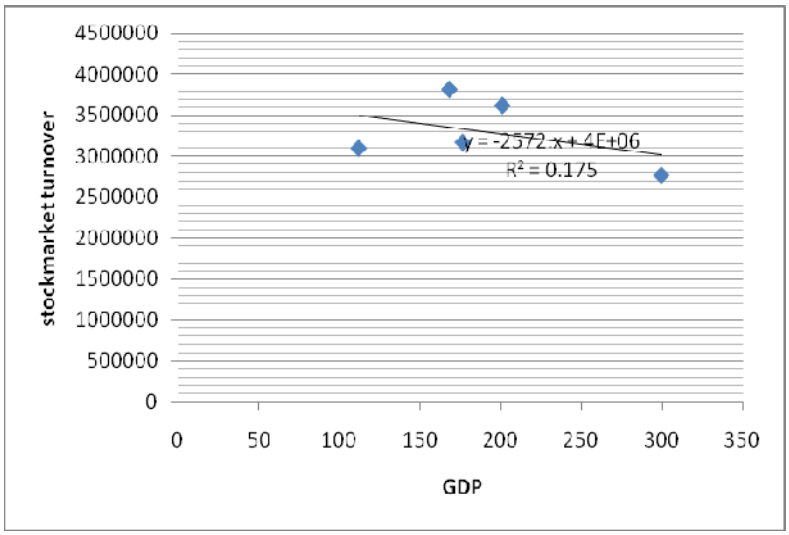

Fig. 4.1.3: variation of stock market turnover and GDP with time

Interpretation

The relation between stock market turnover and GDP are present in graphical and table form. From the Fig4.1.3 it is observed that the relationship between GDP and stock market turnover directly proportional and linear trend. This indicates that GDP increases stock market turnover also increase because GDP indicates economic growth of the country. Higher GDP attract the domestic and foreign investors towards the stock market for higher returns. The relationship between the GDP and equity derivatives turnover can express mathematical equation Y=2572x+4E+06 and correlation coefficient R=0.41833.this indicates a strong relationship between stock market turnover and GDP.Based on above discussion, it is concluded that GDP growth is always favorable for boosting the investment and industrial economy. Hence governments have to make necessary policies to improve the GDP in order to provide employeement and more economic activity.

Comparison of Commodity Market Price with Realistic Price

The comparison of commodity market price with realistic price are presented in the table form from 4.2.1 to 4.2.3 and presented in the graphical form from figure 4.2.1 to 4.2.3.

Table 4.2.1 Variation of Aluminium Prices in Derivative Market and Realistic Market with Time

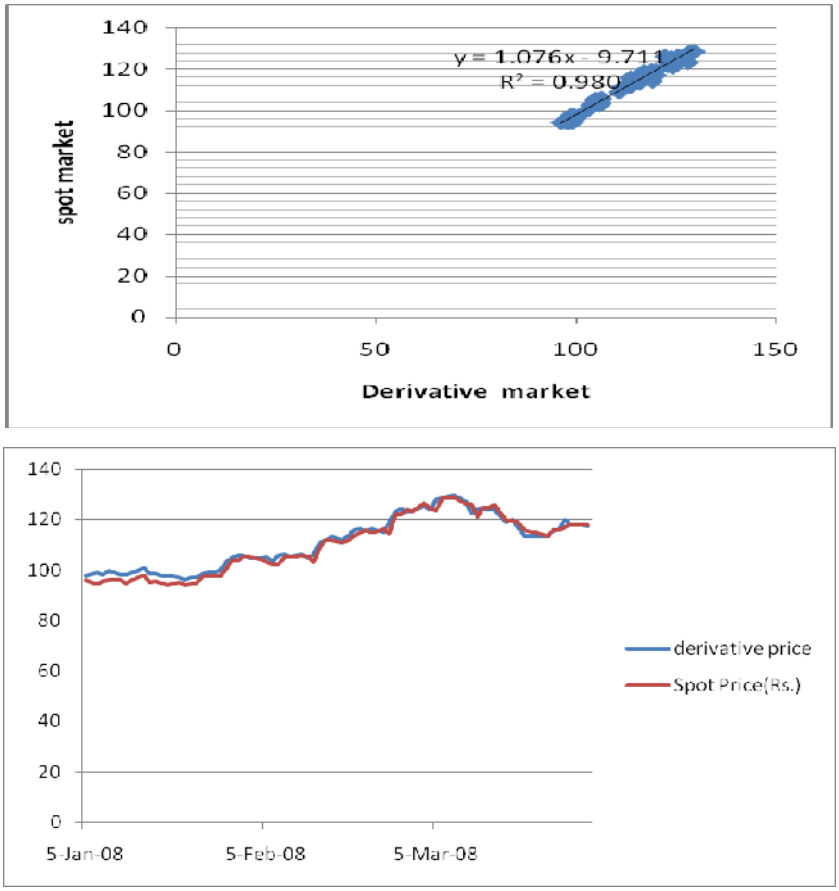

Fig. 4.2.1: variation of aluminium prices in derivative market and realistic market with time.

Interpretation:

The price variation of the aluminium in spot and commodity market is shown in the figure and presented in table form. The Fig 4.2.1 reveals that

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the price variation of commodity market is on far with spot market since the underlying asset commodity is trading in spot market, the above statement is also justify with correlation coefficient 0.9899.the spot price is depend on supply and demand of metals in the market, based on the spot price investor can predict future price trend.so, that the investor can earn desirable profits in trading of the commodities.

Table 4.2.2: Variation of Copper Prices in Derivative Marketand Realistic Market With Time

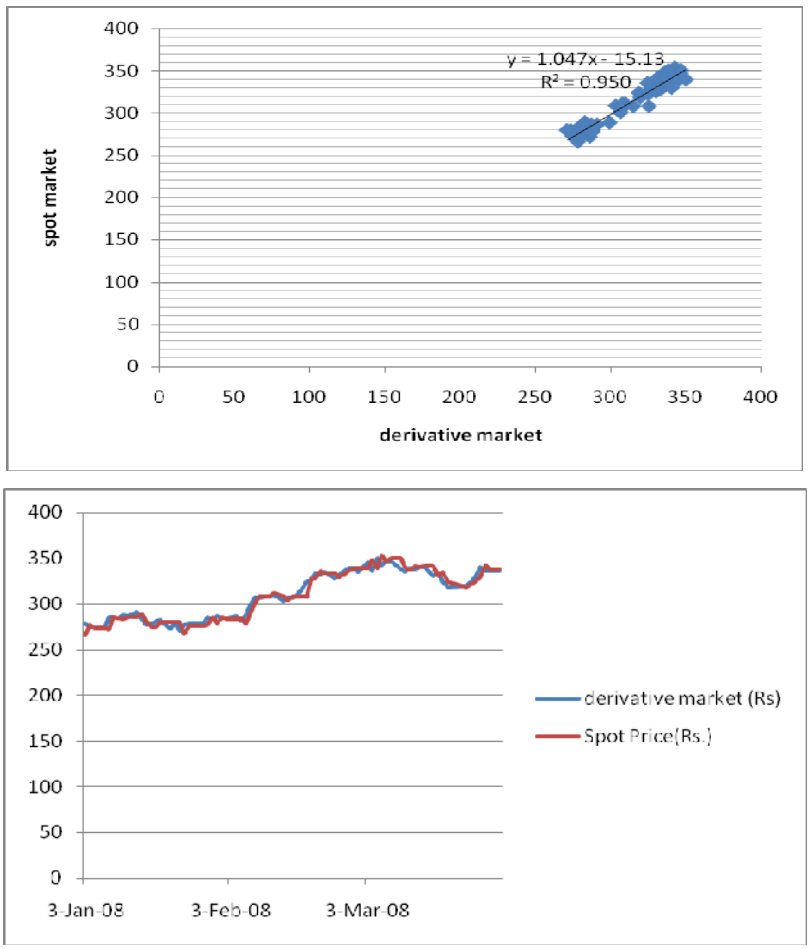

Fig. 4.2.2: variation of copper prices in derivative market and realistic market with time

Interpretation:

The price variation of the copper in spot and commodity market is shown in the figure and presented in table form. The Fig 4.2.2 reveals that the price variation of commodity market is on far with spot market since the underlying asset commodity is trading in spot market, the above statement is also justify with correlation Coefficient 0.9746.The spot price is depend on supply and demand of metals in the market, based on the spot price investor can predict future price trend. So, that the investor can earn desirable profits in trading of the commodities.

Table 4.2.3. Variation of lead prices in derivative market and realistic market with time

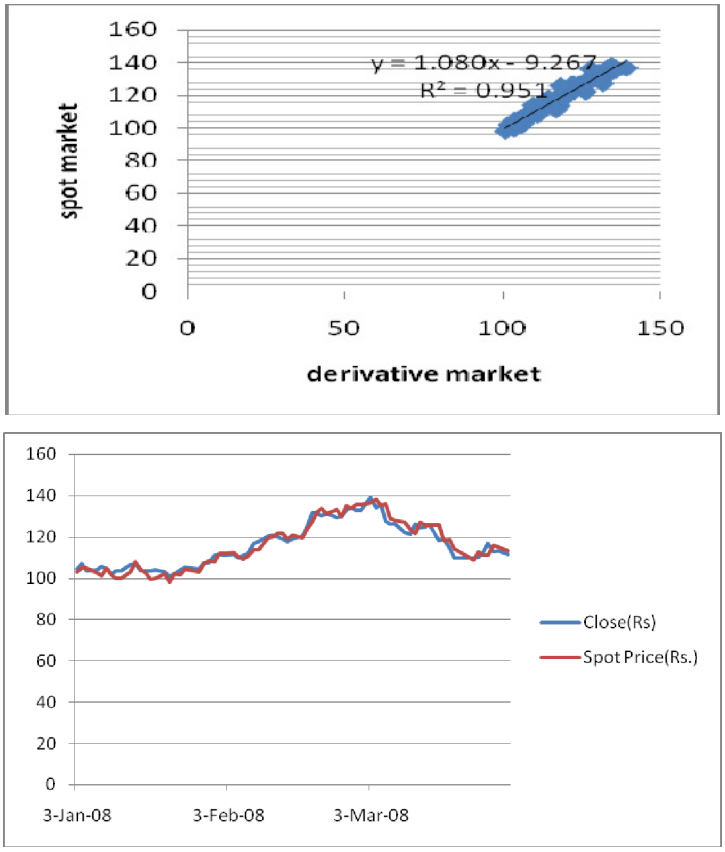

Fig. 4.2.3: variation of lead prices in derivative market and realistic market with time

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Interpretation:

The price variation of the copper in spot and commodity market is shown in the figure and presented in table form. The fig 4.2.3 reveals that the price variation of commodity market is on far with spot market since the underlying asset commodity is trading in spot market, the above statement is also justify with correlation coefficient 0.9751.The spot price is depend on supply and demand of metals in the market, based on the spot price investor can predict future price trend. So, that the investor can earn desirable profits in trading of the commodities.

Table 4.2.4: Variation of nickel prices in derivative market and realistic market with time

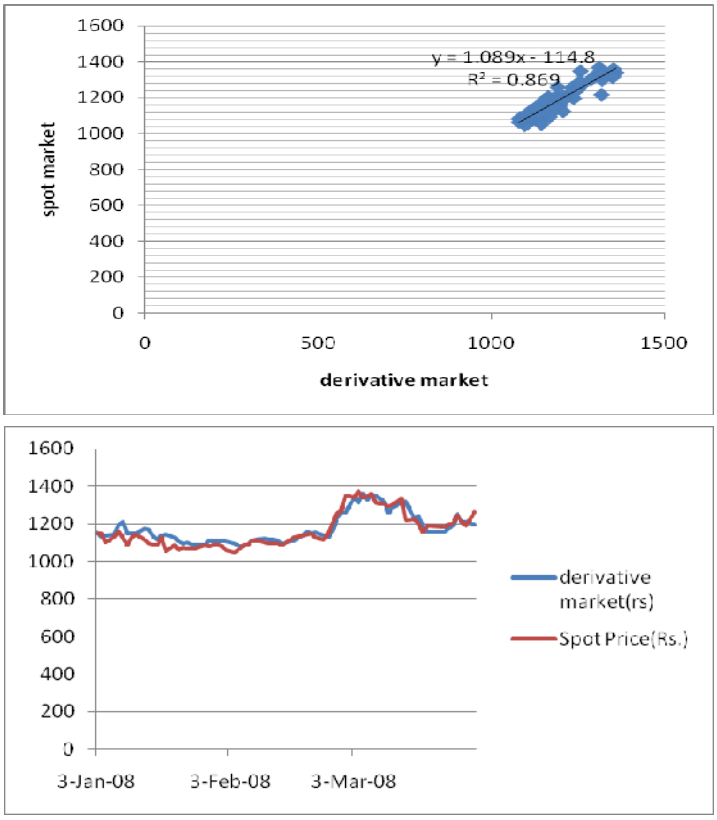

Fig 4.2.4: variation of nickel prices in derivative market and realistic market with time.

Interpretation:

The price variation of the nickel in spot and commodity market is shown in the figure and presented in table form. The Fig 4.2.3 reveals that the price variation of commodity market is on far with spot market since the underlying asset commodity is trading in spot market, the above statement is also justify with correlation coefficient 0.9322.The spot price is depend on supply and demand of metals in the market, based on the spot price investor can predict future price trend. So, that the investor can earn desirable profits in trading of the commodities.

Table 4.2.5: Variation of zinc prices in derivative marketand realistic market with time

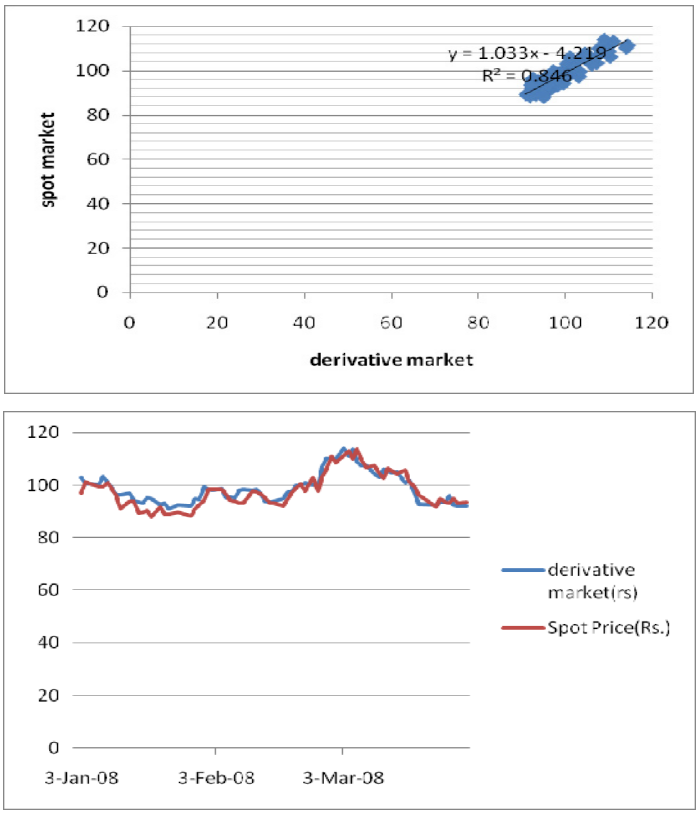

Fig 4.2.5: variation of zinc prices in derivative market and realistic market price with time.

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Interpretation:

The price variation of the zinc in spot and commodity market is shown in the figure and presented in table form. The Fig 4.2.5 reveals that the price variation of commodity market is on far with spot market since the underlying asset commodity is trading in spot market, the above statement is also justify with correlation coefficient 0.9197.The spot price is depend on supply and demand of metals in the market, based on the spot price investor can predict future price trend. So, that the investor can earn desirable profits in trading of the commodities.

The relationship between risk and return of commodities for 2 years:

The relationship between risk and return of commodities for 2 years are presented in the table form from 4.3.1 to 4.3.5 and presented in the graphical form from figure 4.3.1 to 4.3.5.

Table: 4.3.1. Calculation of risk and return of aluminium

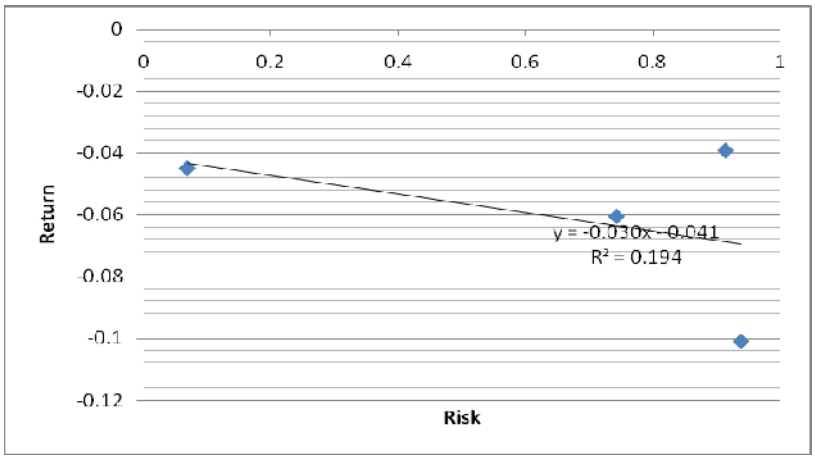

Fig.4.3.1: Risk and Return of Aluminium in 2011-12

Interpretation:

The risk and return relationship of aluminium are shown in fig 4.3.1 this indicates that the risk and return relationship is insignificant because when

risk increases return decreases. The correlation coefficient value R= 0.4404 which also support above reasoning.

Table 4.3.2: Calculation of Risk And Return of Copper

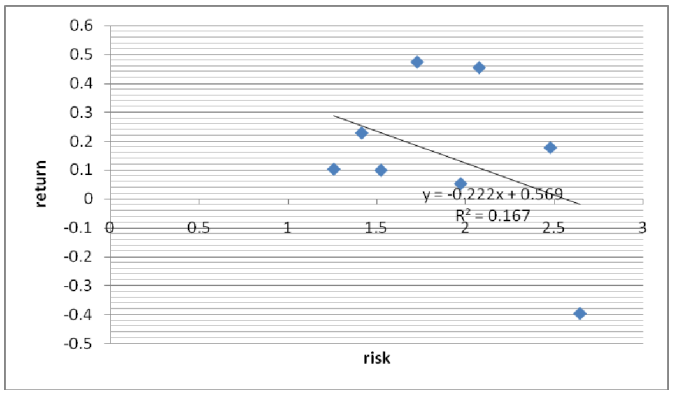

Fig. 4.3.2: Risk and Return of Copper in 2011-12

Interpretation:

The risk and return relationship of copper are shown in fig 4.3.2 this indicates that the risk and return relationship is insignificant because when risk increases return decreases. The correlation coefficient value R= 0.4086 which also support above reasoning.

Table: 4.3.3. Calculation of risk and return of lead

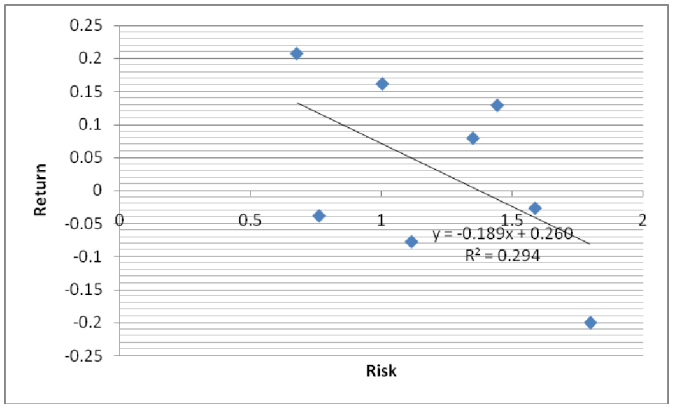

Fig 4.3.3: Risk and Return of Lead in 2011-12

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Interpretation:

The risk and return relationship of copper are shown in Fig 4.3.3 this indicates that the risk and return relationship is insignificant because when risk increases return decreases. The correlation coefficient value R= 0.5422 which also support above reasoning.

Table: 4.3.4. Calculation of risk and return of nickel

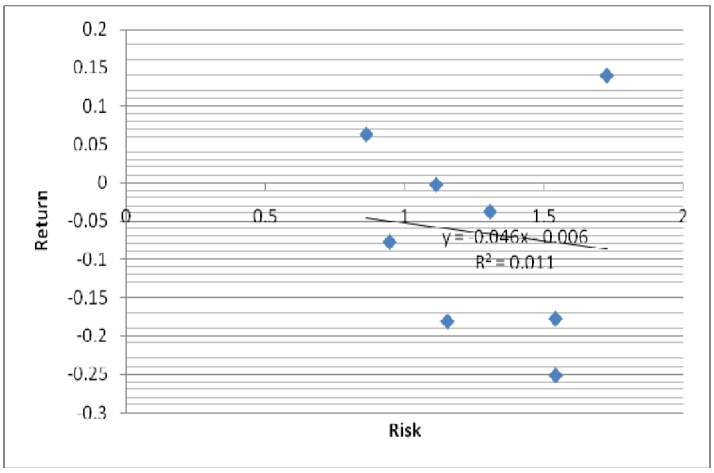

Fig 4.3.4: Risk and Return of Nickel in 2011-12

Interpretation:

The risk and return relationship of nickel are shown in Fig 4.3.4. This indicates that the risk and return relationship is insignificant because when risk increases return decreases. The correlation coefficient value R= 0.1048 which also support above reasoning.

Table: 4.3.5. Calculation of risk and return of zinc

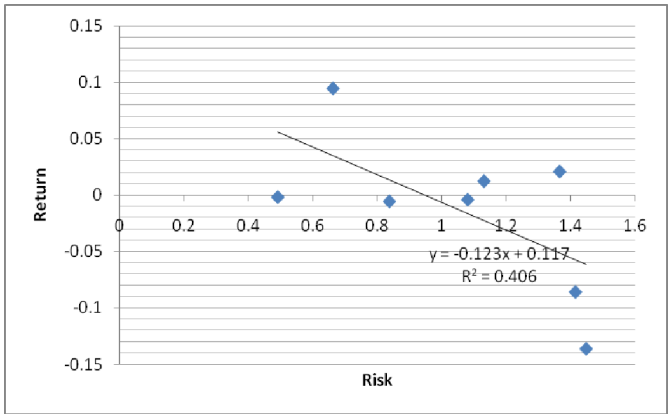

Fig 4.3.5. Risk and Return of Zinc in 2011-12

Interpretation:

The risk and return relationship of zinc are shown in fig 4.3.5. This indicates that the risk and return relationship is insignificant because when risk increases return decreases. The correlation coefficient value R= 0.6371 which also support above reasoning.

Relation Ship Between Spot Indexes And Commodity Indexes

The Relationship between the spot indexes and commodity indexes are presented in the table form 4.5.1 and presented in the graphical form figure 4.5.1.

Table: 4.5.1.Variation of Commodity Indexes and Spot Indexes with Time

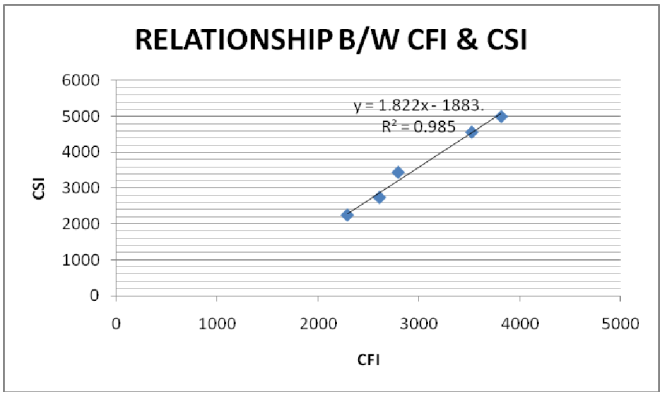

Fig 4.5.1: variation of commodity indexes and spot indexes with time.

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Interpretation:

The price variation trend between the spot and futures indexes is shown in the Fig.4.5.1.The relation between the two indexes is linear and proportional.The Correlation coefficient between two indexes is 0.992 which indicates commodity market perfectly following the spot market because underlying asset is trading at spot market .The price increase of the commodity market is directly proportional to the spot market. The linear relation is expressed in form of equation Y=1.822X-1883.

Role of Participants For Growth of Commodity Market

The role of participants for growth of commodity market are presented in the table form from 4.6.1 to 4.6.3 and presented in the graphical form from figure 4.6.1 to 4.6.3.

Table 4.6.1: Variation of Volume of Traded Contracts in Agro Based Products With Time

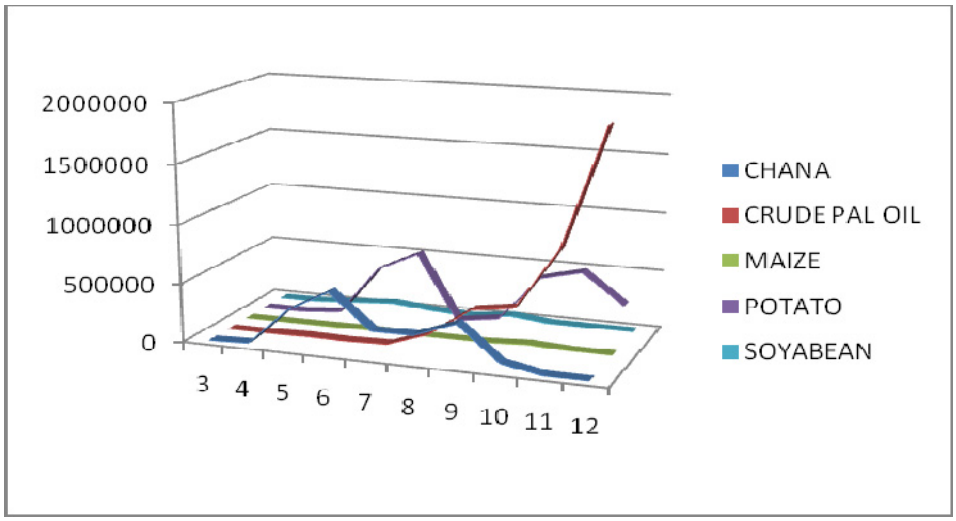

Fig 4.6.1: variation of traded contracts in agro based products with time

Interpretation:

The volume of various commodities derivative contracts traded at commodity market with a time is shown in Fig4.6.1.it is observed that the volume of crude palm oil has increased abnormally from 28tonnes to 1934839 tonnes during the year 2003-12.The crude palm oil is the major ingredient for cooking. Due to the high consumption rate the investors are interested to trade the crude palm oil to get higher return in short duration.

Table 4.6.2: Variation of volume of traded contracts in energy based products with time

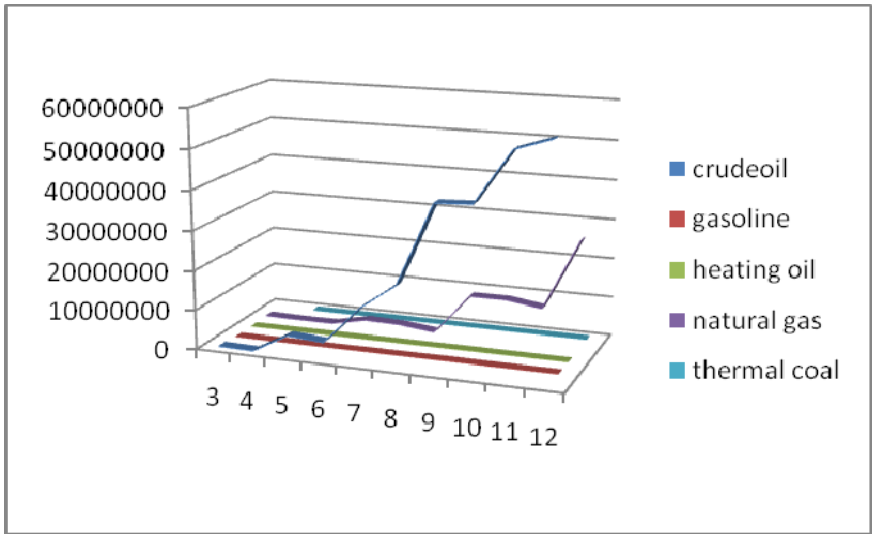

Fig 4.6.2: Variation of traded contracts in energy based products with time

Interpretation:

The volume of various commodities derivative contracts traded at commodity market with a time is shown in Fig4.6.2.It is observed that the volume of crude oil has increased abnormally from 412564 tonnes to 57790229 tonnes during the year 2003-12.Crudeoil is the major ingredient

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for making products like gasoline,disel,fuel, plastics and synthetic rubber, fertilizers, pesticides. Due to the high consumption rate the investors are interested to trade the crude oil to get higher return in short duration.

Table 4.6.3: Variation of volume of traded contracts in metal based products with time

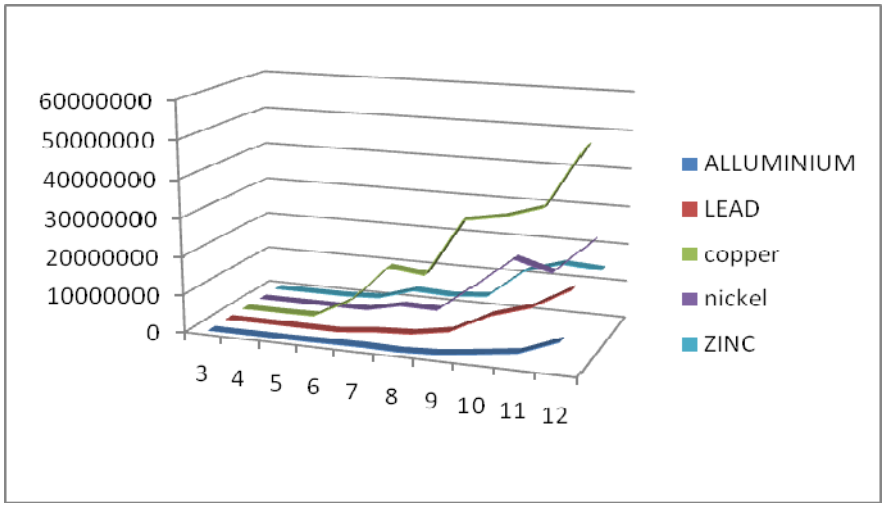

Fig 4.6.3: Variation of traded contracts in metal based products with time

Interpretation:

The volume of various commodities derivative contracts traded at commodity market a with a time is shown in Fig4.6.3.It is observed that the volume of copper has increased abnormally from 2315 tonnes to 50735051 tonnes during the year 2003-12.Copper is the major ingredient for electronic products and other domestic and industrial products. Due to the high consumption rate the investors are interested to trade the copper to get higher return in short duration.

Findings: -

- Relationship between the GDP & commodity derivatives, GDP & equity derivatives and GDP & stock market are directly proportional.
- The price variations of various metals in commodity market moves as par with the spot market and it is directly proportional to each other.
- Relationship between risk and return of various metals of commodity market is insignificant because risk increases, return will be reduces.
- The risk variation for metal commodities is ranging from6.81% to 9.54% which is less than the risk involved in the capital market 11.91% to 19.98%.
- Relationship between commodity indexes and spot indexes is significant and directly proportional to each other.

Conclusion: -

Commodity market boosts up minimum price of commodity and reveals realistic demand in the future .It is a good platform for investment for farmers, investors and government.

A broad range of factors (climatic conditions, political situations, debt default, refugee displacement, land reclamation and environmental health, for example) impact supply and demand of assets (commodities in particular).By knowing the price of future demand of commodities, farmers can make a decision to select which type of crop to be grown in their field in order to gain huge profits and they can able to make decision to buy or sell the commodities.

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Through this, the investors can gain knowledge about the prices of commodities and they can invest in the commodities from which they can gain profits. They can also minimize their risk through hedging. Investors can gauge future demand of commodities so that they can buy at low price and sold commodities whenever price increase in order to gain profit. Manufacturers (or) producers of products can plan optimum inventory for their production process. They can earn desired profits which indirectly motivate the shareholders and economy of the country.

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SYNTHESIS, CRYSTAL STRUCTURES AND SPECTRAL ASPECTS OF ZINC(II) CHELATES DERIVED FROM ONS DONOR THIOSEMICARBAZONES

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Abstract

The thiosemicarbazones of aromatic aldehydes and ketones form stable chelates with transition metal cations by utilizing both their sulfur and azomethine nitrogen as donor atoms. They have been shown to possess a diverse range of biological activities including anticancer, antitumor, antibacterial, antiviral, antimalarial and antifungal properties owing to their ability to diffuse through the semipermeable membrane of the cell lines. So in the present paper, we have prepared zinc(II) complexes using two different ONS donor thiosemicarbazones as principal ligands and heterocyclic bases like 1,10-phenanthroline, 2,2'-bipyridine, 4,4'-dimethyl-2,2'-bipyridine and 5,5'-dimethyl-2,2'-bipyridine as coligands. They were characterized by elemental analyses, IR, UV-Vis spectral studies and conductivity measurements. The structure of one of the complexes has been resolved using single crystal X-ray diffraction studies.

Keywords: thiosemicarbazones, zinc (II) complexes, single crystal XRD

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Introduction

The structural and chemical properties of thiosemicarbazones and their metal complexes have attained considerable attention. They have been investigated intensively since they hold good promises in various fields of medicine. The pharmacological activity of thiosemicarbazones of *o*-hydroxy aromatic aldehydes is correlated to their ability to form chelates with biologically important metal ions by bonding through O, N and S atoms[1,2] and reductive capacity. It is observed that biological activity depends on the parent aldehyde or ketone[3] and increases remarkably when bulky groups are present at N^4 position. Metal complexes of thiosemicarbazones often display enhanced activities when compared to the uncomplexed thiosemicarbazones. The biological activity of Zn(II) complexes of thiosemicarbazones mainly 2-pyridyl ketone thiosemicarbazone and *p*-isopropylbenzaldehyde thiosemicarbazone were reported earlier[5,6]. Zinc atom has either a structural or analytical role in several proteins. It has been recognized as an important cofactor in biological molecules, either as a structural template in protein folding or as a Lewis acid catalyst that can readily adopt 4-, 5- or 6-coordination[7]. Zinc is able to play a catalytic role in the activation of thiols as nucleophiles at physiological pH. The zinc(II) ion is known to have a high affinity towards nitrogen and sulfur donor ligands. Dowling and Perkin investigated Zn(II) complexes with mixed N, O and S coordination to understand the reactivity of the pseudotetrahedral zinc center in proteins[8]. The zinc(II) ion has been found to be of catalytic importance in enzymatic reactions[9]. The enhancement of antitumor activity of some thiosemicarbazones in the presence of zinc(II) ions has been reported[10].

Experimental

Materials

Zinc(II) acetate dihydrate, 1,10-phenanthroline (phen), 2,2'-bipyridine (bipy), 4,4'-dimethyl-2,2'-bipyridine (4,4'-dmbipy), 5,5'-dimethyl-2,2'-bipyridine (5,5'-dmbipy) were used as received.

Syntheses of the complexes

The complexes were synthesized using ligands, 5-bromo-3-methoxysalicylaldehyde-N(4)-phenylthiosemicarbazone (H_2L^1) and 5-bromo-3-methoxysalicylaldehyde-N(4)-cyclohexylthiosemicarbazone (H_2L^2).

The complexes $[(ZnL^1)_2]$ (**1**) and $[(ZnL^2)_2]$ (**6**) were synthesized by refluxing a solution of the respective ligand in 1:1 (v/v) mixture of DMF and methanol with a methanolic solution of $Zn(OAc)_2 \cdot 2H_2O$ (0.109 g, 0.5 mmol) for 3 hours. The complexes formed were filtered, washed with methanol and dried *in vacuo*. The other complexes $[ZnL^1phen]$ (**2**), $[ZnL^1bipy]$ (**3**), $[ZnL^1(4,4'\text{-dmbipy})] \cdot DMF$ (**4**), $[ZnL^1(5,5'\text{-dmbipy})]$ (**5**), $[ZnL^2phen]$ (**7**) and $[ZnL^2bipy]$ (**8**) were synthesized by refluxing $Zn(OAc)_2 \cdot 2H_2O$ with the respective ligand and heterocyclic base in 1:1:1 ratio for almost 3 hours.

$[(ZnL^1)_2]$ (**1**) Elemental Anal. Found (Calcd.) (%) : C, 40.83 (40.61); H, 3.06 (2.73); N, 9.66 (9.47); S, 7.46 (7.23)

$[ZnL^1phen]$ (**2**), Elemental Anal. Found (Calcd.) (%) : C, 52.14 (51.98); H, 3.41 (3.23); N, 11.34 (11.23); S, 5.35 (5.14)

$[ZnL^1bipy]$ (**3**), Elemental Anal. Found (Calcd.) (%) : C, 50.35 (50.06); H, 3.64 (3.36); N, 11.73 (11.68); S, 5.35 (5.35)

$[ZnL^1(4,4'\text{-dmbipy})] \cdot DMF$ (**4**), Elemental Anal. Found (Calcd.) (%) : C, 51.30 (51.40); H, 4.54 (4.46); N, 11.56 (11.99); S, 4.84 (4.57)

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[ZnL^1(5,5'-dmbipy)] (**5**), Elemental Anal. Found (Calcd.) (%) : C, 51.45 (51.65); H, 3.57 (3.85); N, 11.31 (11.15); S, 4.97 (5.11)

[$(ZnL^2)_2$] (**6**) Elemental Anal. Found (Calcd.) (%) : C, 40.25 (40.06); H, 3.88 (4.03); N, 9.68 (9.34); S, 6.86 (7.13)

[ZnL^2phen] (**7**) Elemental Anal. Found (Calcd.) (%) : C, 51.14 (51.48); H, 4.36 (4.16); N, 11.55 (11.12); S, 5.36 (5.09)

[ZnL^2bipy] (**8**) Elemental Anal. Found (Calcd.) (%) : C, 49.69 (49.56); H, 4.66 (4.33); N, 11.87 (11.56); S, 5.51 (5.29)

Results and discussion

Equimolar ratios of the thiosemicarbazones and the metal acetate yielded the light yellow colored complexes [$(ZnL^1)_2$] (**1**) and [$(ZnL^2)_2$] (**6**). The other compounds were prepared by using the heterocyclic bases like 1,10-phenanthroline, 2,2'-bipyridine, 4,4'-dimethylbipyridine and 5,5'-dimethylbipyridine. Single crystals of compound **4** could be isolated and the structure was established by single crystal XRD studies. The complexes were characterized by the following physico-chemical methods.

1. Elemental analyses

From the observed C, H, N and S values, the above stoichiometry of the complexes were proposed.

2. Molar conductivity

The molar conductivity of the complexes in DMF (10^{-3} M) was measured at 298 K with a Systronic model 303 direct reading conductivity bridge. The molar conductivity measurements showed that all the complexes are non-electrolytic in nature since the observed values are less than 10 $ohm^{-1}cm^2mol^{-1}$ which are very much less than the

value of 65-90 $ohm^{-1}cm^2mol^{-1}$ reported for a 1:1 electrolyte in the same solvent[11].

Table 1: Molar conductivity of Zn(II) complexes

Compound	λ_m [a]
$[(ZnL^1)_2]$ (**1**)	2.0
$[ZnL^1phen]$ (**2**)	4.0
$[ZnL^1bipy]$ (**3**)	2.5
$[ZnL^1(4,4'\text{-dmbipy})]\cdot DMF$ (**4**)	4.0
$[ZnL^1(5,5'\text{-dmbipy})]$ (**5**)	3.5
$[(ZnL^2)_2]$ (**6**)	2.0
$[ZnL^2phen]$ (**7**)	4.3
$[ZnL^2bipy]$ (**8**)	3.0

[a] = mho cm^2 mol^{-1}

3. Infrared spectra

To clarify the mode of bonding, the IR spectra of the thiosemicarbazones and their Zn(II) complexes were studied and assigned on the basis of a careful comparison of the latter with the thiosemicarbazones. The tentative IR spectral assignments are listed in Table 2. The IR spectra of the thiosemicarbazones exhibit a medium band at ~3305 cm^{-1} which is assigned to ^{2}NH vibration. It disappears in the spectra of complexes providing strong evidence for ligand coordination to the metal in the deprotonated thioiminolate form[12]. The band corresponding to azomethine bond, ν(C=N), shifts to higher energy on coordination due to the combination of ν(C=N) with the newly formed C=N bond which results from the loss of the thioamide hydrogen from the thiosemicarbazone moiety[13]. The involvement of this nitrogen in bonding is also supported by a shift in ν(N–N) to higher frequencies.

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Coordination *via* the thioiminolate sulfur is indicated by the negative shift of the two bands assigned to ν(C=S) and δ(C=S) vibrations. Some of the IR spectra of the Zn(II) complexes are depicted in Figs. 1-2.

Table 2: IR spectral assignments (cm^{-1}) of thiosemicarbazones and their Zn(II) complexes

Compound	ν(O–H)	ν(C=N)	ν(C=N)[a]	ν(N–N)	ν(C=S)/ν (C–S), δ (C=S)/δ (C–S)	ν(C–O)	ν(Zn–O)	ν(Zn–N)
H_2L^1	3441	1540	----	1071	1333, 857	1267	----	----
$[(ZnL^1)_2]$ (**1**)	----	1603	1523	1112	1318, 833	1237	498	435
$[ZnL^1phen]$ (**2**)	----	1595	1535	1102	1306, 766	1232	502	458
$[ZnL^1bipy]$ (**3**)	----	1599	1481	1100	1306, 766	1228	502	454
$[ZnL^1$(4,4′-dmbipy)]·DMF (**4**)	----	1608	1539	1093	1316, 832	1228	502	460
$[ZnL^1$(5,5′-dmbipy)] (**5**)	----	1608	1539	1096	1316, 834	1237	504	470
H_2L^2	3454	1539	----	1067	1342, 851	1257	----	----
$[(ZnL^2)_2]$ (**6**)	----	1597	1556	1101	1328, 811	1225	500	459
$[ZnL^2phen]$ (**7**)	----	1589	1535	1110	1315, 806	1232	482	441
$[ZnL^2bipy]$ (**8**)	----	1590	1542	1097	1322, 821	1233	480	436

[a] = newly formed C=N bond

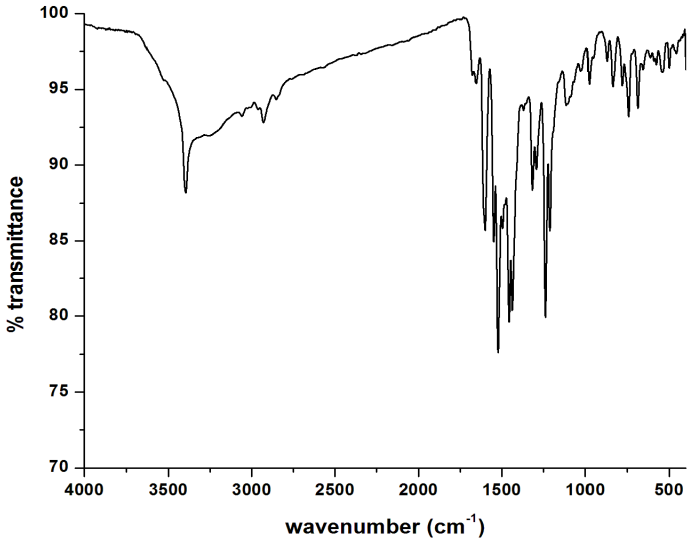

Fig. 1: Infrared spectrum of $[(ZnL^1)_2]$ (1).

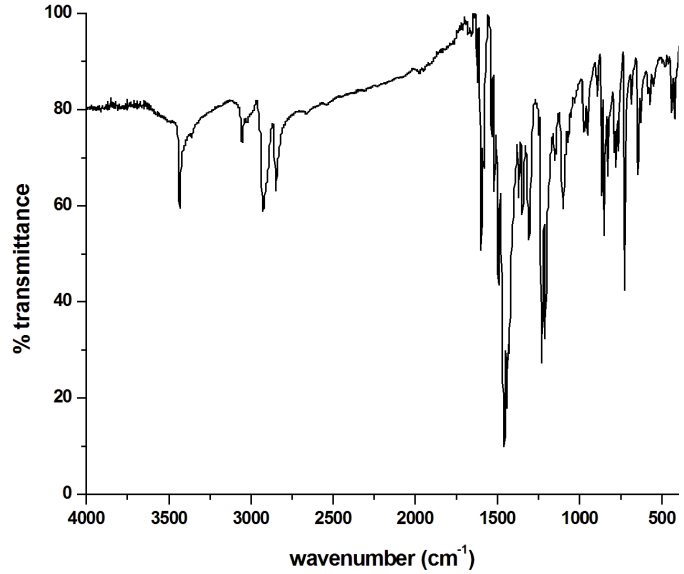

Fig. 2: Infrared spectrum of $[ZnL^2phen]$ (7).

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4. Electronic spectra

Electronic spectroscopy is an important and valuable tool for chemists to draw important information about the structural aspects of complexes. The UV-vis spectra of the Zn(II) complexes were studied in DMF. The bands in the range 28700-30590 cm^{-1} in the electronic spectra of thiosemicarbazones due to $\pi\rightarrow\pi^*$ and $n\rightarrow\pi^*$ transitions suffered marginal shifts upon complexation. This may be due to the weakening of the C=S bond and the extension of conjugation upon complexation[14]. The shift occurs also due to coordination *via* phenolic oxygen and azomethine nitrogen[15] and is an indication of the enolization followed by the deprotonation of the ligands during complexation. In addition to this, a new band in the range 24300-25170 cm^{-1} is observed in the spectra of complexes and this can be assigned to the $O_{phenolate} \rightarrow Zn$, $N_{azomethine} \rightarrow Zn$ and $S \rightarrow Zn$ LMCT transitions[16]. The electronic spectral data of the Zn(II) complexes are given in Table 3. Figs. 3 and 4 represent the electronic spectra of the complexes.

Table 3: Electronic spectral assignments (cm^{-1}) of thiosemicarbazones and their Zn(II) complexes

Compound	$n\rightarrow\pi^*/\pi\rightarrow\pi^*$	LMCT
H_2L^1	28770, 30490	----
$[(ZnL^1)_2]$ (**1**)	29160, 30590	24600
$[ZnL^1phen]$ (**2**)	29160, 30530	24480
$[ZnL^1bipy]$ (**3**)	29100, 30590	24650
$[ZnL^1(4,4'\text{-dmbipy})]\cdot DMF$(**4**)	29100, 30590	24650
$[ZnL^1(5,5'\text{-dmbipy})]$ (**5**)	28700, 29960	24300
H_2L^2	29300, 30490	----
$[(ZnL^2)_2]$ (**6**)	29620, 30980	25170
$[ZnL^2phen]$ (**7**)	29670, 31040	25170
$[ZnL^2bipy]$ (**8**)	29670, 30990	25170

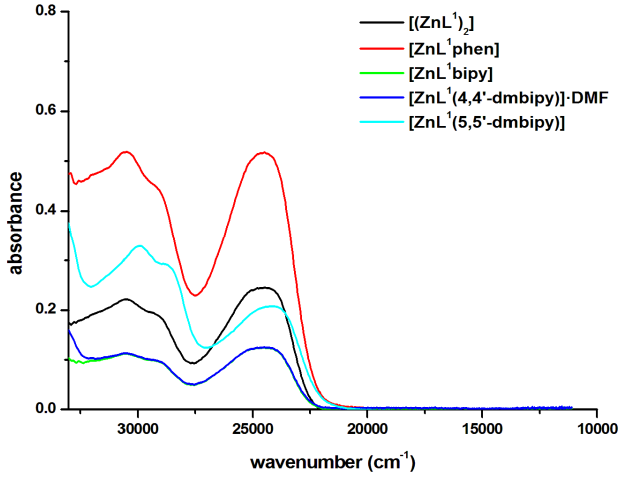

Fig. 3: Electronic spectra of Zn(II) complexes of H_2L^1.

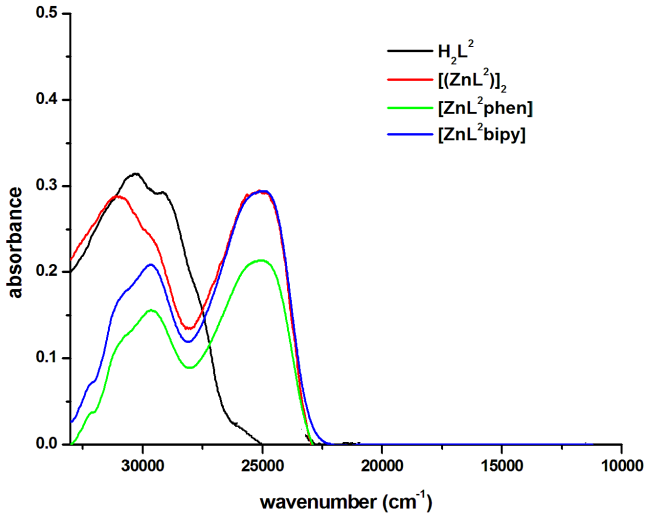

Fig. 4: Electronic spectra of Zn(II) complexes of H_2L^2.

5. X-ray crystallography

Crystal structure of the compound [ZnL^1(4,4'-dmbipy)]·DMF (4)

Single crystals of the complex **4** suitable for X-ray diffraction studies were obtained by slow evaporation of the mother liquor over 3 days. The crystallographic data and structure refinement parameters for the complex are given in Table 4.

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Table 4: Crystal data and structure refinement parameters for complex 4

Parameters	**[ZnL^1(4,4'-dmbipy)]·DMF (4)**
Empirical formula	$C_{30}H_{31}BrN_6O_3SZn$
Formula weight	700.95
Temperature	293 K
Wavelength	0.71073 Å
Crystal system	Monoclinic
Space group	$P2_1$
Unit cell dimensions	a = 15.2674(3) Å
	b = 12.2422(3) Å
	c = 22.3402(5) Å
	α = 90°
	β = 131.425(10)°
	γ = 90°
Volume	3130.90(12) Å^3
Z	4
Density (calculated)	1.487 Mg/m^3
Absorption coefficient	2.168 mm^{-1}
F(000)	1432
Crystal size	0.40 x 0.30 x 0.25 mm^3
θ range for data collection	2.47 to 26.31°
Limiting indices	$-19 \le h \le 19$,
	$-15 \le k \le 15$,
	$-29 \le l \le 28$
Reflections collected	52133
Independent reflections	14238 [R(int) = 0.0505]
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	14238 / 66 / 676
Goodness-of-fit on F^2	1.011
Final R indices [$I>2\sigma(I)$]	R_1 = 0.0697, wR_2 = 0.1751
R indices (all data)	R_1 = 0.1204, wR_2 = 0.2105
Largest diff. peak and hole	1.22 and -1.64 e Å^{-3}

$R_1 = \Sigma||F_o| - |F_c|| / \Sigma|F_o|$

$wR_2 = [\Sigma w(F_o^2-F_c^2)^2/\Sigma w(F_o^2)^2]^{1/2}$

A yellow prism like crystal of the compound having approximate dimensions of 0.40 × 0.30 × 0.25 mm^3 was selected. The unit cell parameters were determined and the data collections were performed on a Bruker SMART APEXII CCD diffractometer with graphite-monochromated Mo Kα (λ = 0.71073 Å) radiation at the Sophisticated Analytical Instruments facility (SAIF), Cochin University of Science and Technology, Kochi-22, Kerala, India. The programs SAINT and XPREP were used for data reduction and APEX2 and SAINT were used for cell refinement. The structure was solved by direct methods using SHELXS97[17] and refined by full-matrix least-squares refinement on F^2 using SHELXL97[18]. The molecular and crystal structures were plotted using DIAMOND version 3.2g[19] and X-SEED[20].

Carbon and nitrogen bound H-atoms were placed in calculated positions (C–H 0.93 to 0.96 Å, N–H 0.88 Å) and were included in the refinement in the riding model approximation, with *U*(H) set to 1.2 to 1.5 *U*(C,N). Omitted owing to bad disagreement was (0 1 1). All aromatic and pyridine rings were refined as rigid hexagons of 1.39 Å sides. One of the phenyl rings of the thiosemicarbazone is disordered over two positions in a 1:1 ratio. The temperature factors of the primed atoms were set to those of the unprimed ones but in the reverse order (*i.e.*, those of C11 to those of C15), and the pair of $N–C_{phenyl}$ distances were restrained to within 0.01 Å of each other. The molecules of DMF were each restrained to lie on a plane. The anisotropic temperature factors were restrained to be nearly isotropic. The final difference Fourier map had a peak at 0.91 Å from Br1 and a hole at 0.96 Å from Br2. The base scale factor was explicitly refined.

The zinc homolog has been isolated as a 2,2′-bipyridine adduct[21]. The compound crystallizes as a DMF solvate. The asymmetric unit of the compound, $[Zn(C_{15}H_{12}BrN_3O_2S)(C_{12}H_{12}N_2)]C_3H_7NO$ **(4)** contains two

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independent molecules with a similar structure. In one molecule, Zn is displaced by 0.305(3) Å in the direction of the apical occupant (Fig. 5) whereas in the other, the displacement is 0.103(6) Å in the opposite direction.

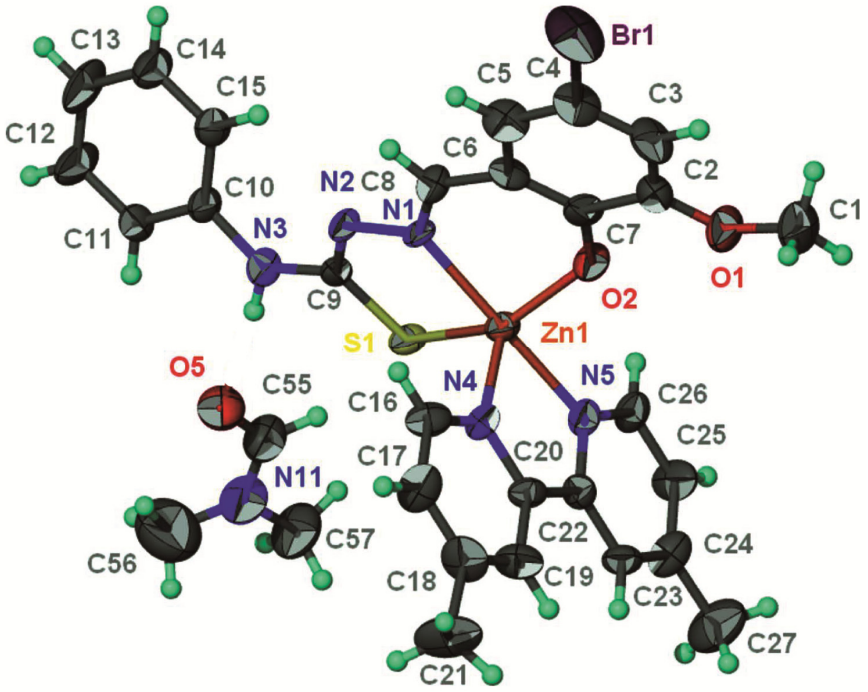

Fig. 5: Thermal ellipsoid plot of one [ZnL^1(4,4'-dmbipy)]·DMF molecule at the 50% probability level; hydrogen atoms are drawn as spheres of arbitrary radius. The disorder in one of the phenyl rings is not shown.

The metal center shows square pyramidal coordination. Substituents in the thiosemicarbazone as well as 2,2′-bipyridine do not perturb the square pyramidal coordination geometry in [Zn($C_{12}H_{12}N_2$) ($C_{15}H_{12}BrN_3O_2S$)]·DMF. The doubly deprotonated Schiff base ligand O,N,S-chelates to the metal atom and the three coordinating atoms along with one N atom of the substituted 2,2'-bipyridine constitute the square plane of the distorted square pyramid surrounding the metal atom. The apical site is occupied by the second N atom of the substituted 2,2'-bipyridine. The secondary amine group of the

Schiff base dianion forms a hydrogen bond to the O atom of the dimethylformamide solvent (Fig. 6). In the crystal, the phenyl ring of one of the two thiosemicarbazones is disordered over two positions in a 1:1 ratio. The crystal is found to be a racemic twin. The packing diagram of the compound is shown in Fig. 7. The coordination polyhedra present in the unit cell is shown in Fig. 8. Selected bond distances and bond angles are given in Table 5 and interaction parameters are given in Table 6.

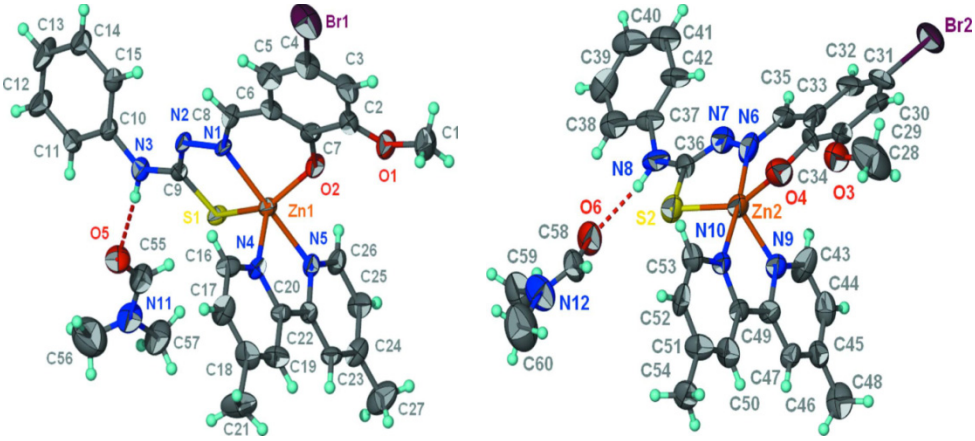

Fig. 6: Hydrogen bonding interactions shown as dotted lines.

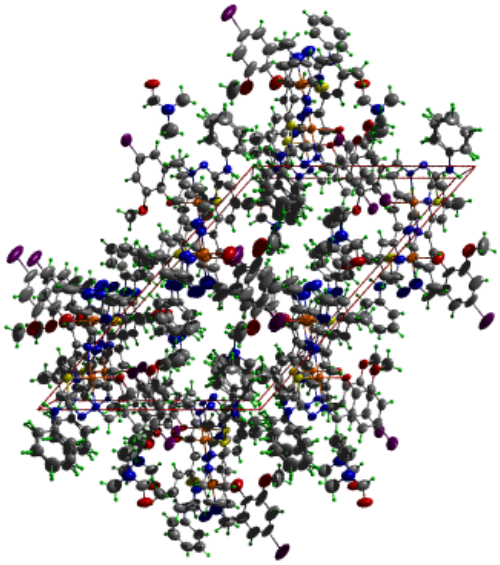

Fig. 7: Packing diagram along '*b*' axis.

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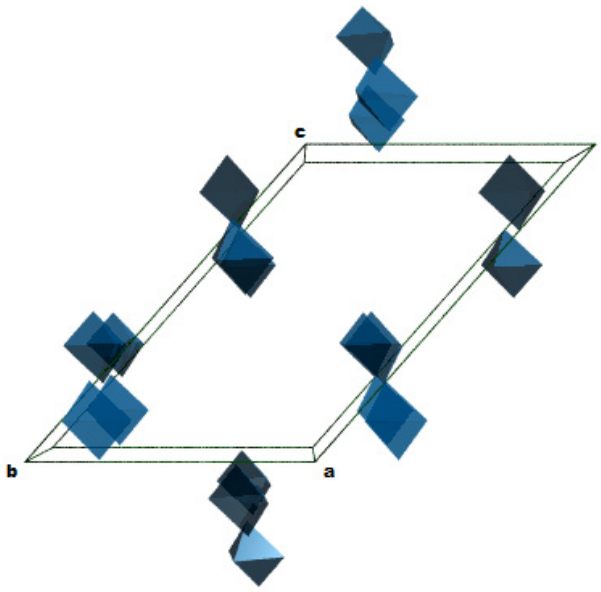

Fig. 8: Coordination polyhedra in a unit cell.

Table 5: Selected bond lengths and angles for complex 4

Bond lengths (Å)		Bond angles (°)		Bond angles (°)	
Zn(1)–S(1)	2.353(2)	N(1)–Zn(1)–O(2)	87.7(2)	C(22)–N(5)–C(26)	120.0
Zn(1)–O(2)	1.987(6)	O(2)–Zn(1)–N(5)	93.9(2)	O(1)–C(2)–C(3)	124.2(5)
Zn(1)–N(1)	2.124(6)	N(1)–Zn(1)–N(5)	176.3(3)	N(1)–C(8)–C(6)	128.3(8)
Zn(1)–N(5)	2.134(4)	O(2)–Zn(1)–S(1)	148.2(2)	C(7)–O(2)–Zn(1)	126.8(4)
S(1)–C(9)	1.765(10)	O(2)–Zn(1)–N(4)	103.2(3)	C(9)–N(2)–N(1)	114.2(6)
N(1)–N(2)	1.388(9)	N(1)–Zn(1)–S(1)	82.0(2)	C(20)–N(4)–Zn(1)	114.9(3)
N(4)–C(16)	1.390	N(1)–Zn(1)–N(4)	104.9(3)	O(1)–C(2)–C(3)	124.2(5)
N(5)–C(26)	1.390	N(4)–Zn(1)–N(5)	78.0(2)	N(3)–C(9)–S(1)	111.4(7)
N(2)–C(9)	1.251(11)	N(5)–Zn(1)–S(1)	94.97(17)	C(9)–S(1)–Zn(1)	93.8(3)
N(1)–C(8)	1.246(11)	C(8)–N(1)–N(2)	117.1(7)	N(2)–N(1)–Zn(1)	119.5(5)
N(3)–C(9)	1.401(11)	C(9)–N(3)–C(10)	130.1(11)	C(16)–N(4)–Zn(1)	125.1(3)
Zn(1)–N(4)	2.088(4)				

Table 6: Interaction parameters

H bonding				
D–H···A	**D–H (Å)**	**H···A (Å)**	**D···A (Å)**	**D–H···A (°)**
N(3)–H(3)···O(5)	0.88	2.07	2.950(10)	175
N(8)–H(8)···O(6)	0.88	2.07	2.950(10)	172
C(15)–H(15)···N(2)	0.93	2.39	2.954(17)	119
C(17)–H(17)···O(5)	0.93	2.52	3.089(10)	120
C(19)–H(19)···O(3)	0.93	2.35	3.168(14)	146
C(42)–H(42)···N(7)	0.93	2.31	2.917(15)	123
C(46)–H(46)···O(1)	0.93	2.34	3.204(11)	154

D = Donor, A = acceptor, Cg = Centroid

Summary and Conclusions

Eight zinc complexes of the thiosemicarbazones were synthesized and characterised by CHNS analyses, conductivity measurements, infrared and electronic spectral studies. The observed molar conductivity values in 10^{-3} M DMF solution confirm that all the complexes are non-electrolytes. The tridentate character of the thiosemicarbazones is inferred from IR spectra. The structure of one of the complexes has been resolved using single crystal X-ray diffraction studies. The crystal structure revealed a monoclinic space group $P2_1$. The compound adopts a distorted square pyramidal geometry with an N_2OS core as the base. The secondary amine group of the Schiff base dianion forms a hydrogen bond to the O atom of the dimethylformamide solvent. In the crystal, the phenyl ring of one of the two Schiff base anions is disordered over two positions in a 1:1 ratio. The crystal is found to be a racemic twin.

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COMPOSITION AND BIOMASS OF NEMATODE FAUNA OF SELECTED BEACHES OF KERALA, INDIA

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Abstract

Forty species of Adenophorean nematodes are reported as part of a taxonomic study conducted on aberrant groups of interstitial fauna from five sandy beaches of Kerala, India. These include 20 enoplids, 12 chromadorids and 8 monhysterids. Cherai beach supported the maximum number of nematode species (28sp.) belonging to all the four trophic groups. Fort Kochi, Arthungal and Veli beaches were dominated by predators/omnivores; deposit feeders and predators co-dominated in Cherai, whereas a preponderance of deposit feeders was noticed at Sakthikulangara beach. In terms of biomass, predators contributed the maximum, notwithstanding the type of dominant trophic group in a habitat. Individual body mass of nematodes ranged from 0.05 µg to 1.475 µg. The diversity profile, presented as k-dominance curves shows a gradual s-shaped curve for Cherai beach, indicating species diversity of this beach.

Key words: biomass, nematodes, predators, trophic group

Introduction

Nematodes are arguably the most diverse and numerically dominant metazoans in marine habitats[1,2,3]. Free living nematodes comprise a variety of

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feeding guilds including bacteria and diatom-feeding species, scavengers and predators, which play a fundamental role in the benthic food web as recyclers and as a trophic link between microorganisms and macrofauna[4,5,6,7]. Though several nematofaunal and meiofaunal works have been carried out on the west coast of India[8,9,10,11,12,13], studies on nematode taxonomy of the sandy beaches of Kerala[14,15] and the composition and biomass of nematodes based on trophic groups are meagre. Comprehensive works on taxonomy or ecology of free-living marine nematodes from the Indian subcontinent are less as compared to other areas of the world[16]. The most important climatological aspect of the west coast of India is the occurrence of heavy south-west monsoon often accompanied by strong winds[17]. About 90% of the 590km stretch of the Kerala coast on the west coast of India is sandy with 35 tidal inlets. The sandy beaches and the tidal inlets make this coast morphologically highly dynamic. The main objectives of the study are to identify the nematode fauna of sandy beaches of Kerala and understand the trophic group composition and biomass of marine nematodes.

Materials and Methods

The study area include five sandy beaches (Fig.1), Cherai (lat.10°09′N; long.76°02′E (St.1), Fort Kochi (lat.9°18′N; long.76°05′E (St.2), Arthungal (lat.9°10′N; long.76°23′E (St.3), Sakthikulangara (lat.8°45′N; long.76°38′E (St.4) and Veli (lat. 8°29′ N; long.76°59′ E (St.5) located along the coast of Kerala, India. Samples in triplicate were collected in three seasons of the year from two points each (100 meters apart) per beach during low tide by pressing a galvanized iron core (8 cm inner diameter) up to the level of interstitial water (12-18cm). The undisturbed sediment samples were immediately transferred into bottles and 7% $MgCl_2$ prepared in filtered seawater was added to anaesthetize the interstitial organisms. After 15 minutes, the

sample was fixed and preserved in buffered formalin diluted to 4% by filtered seawater. The fixed samples were stained with .1% Rose Bengal[18] for efficient faunal extraction.

Fig.1: sampling locations of the study area

Extraction of the interstitial fauna: Meiofauna was separated by suspension-decantation method[19]. The organisms were sorted and counted group wise into major taxa. Seinhorst's method[20] was followed to prepare the permanent mounts of nematodes. Samples dehydrated for two weeks, were used for the preparation of the slides. Several nematodes were arranged in the center of the slide where anhydrous glycerine was the mountant. A 22mm cover glass was kept wedged with 2mm glass wool. The coverglass was sealed twice to avoid evaporation. The specimens were examined with the aid of microscopes

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equipped under oil immersion lens. Necessary measurements were taken using calibrated ocular micrometer based on De Man's formula, as adopted by Jansen[21,22]. Identification of nematodes was done using the pictorial keys of Platt & Warwick[23,24,25] and Warwick & Platt .

Nematode trophic groups: Free living nematodes partition the environment in various ways of which food partitioning is the most important. Based on the buccal features, the nematodes were categorized into four feeding groups such as selective deposit feeders (1A), non-selective deposit feeders (1B), epigrowth feeders (2A) and predators (2B) as proposed by Wieser[26]. Diversity was estimated by k-dominance.

Nematode biomass: Biomass was estimated with the biovolumes method using the equation $V=530 * L * W^2$ [27], where V is the volume (nl), L total length (mm) and W maximum width (mm) of a given specimen. The nematode's wet weight (µg w.w) was obtained by using a specific gravity of 1.13 and converted into dry weight (µg d.w) assuming a dry/wet ratio of 0.25[28].

Results

The nematode fauna consisted of forty free living Adenophorean species belonging to three orders, fourteen families and twenty nine genera. Of the 40 nematode species, enoplids was the dominant group represented by 20 sp., followed by chromadorids and monhysterids comprising of 12 and 8 sp. respectively. Functionally and structurally, this classification is generally related to their mode of feeding, enoplids being mostly predators; monhysterids belonging to deposit feeders and the epigrowth feeding chromadorids. By and large selective deposit feeders are represented in all the groups. The list of nematode species, their trophic groups, wet weight, dry weight and their

presence or absence in the study locations are presented in **Table 1.** Selective and non selective deposit feeders were pooled into one group and the mean numerical abundance of nematode trophic groups ($100cm^{-3}$) in different beaches is presented in **Table 2.** Fort Kochi, Athungal and Veli beaches were abounded by predators/omnivores; deposit feeders and predators were found to co-dominate in Cherai, and a preponderance of deposit feeders was the trophic picture of nematodes in the Sakthikulangara beach. **Table 3.** gives the biomass contributed by the feeding groups in different beaches.

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Table 1: List of nematode species found in the study locations with the corresponding feeding groups (Wieser, 1953), mean individual body length, body width, wet weight and dry weight

Species	TG	L (mm)	W (mm)	V (nl)	W.W (µg)	D.W (µg)	Cherai	F.Kochi	Arthungal	Sakthi kulangara	Veli
Trissonchulus acutus	2A	1.37	0.061	2.7	3.05	0.763	●	○	○	○	●
Trissonchulus janetae	2A	1.94	0.053	2.89	3.27	0.816	○	●	○	○	○
Halalaimus capitulatus	1A	1.78	0.015	0.21	0.24	0.06	●	○	○	●	○
Epacanthion buetschlii	2B	2.01	0.07	5.22	5.9	1.475	●	○	●	○	●
Epacanthion georgei	2B	1.86	0.046	2.09	2.36	0.59	○	○	●	○	○
Epacanthion gorgonocephalum	2B	2.14	0.055	3.43	3.88	0.97	●	●	●	○	●
Epacanthion pellucidum	2B	1.73	0.028	0.72	0.81	0.2	●	○	○	●	●
Enoplolaimus connexus	2B	2.03	0.045	2.18	2.46	0.62	●	○	●	○	○
Enoplolaimus propinquus	2B	1.23	0.032	0.67	0.76	0.19	○	○	○	○	●
Mesacanthion pali	2B	1.76	0.038	1.35	1.53	0.38	○	○	●	○	○
Enoploides brunetti	2B	2.32	0.064	5.04	5.69	1.42	○	○	●	○	○
Oxyonchus culcitatus	2B	1.9	0.049	2.42	2.73	0.68	●	○	●	○	○
Trileptium sp.	2B	4.4	0.065	9.85	11.13	2.78	●	○	○	○	○
Phanoderma campbelli	2B	1.61	0.05	2.13	2.41	0.6	●	●	●	●	○
Metoncholaimus haplotretos	2B	2.37	0.058	4.23	4.78	1.19	○	○	●	○	○
Oncholaimus flagellatus	2B	2.27	0.051	3.13	3.54	0.88	○	○	○	●	○
Oncholaimus brachycercus	2B	0.92	0.05	1.22	1.38	0.35	○	●	●	○	●
Viscosia antartica	2B	2.08	0.059	3.58	4.05	1.01	●	●	○	●	●
Bathylaimus capacosus	1B	1.3	0.05	1.73	1.95	0.49	○	○	●	○	●
Rhabdocoma obtusicaudata	1A	1.2	0.017	0.18	0.2	0.051	○	●	○	○	○

Daptonema psammoides	1B	0.91	0.038	0.7	0.79	0.2	●	●	●	●	○
Daptonema setifer	1B	1.37	0.039	1.1	1.24	0.62	●	●	●	○	●
Daptonema vicinum	1B	1.15	0.04	0.98	1.11	0.28	●	○	○	○	●
Theristus acer	1B	0.84	0.027	0.32	0.36	0.09	●	●	○	●	●
Theristus sp.	1B	0.76	0.033	0.44	0.5	0.12	●	●	○	○	○
Paramonhystera albigensis	1B	1.53	0.036	1.05	1.19	0.3	●	●	●	○	○
Rhynchonema hirsutum	1B	0.52	0.025	0.17	0.19	0.05	●	○	○	●	●
Prorhynchonema warwicki	1B	0.583	0.031	0.3	0.34	0.08	●	○	○	●	○
Ceramonema africana	1A	0.13	0.025	0.37	0.42	0.105	○	○	○	○	●
Ceramonema sp.	1A	1.18	0.031	0.6	0.68	0.17	●	○	○	○	●
Marylynnia sp.	2A	0.86	0.041	0.77	0.87	0.22	●	○	●	●	○
Pomponema multipapillatum	2A	0.99	0.035	0.64	0.72	0.18	●	○	○	○	●
Paracyatholaimus chilensis	2A	0.1	0.063	0.21	0.24	0.06	●	○	○	●	○
Gammanema sp.	2A	0.895	0.048	1.09	1.23	0.31	●	○	●	●	○
Prochromadorella quinquepapillata	2A	1.25	0.03	0.6	0.68	0.17	○	●	○	●	●
Neochromadora tecta	2A	1.26	0.045	1.35	1.53	0.38	●	○	○	○	○
Metachromadora(Bradylaimus) suecica	2A	0.86	0.042	0.8	0.9	0.23	●	○	○	○	○
Onyx ferox	2A	0.84	0.05	1.11	1.25	0.31	●	○	●	●	○
Onyx perfectus	2A	0.928	0.05	1.23	1.39	0.35	●	●	○	●	●
Metepsilonema magdae	2A	0.213	0.029	0.09	0.1	0.03	●	○	○	○	○

●: present; ○: absent; TG: Trophic Group; L: total length; W: maximum width; V: volume; W.W: wet weight; D.W: dry weight

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Table 2: Numerical abundance (annual mean) 100cm^{-3} of nematode trophic groups at the various beaches

Trophic groups			
Beaches	**Deposit feeders (1A & 1B)**	**Epigrowth feeders (2A)**	**Predators (2B)**
Cherai	399	350	401
Fort Kochi	162	92	183
Arthungal	191	63	317
Sakthikulangara	339	191	252
Veli	19	15	69

Table 3: Mean Biomass (µg) of nematode trophic groups100 cm^{-3} in the five beaches.

Beaches	**Deposit feeders (1A & 1B)**	**Epigrowth feeders (2A)**	**Predators (2B)**
Cherai	131.6	100.5	399.7
Fort Kochi	31.4	20	143.3
Arthungal	67.3	16	210
Sakthikulangara	31.9	35	234
Veli	7.9	5.7	78

The diversity profiles are presented as k-dominance curves[29]. The starting point of the curve and its inclination are indicative of the diversity profile of the community. It is apparent that the gentle slope of the k-dominance curve for Cherai beach (**Fig.2**) indicates high species diversity. The rest of the nematode curves cannot be strictly compared since they are almost co-incident, touching or crossing each other.

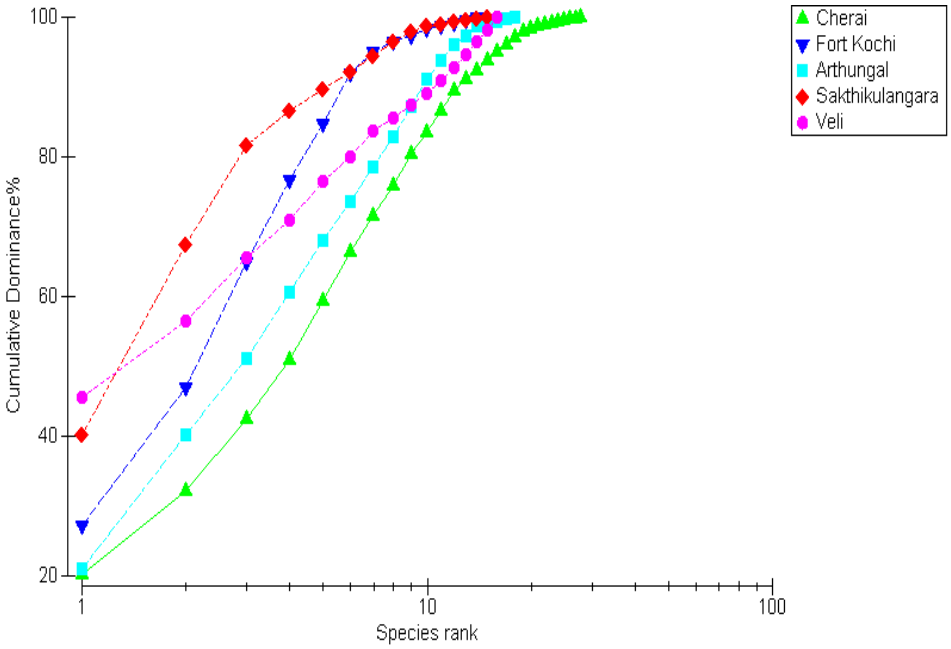

Fig. 2: k – dominance ranked curves of nematode species in the five beaches

Discussion

Biodiversity investigations aim to integrate species checklists and the compilation of databases that represent a regional and global benefit for researchers worldwide[30]. The taxonomy of marine nematodes is known to be very difficult and the identification of nematodes to species level is often hampered by the fact that a significant proportion of the specimens collected are either juveniles or females, which often lack the diagnostic features required for an accurate identification. In the case of male specimens it is necessary to examine a high number of specimens to arrive at a specific diagnosis. These limitations render biodiversity studies inadequate and hence have been frequently replaced by ecological studies where generic level treatment would suffice[30]. All the nematodes present in the samples were identified up to the species level; however, five species are assigned to specific genera only and are reserved to be described as new species. For a

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long time the trophic guilds[26] have been used to discriminate between the functional roles of nematodes and today they still represent a valid tool used in ecological studies. But Gingold et al.[31] have opined that the trophic function is just one of multiple functions nematode communities are involved in, and redundancy patterns may vary among multiple functions. Size, shape, quality and quantity of food resources may explain coexistence of congeneres. Nematodes have very different types of mouth openings and buccal cavities, which indicates food resource partitioning in a habitat. Food-size selection may effectively minimise interspecific competition. Of the forty nematode species, 15 sp. were predators/omnivores (Group 2B), 12 sp. belonged to epistrates (Group 2A) and 1A and 1B (selective and non selective deposit feeders) constituted 4 and 9 species respectively. Cherai beach supported the maximum number of species (28sp.) belonging to all the four feeding types, even though selective deposit feeders were minimal. The presence of all feeding types in Cherai indicates the availability of a broad spectrum of potential food ranging from microbes to detritus and fresh stranded sea weeds[32]. Distribution and abundance of the type of trophic group, in fact, determine the contribution of nematode biomass. It was quite apparent that the bulk of the nematode biomass was contributed by the predators. The preponderence of nematodes which were predators could considerably influence the trophodynamics of interstitial realm which is a major repository of particulate organic matter in sandy beaches. Omnivore-predator feeding nematodes indicate significance in this habitat since they can play an important role in the food web[33].

Though the deposit feeders outnumbered the other groups in Sakthikulangara beach, the maximum biomass was contributed by the predators. This is because predators are typically psammophilous and large sized. It is

evident from tables 2 & 3 that the biomass contributed by the deposit feeders is much less in Sakthikulangara beach, despite the fact that this group was represented by 339 individuals. Among the deposit feeders itself, biomass of nematodes varies widely with species, wherein, *Daptonema setifer* Gerlach had an average biomass of 0.62µg per individual whereas *Theristus acer* Bastian, another deposit feeder had an average biomass of 0.09µg only. *Daptonema setifer* was absent in Sakthikulangara beach whereas abundant species were encountered in Cherai beach. Though the dominance of epigrowth feeders is said to be a common feature of sandy beaches[34], none of the sandy beaches now studied encouraged existence of epigrowth feeders.

Conclusion

Meiofauna constitute the best studied component of the interstitial biota. The dominant taxa of sandy beach meiofauna are nematodes and harpacticoid copepods, with other important groups including turbellarians, oligochaetes, mystacocarids, gastrotrichs, archi-annelids, ostracods, mites and tardigrades. Nematofauna studies conducted on five selected sandy beaches of Kerala revealed the presence of 20 enoplids, 12 chromadorids and 8 monhysterid nematode species. Cherai beach supported the maximum number of nematode species (28sp.) belonging to all the four trophic groups, with a co-domination of deposit feeders and predators. In terms of biomass, predators contributed the maximum, notwithstanding the type of dominant trophic group in a habitat. Individual body mass of nematodes ranged from 0.05 µg to 1.475 µg. The diversity profile, presented as k-dominance curves shows a gradual s-shaped curve for Cherai beach, indicating species diversity of this beach.

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SCRUM METHODOLOGY IN HUGE PROJECTS

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Abstract

Agile Methodology is now becoming the mostly accepted software development method. The main challenge faced by most of the software development team is to include the continuous changes demanded by the customer. For this purpose, software development method must be flexible. Agile Methodology is the one which could satisfy this demand and hence most of the companies are now in the way to accept this new technology. Among the different Agile methodologies, the one we have concentrated is Scrum Methodology. Even if it is flexible, the problem that is still noticed is that the method is best suitable for small project. In this paper we have introduced some changes in the Scrum Methodology so that it could be used for huge projects too.

Key words : Scrum, agile methodology, software development

Introduction

Scrum principles are consistent with the agile manifesto and are used to guide development activities within a process that incorporates the following framework activities: requirements, analysis, design, evolution, and delivery. Within each framework activity, work tasks occur within a process pattern called a sprint. The work conducted within a sprint (the number of sprints

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required for each framework activity will vary depending on product complexity and size) is adapted to the problem at hand and is defined and often modified in real time by the Scrum team. Each of these process patterns defines a set of development actions: Backlog—a prioritized list of project requirements or features that provide business value for the customer. Items can be added to the backlog at any time. The product manager assesses the backlog and updates priorities as required. Sprints consist of work units that are required to achieve a requirement defined in the backlog that must be fit into a predefined time-box. A time-box is a project management term that indicates a period of time that has been allocated to accomplish some task. Scrum incorporates a set of process patterns that emphasize project priorities, compartmentalized work units, communication, and frequent customer feedback. Changes(e.g., backlog work items) are not introduced during the sprint. Hence, the sprint allows team members to work in a short-term, but stable environment. Scrum meetings are short (typically 15 minutes) meetings held daily by the Scrum team. Three key questions are asked and which are answered by all the team members :

- What did you do since the last team meeting?
- What obstacles are you encountering?
- What do you plan to accomplish by the next team meeting?

A team leader, called a Scrum master, leads the meeting and assesses the responses from each person. The Scrum meeting helps the team to uncover potential problems as early as possible. Also, these daily meetings lead to "knowledge socialization" and thereby promote a self-organizing team structure. Demos—deliver the software increment to the customer so that functionality that has been implemented can be demonstrated and evaluated by the customer. It is important to note that the demo may not

contain all planned functionality, but rather those functions that can be delivered within the time-box that was established. The Scrum process patterns enable a software team to work successfully in a world where the elimination of uncertainty is impossible.

Here in this paper we are trying to go through Scrum focusing on the limitations and thereby bringing some changes in the usual methods of scrum. These changes may help us to use the Scrum Methodology for huge projects.

Limitations of Scrum

In Agile Methodology Scrum is the one that is mostly used in many companies. After our discussion with many people working at different companies, the problems they shared are:

1) Agile have very short time period for each sprint.
2) Time limitation increases work pressure.
3) Daily meeting becomes burden for majority of the people.
4) Perfection suffers due to short time span.
5) Testing will not be perfect always.
6) Testing can be automated, but the big problem is that it does not find a new bug. The cost of test automation is high when it is short term testing.
7) Chances are there to deviate from the right goal for large project. The size of the project is judged by the number of people, complexity, development time framework, cost of the project or a combination of these parameters.
8) Product owner has to be a well efficient person to monitor the whole project.

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After analysed all these parameters , we set the objective to develop Scrum Methodology suitable for Huge Projects. To develop such a Methodology, we have used the concept of "Scrum of Scrum ". Some of the problems of this concept raised are :-

1) Lack of a unified view of the product/service
2) Redundancy of work (two teams implementing the same part of the scope)
3) Communication failure
4) Integration hell (how to integrate different parts of a product developed by different teams)
5) Dependencies between tasks of different teams
6) Complex change management
7) The first technique to solve these problems is "the replication of key roles in each of the teams, such as the PO, Scrum Master, and technical lead".

We have used these ideas and have restructured the whole concept of Scrum Methodology so that it could be used for huge projects.

Scrum Methodology for Huge Projects

When we have to use Scrum Methodology for huge projects we split the main projects to a particular number of mini projects. This number is decided by the complexity and time limitations of the project. Also we will have a Product Owner, Scrum Master, Documentation Master, Integration Phase, and Test Master for the main project. They may be leading force of the main project.

The mini projects will work in normal Scrum Methodology, having their own Product Owner, Scrum Master, Documt-Person and the team.

Role of Chiefs:

- **Main Product Owner:**
  - He will be having the ultimate control over the whole project.
  - He conducts meetings with the other Product Owners of each team.
  - These meetings decide how to divide the project, what the requirements are and also, which team will handle which project.
  - The directions of work and its progress are also monitored by the Main Product Owner.
- **Main Scrum Master:**
  - He directs the Scrum Masters of the other teams.
  - He is the Scrum Master of all other Scrum Masters of the team
  - He too conducts Meetings with the other Scrum Masters and works on the needs and requirements needed for the team.
- **Document Master:**
  - He makes the final documentation of the whole project.
  - He collects documents from the corresponding team member assigned for documentation for each team.
  - He verifies all the documents submitted to him from each team.
- **Integration Phase:**
  - This is phase in which all the modules are integrated together to form the final project.
  - It is in this phase where integration testing is done.

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- **Test Master:**
  - He does the testing of the whole project after integration.
  - He does testing of work of each team daily using the documents obtained from the testers and the developers.
  - He re-checks the checked areas using the documents and would try to find the maximum bug.
  - If any changes required, he would inform it to the development team by mail.

So far we have explained the different main members and their roles in the project. Along with this, we have introduced some changes in the meeting also. This is because of the fact that, as the project is very huge and if so many changes has to be made again and again , then it would cause definite problems. Hence it would be better to develop software that is flawless.

Meetings

Meeting is a very crucial part of Scrum Methodology. If the project is very huge , then the process of meeting will also be crucial. In this paper we have also introduced some changes in this usual process of meetings too.

The meetings are divided in to two phases. The first phase is between the chiefs and the second phase is similar to the normal Scrum meetings. The phases are explained below:

- **Phase I**
  - **Between Product Owner (main) +PO1 +PO2+PO3……. :**
    - Throws light on the project.
    - Makes thorough study and there by decides on what basis the project has to be divided.

- The main decisions taken on this meeting are:

- Basis on which the project has to be divided.
- How many teams should be there for the complete project.
- Which team has to be assigned which section?
- What should be the time limit for each section?
  - **Between Scrum Master (main) +SM1+SM2+SM3…….**
    - Each team will be having their own scrum master
    - They all have to be controlled by the main Scrum Master.
    - The main Scrum master conducts meeting with all other Scrum Master to discuss about the progress of the whole team.
    - Any complaints or requirements of the independent team can be presented in this meeting ,which the subordinate Scrum Master things should be done.
- **Phase II**
- This phase is the meetings normally done within an individual team.
- The team will have its own Product Owner & Scrum Mater.
- In phase II everything is same except that the daily meeting. Daily meeting is considered as a burden by many and as benefit by few. Hence a small variation has been included in it. The different meetings within the team has been described below:
  - Sprint Planning Meeting : Output is Sprint backlog
  - Sprint Review meeting: Held at the end of sprint, team demonstrates the work done in sprint to the Product Owner and the Stakeholder.

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- Sprint Retrospective meeting: After the current sprint and before the next sprint, discuss what went wrong and what can be improved.
- ***Daily Scrum :*** Inspects the progress toward the Sprint goal and to make adaptations that optimize the value of the next workday.

- Each team member is asked to do documentation for each day based on certain questionnaires.
- These documents have to be mailed to the Scrum Master each day.
- They would conduct meetings only in the weekly basis (face to face or by video conferencing).

Conclusion

After the study and discussion with various people, the ideas emerged to make scrum useful for huge project are being discussed above. With these changes in the whole structure and also in the meetings, we can use scrum for huge projects.

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SALVINIA MOLESTA MICROFIBRILS – AS A FILLER IN NITRILE RUBBER

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Abstract

Salviniamolesta is weed of national significance. It is regarded as one of the worst weed because of its invasiveness, potential for spread and economic and environmental impacts. There is a need to develop a set of catchment management protocols to minimize impacts in aquatic ecosystems. The effect of SMMF on cure characteristics and physicomecanical properties of NBR were studied at various fibre loading (20,30,40phr) was investigated. The solvent swelling characteristics of NBR composites were investigated in aromatic solvents like benzene, toluene and xylene. Maximum uptake is observed for benzene and minimum for xylene and toluene in the intermediate position. Incorporation of SMMF to NBR caused an improvement in tensile strength modulus, hardness and, it decreases elongation at break. Tensile strength is more significant at 30phr.

Introduction

Fiber-reinforced rubber composites are of immense important both in industrial field and in the research and development.[1-4]In the rubber industry, the use of fillers is widely adopted because of the several advantages they present [5-7]. The incorporation of fillers in polymers, in fact, is the improvement of physical, thermal and mechanical properties, as well as the

modification of processing characteristics and the reduced costs of the final product. Recent studies [8- 9] on natural fibers have shown that it is possible to obtain materials that perform well by using environmentally friendly reinforcements. Taking this into consideration, the main mechanical properties of elastomer/cellulose based reinforced systems have been analyzed by several authors [10-12].

The mechanical properties of filled rubber are usually describer in terms of tensile strength, tear strength, young's modulus ,hardness, resilience and abrasive loss. The mechanical properties of filled rubber depends mainly on the type of ,filler loading , filler dispersion, filler particle size and the interaction between the filler and the rubber matrix. Swelling of rubber vulcanized in a number of solvents have been studied .[13-15]The contact of rubbers with organic solvents can be well explained by absorption and diffusion phenomena [16].Acrylonitrile butadiene rubber, commonly known as nitrile rubber (NBR), is a synthetic rubber that possesses good heat and oil resistance. It has a wide range of product applications. The present study deals with the curing characteristics, mechanical properties, and swelling behavior of SMMF reinforced NBR composites. In this study SMMF was utilized as reinforcing filler in NBR compounds. The effect of the content of the filler (0, 20, 30,40phr) on the curing characteristics and mechanical properties of rubber are reported.

Experimental

Materials

Fibres were isolated from fresh Salviniamolesta by NaOH treatment. NBR was obtained from Apar Industries, Mumbai, India. The compounding ingredients used in the vulcanized systems and solvents used for swelling studies are of laboratory reagent grade.

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Preparation of micro fibril

Fresh Salviniamolesta were collected and washed to remove adhering dirt and dried.It is then treated with 2% NaOH in an autoclave and kept under a pressure of 15 kg/cm^2 and100^{0}C temperature for a period of I hour . Release the pressure of the autoclave and wash the materials with distilled water for many times .The washed fibres are then allow to drain off the free floating water. Finally the fibres are bleached using NaOH-acetic acid and Sodium hypochlorite solution.

Fig. 1: Salviniamolestamicrofibrils

Compounding and Processing.

Formulation of the mixes used in the present work are given in Table1. A,B,C and D represents mixes vulcanized by Sulphur. Mix A represents the gum vulcanizate.B,C and D represents mixes at different fibre loading .Composites were prepared using a laboratory two-roll mixing mill according to the ASTM D 3182 method. Vulcanization was carried out in an electrically heated hydraulic press with 2 mm spacers at 160°C and a pressure of 200 bars for the optimum cure time previously determined from an moving die Rheometeraccording to ASTM Standard Test Method D2084. Specimens were mechanically cut from the vulcanized plaques.

Table 1: Formulation of Mixes (phr[a])

Sl No		A	B	C	D
1	NBR[b]	100	100	100	100
2	Zinc oxide	5	5	5	5
3	Stearic acid	1	1	1	1
4	CBS[c]	1	1	1	1
5	TDQ[d]	1	1	1	1
6	Sulphur	1.5	1.5	1.5	1.5
7	Filler[e]	_	20	30	40

[a] phr parts per hundred rubber

[b]Acronytrile butadiene rubber.

[c] N-Cyclohexyl-2-benzothiazyl sulfonamide.

[d] 2,2,4-Trimethyl-1,2-dihydroxy quinoline polymerized

[e]Salvinia Molesta microfibrils

Mechanical properties

Tensile properties were determined on an Instron Corporation Series IX Automated Materials Testing System 1.34 using dumbbell specimen, according to the ASTM D412-68.Hardness measurement of samples was done according to ASTM D-2240-81 test method using shore A type Durometer.

Swelling behavior

Swelling studies were carried out using circular samples of diameter 2cm diameter which were punched out from the vulcanized sheets by means of a standard die. Initial weight of the sample is taken and it is immersed in aromatic solvent (benzene, toluene and p-xylene) in diffusion bottles and kept at room temperature. The samples were taken out from the bottles at periodic intervals and the wet surfaces were quickly dried using tissue paper and weighed immediately. The experimental procedure was continued until no further increase in solvent uptake was detected.

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Results and discussions

Cure chararacteristic

The cure characteristics of SMMF loaded NBR compounds has been studied from the rheographs. Values of the cure time, t90, are decreased with increasing fibre content. The maximum torque in the rheographs is a measure of crosslink density and stiffness of the NBR matrix. It is clear from the figure 2 that for all mixes ,the torque initially decreases and then increases ,and finally level off. As the torque value increases with the incorporation of the fibres which suggest that in the presence of the fibres, more energy for the elastomers cross linking is needed. The initial decrease in torque to minimum value is due to the softening of the rubber matrix, while the increases in torque is due to the cross linking of the rubber.

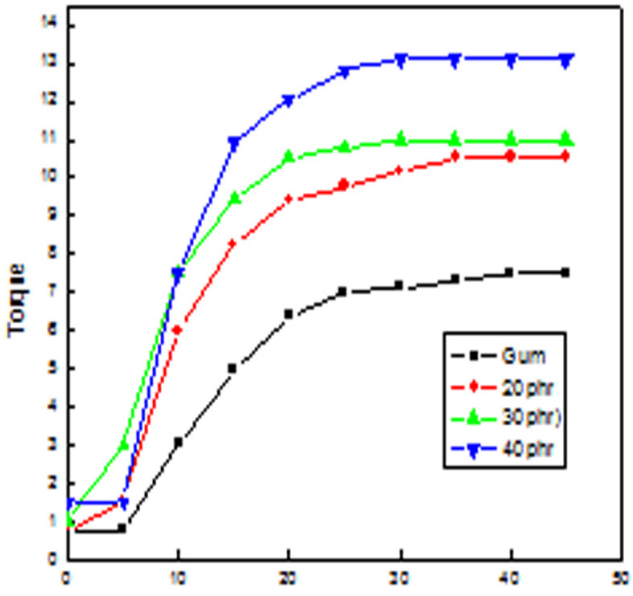

Fig. 2: Change of torque with fibre loading of NBR mixes

Mechanical properties

Table 2: Mechanical properties of SMMF, reinforced NBR vulcanizates.

Sl No		Tensile strength (MPa)	Modulus at 100% (MPa)	Modulus at 200% (MPa)	Modulus at 300% (MPa)	Elongation at Break (%)	Hardness (ShoreA)
1	NBR (Gum)	2.938	1.095	1.400	1.396	434.4	50
2	NBR(20phr)	4.265	1.213	1.537	1.655	201.1	58
3	NBR(30phr)	4.406	1.354	1.678	1.763	115.3	60
4	NBR(40phr)	3.831	1.260	1.352	1.462	99.5	62

The mechanical properties of NBR compounds are shown in Table 2. To study the effect of filler loading on the mechanical properties various fillers were incorporated, with loading range from (0,20,30,40phr) in NBR. Figure 3 shows the effect of filler loading on tensile strength of NBR . The tensile strength has been found to increase with increases in fibre concentration. The tensile strength values mainly dependent on the host matrix and is more significant at 30 phr .The interfacial bond formed facilitates better load transfer to the fibres and result high tensile strength values. A higher concentration of fiber does not cause significant increase in tensile strength. This behaviour can be related to the probable tendency to form filler agglomerates. It is well known that if there is adhesion between the polymers and filler tensile strength of the composites increases. If there is no adhesion tensile strength decreses.[17]

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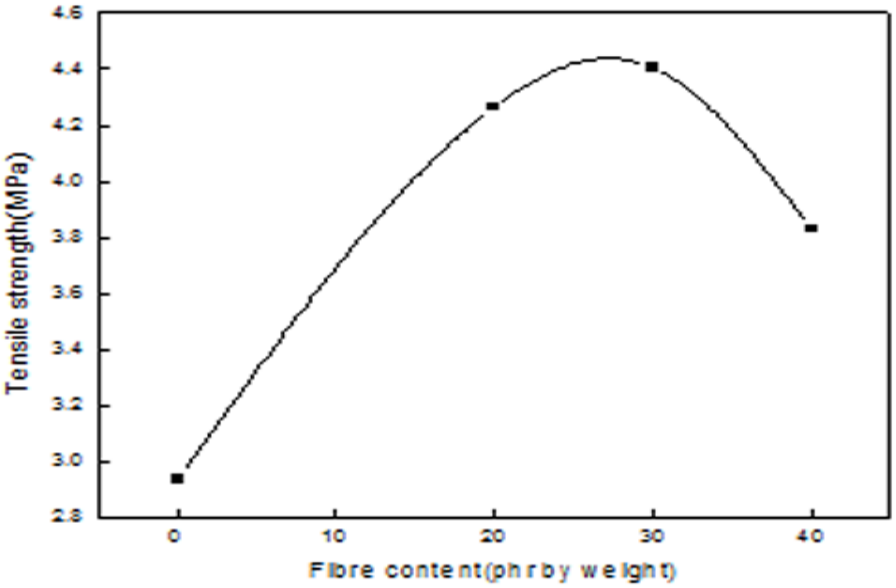

Fig. 3: Effect of loading on tensile strength of SMMF reinforced NBR composites

Modulus is the indication of the relative stiffness of the material. Figure 4shows the effect of micro fibrils loading on Young's Modulus (100%) of SMMF reinforced NBR composites.The modulus at 100% elongation in the orientation of the fiber increases as the filler concentration increases for 30phr for NBR composites This indicates a better restraint of the matrix by the improved fiber–matrix interfacial bond in the presence of the fibre. For a 0–30 phr fiber loading, the modulus remains more or less constant with the filler concentration. The modulus at 100,200and300%elongation shows a maximum value for composites with SMMF of 30phr.Sae-oui et al[18] also reported that surface activity is the most important factor controlling the modulus.

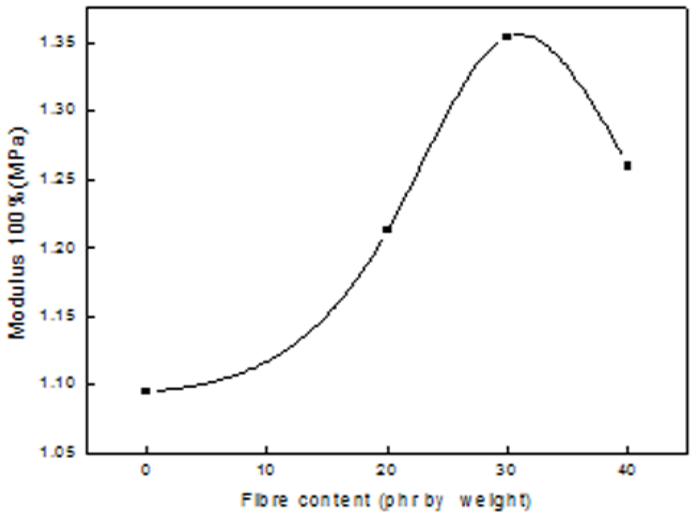

Fig. 4 : Effect of loading on modulus of SMMF reinforced NBR composites.

The effect of micro fibrils loading on elongation at break(%) of SMMF reinforced NBR composites shown in figure 5. Elongation at break of mixes falls sharply at low fibre loading and then decreases gradually. With an increases in fibre loading the stiffness and brittleness of the composites increases gradually with an associated decreases in elongation at break.

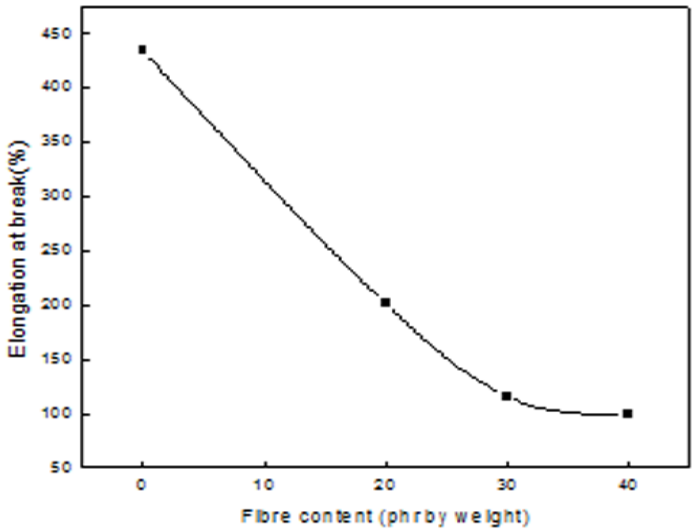

Fig. 5: Effect of loading on elongation at break of SMMF reinforced

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The hardness of the compound increases as fibre content increases. This indicate that the fibres behaved as effective reinforcing agent regardless of the rubber phase used i.e., the incorporation of fibres give rise to more rigid material. Figure 6shows the effect of micro fibrils loading on hardness of SMMF reinforced NBR composites. The increase in hardness is also due to the rigid nature of fiber. Moreover higher hardness was reached when amount of filler increased passing from a hardness of 50-62 for Shore A when SMMF content increased from 0-40 phr for NBR composites

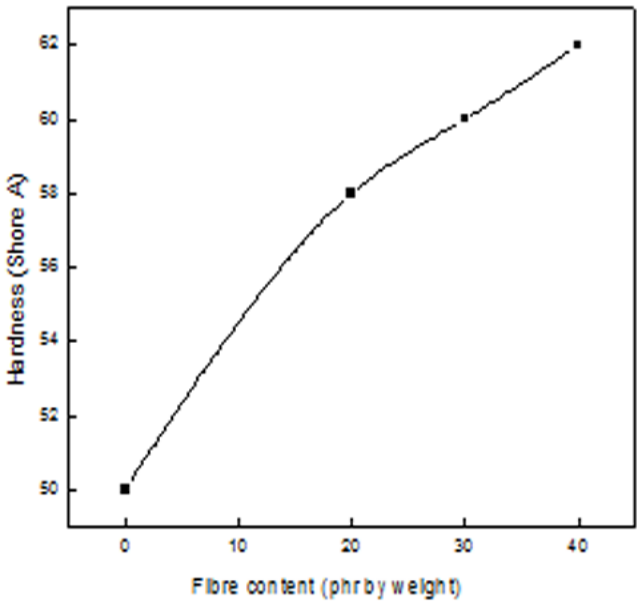

Fig.6: Effect of loading on hardness of SMMF reinforcedNBR composites

The mechanical properties of NBR compounds are shown in Table 2.A noticeable improvement of tensile strength was exibited with the increment of filler content .As the fibre concentration increases ,the stress is more evenly distributed and the strength of the composite increases. The composites with a fibre loading of 30 phr shows highest tensile strength and modulus. Hardness also increases with increases of fibre loading.

Swelling studies

The diffusion properties of different liquids in polymers have been studied extensively by several authors[19-21]. The effect of crosslink density on diffusion has been observed by Pohet al[22.] The Q_∞values of the SMMF reinforced composites for NBR composites for benzene, toluene and xylene at room temperature are given in Table 3.

Table 3: Values of equilibrium uptake (Q_∞ (mol%)) of SMMF reinforced NBR composites in benzene, toluene and xylene at 25^0C

Sl No	Benzene	TolueneXylene		
1	NBR (Gum)	2.432	1.7435	1.1259
2	NBR(20phr)	3.215	2.3026	1.5570
3	NBR(40phr)	2.645	1.912	1.3370

It is obvious from the figures that there is a tendency to increase solvent uptake, as filler content increases. The diffusion and transport in filled rubber composites depend upon the nature of fillers, degree of adhesion and their compatibility with polymer matrix .Fillers takes up the free volume of the polymer matrix and create a path for the permeating molecule. The figures 7,8, 9 shows the plot of Q_t versus √t of NBR samples in benzene, toluene,xylene.

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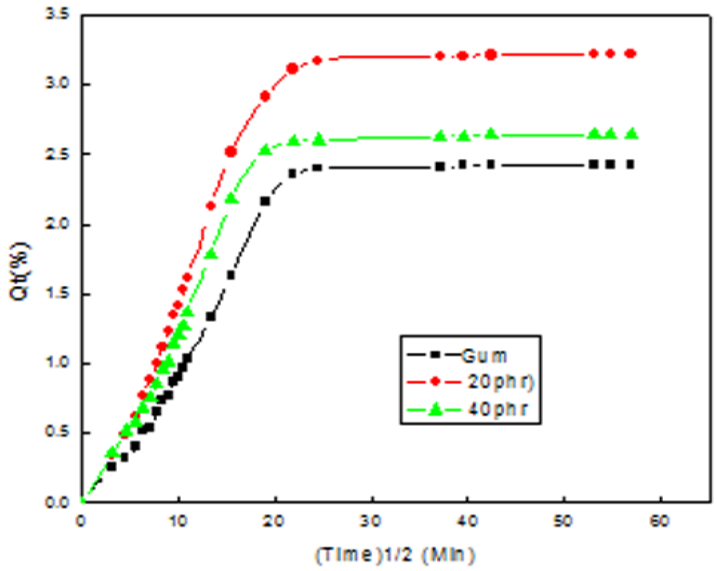

Fig. 7: Mole percent benzene uptake of NBR composites with differentfibre concentration

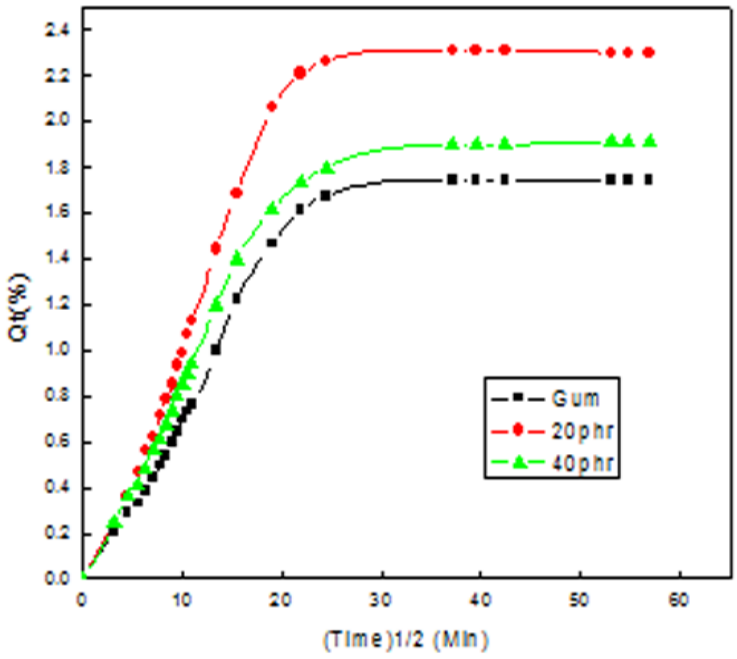

Fig. 8: Mole percent toluene uptake of NBR composites with differentfibre concentration

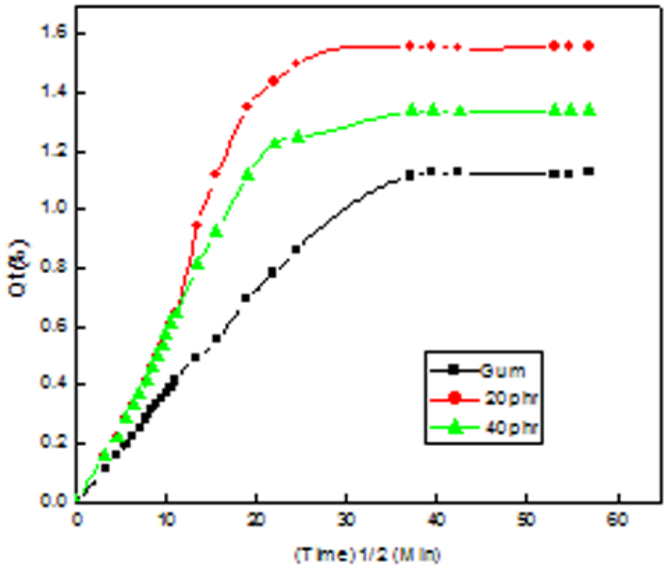

Fig. 9: Mole percent xylene uptake of NBR composites with differentfibre concentration

The Q_∞ values are given in Table 3 shows that Q_∞ value decrease with the increase of molecular weight of penetrant molecules. With increasing size of solvent molecules, there is a decrease in the value of Q_t mol%in all systems. Among the solvent used in this work, benzene shows maximum $Q_t$mol% and Xylene , the minimum. Toluene the intermediate position. The decrease in Q_t mol%uptakewith increase inpenetrant size might be due to the greater activation energy needed for activation of diffusion process.

Opitical Photographs of NBR composites of varying fibre loading before and after swelling in Benzene, Toluene and Xylene are shown in figure 10.

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Fig. 10: Photographs of NBR composites of varying fibre loading before and after swelling in Benzene, Toluene and Xylene

It was clear that by comparing the gum samples with the filled one (20 phr and 40phr) there is a drastic change in dimension ie, in both NR and NBR. It is clear from figure.5 that as fibre loading increases percentage increase in thickness increases but the diameter of the sample decreases as going from gum to 40 phr.This is due to the fact that swelling occurs predominantly in the thickness direction i.e., as fibre loading increases the number of fibres in a unit volume increases and it is difficult to diffuse the penetrant molecule into the polymer. Also there is a decreasing trend in dimension (both thickness and diameter) with increasing size of the solvent molecules. Among the solvents used benzene shows the the maximum dimensional change and xylene the minimum.

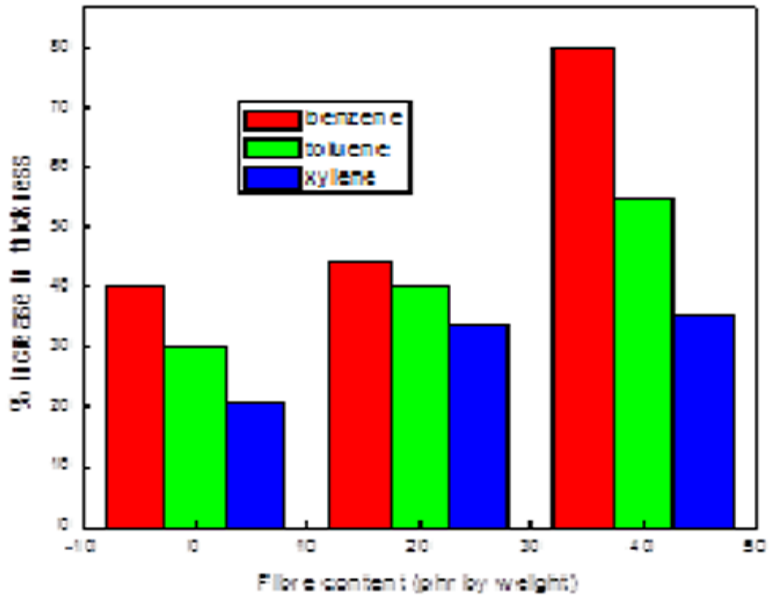

Fig.11: Variation of %increase in thickness with fibre loading for NBR composites in Benzene, Toluene and Xylene.

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HOSPITALS AND HOSPITALITY - A BLEND OF A CURATIVE CARE: A STUDY OF MEDICAL TOURISM HOSPITALS IN KERALA

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Abstract

Medical Tourism (MT) is a new phenomenon, which has largely reversed an earlier pattern of wealthy patient travelling abroad in search of quality treatment. It is a fastest growing industry especially in Asian countries. India has become a favored destination and its southern state of Kerala stands at the helm with extensive, functional healthcare facilities. Medical tourism has been identified as a potential industry segment in Kerala, which is promoted with its competitive advantages. This paper explores the MT industry by studying the hospitals catering medical tourists (MTs). Here the two important domains such as medical services, tourist services from the hospital point of view are analyzed using Consensual Quality Research (CQR) method. This paper throws light in to the present medical tourism industry in Kerala in terms of hospitals and both medical and services offered to them.

Key Words: Medical Tourism (MT), Medical Tourists (MTs), Medical Tourism Facilitators (MTFs)

Introduction

Travel for medical care (and wellbeing) has been existed from the early age itself hence the concept of medical tourism is almost as old as medicine itself. But the level, amount of promotion, organization, relations with

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worldwide corporate resources, networks, and effortlessness of global health travel is novel (Whittaker, 2008). Globalization gave impetus to the privatization of healthcare and is getting more attention than ever before worldwide and hence the healthcare industry is becoming more of a business opportunity nowadays. The earlier localized healthcare has become globalized with international accreditation, training and technologies. By 2017, the healthcare industry size is expected to touch US$ 160 billion (IBEF, 2013). Medical tourism is the new buzzword of the new globalized world which enhances the revenue portfolio of many direct and indirect sectors of the economy. More than 50 nations have identified medical tourism as a national industry (Gahlinger, 2008; Rad et al., 2010).The average contribution of MT is accounted as $45-95 billion to global Gross Domestic Product for six million patients (Medical Tourism Survey, 2013).

Literature Review

Different researchers consider different criteria to describe medical tourists and medical tourism. Ehrbeck et al., (2008) refer to medical travellers as travellers whose primary and explicit motivation is to seek medical treatment in foreign countries. According to Bennet (2009), medical tourism is the access to and quality of health care for local residents in countries offering it to foreigners and thus the slogan becomes "First World Medical Services at Third World Prices" and thus "offer an alternative to medical risk, prolonged suffering, and severe debt burden or possible bankruptcy". Connell (2006) viewed the nature of medical tourism as a popular mass culture " where people travel often-long distances to overseas destinations (India, Thailand, Malaysia) to obtain medical, dental and surgical care while simultaneously being holidaymakers, in a more

conventional sense" (p.1094). Thus according to Helmy (2012), Medical and healthcare services + Tourism and travel services + Support services = Medical tourism.

The Medical Tourism Survey (2013) has found out that the prominent areas of MT are Latin America and Asia. The highly demanded and favoured destinations are India and Mexico. In 2006, out of 10 million tourists in Singapore, 410,000 (4%) were medical tourists and 89,000 were their accomplice (Voigt et al., 2010). The highest sought procedure is cosmetic treatments having 38 % of the total market.

Average spending of a medical tourist is higher than that of a leisure tourist (Bennet et al., 2004) which is between $7,475 and $15,833 per medical travel trip (Medical Tourism Survey, 2013). World Travel and Tourism Council (2011) accounted the average spending of a medical tourist as US$12,000 while a leisure tourist spends only US$6,383 which means a medical tourist spends approximately twice as much money in the destination country. Viewing this financial aspect, both the governments and stakeholders are increasingly interested in MT activity with policies, corporate tertiary care multi-specialty hospitals, MT networks and collaborations, and insurance portability concerns. Though there is a vacuum in the collection and dissemination of statistical information of MTs' volume and revenue, the UK provides some statistics which help to assume that the phenomenon is growing faster. The outbound MTs in UK estimated as 63,000 in 2010 while inbound MTs were 52,000 (Lunt et al., 2014) and outbound travel has been increasing tremendously for the past few years.

The main push factors for medical tourism are the cost, quality care and quick access to healthcare. The Joint Commission International (JCI), the

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health care industry's official accreditation institution has increased the number of approved foreign medical sites from 76 in 2005 to over 220 in 2008(Galland , 2008 cited in Deloitte , 2009). This shows the real indication of medical tourism growth.

Medical Tourism Association (MTA) Patient Survey(June 2009) found that 64% of patients that travelled abroad for care did not have health insurance and almost 90% of patients or their companions engaged in tourism activities. The Survey found that 48% of respondents would be interested in engaging in medical tourism again at some point in the future. Further the survey found that the cost of medical treatment and state-of-the-art technology were the most important factors in their decision to travel abroad for treatment.

Identifying the positive impacts and the business opportunities of MT, both Indian government and the states have come up with promotional efforts. "The advancement was made particularly during the1990's, when, due to the liberalization in the health sector and the appearance of private hospitals, the import of new medical technologies and other medical equipment was made significantly easier" (Connell, 2006, p. 1099).

Medical tourism in Kerala is a fast growing industry offering ample opportunities for economic and social development, where in, no studies have been undertaken. "Low cost is the norm today without compromising on the quality and it is this 'cost -effectiveness and competency' bundled and packaged well with amazing tourism products of Kerala. World class hospitals, cost-effective treatment and ample opportunities to relax in the scenic landscape of 'God's own country' -- medical tourism promises to be the next big money spinner in Kerala, with a steady stream of overseas

patients flocking to the state" (Medical tourism: Sweet pill for Kerala , 2011). Many tourists have now realized that Kerala has a pool of trained doctors and nurses and an excellent network of hospitals that offer international standard treatments at very affordable prices. Faced with exorbitant fees for procedures such as cardiac surgery, dentistry and cosmetic surgery in their home countries, patients from the West and the Middle East have begun looking at India and Kerala in particular. Kerala doctors and nurses have established themselves as highly skilled and conscientious caregivers worldwide. Out of a total of 17.5 lakhs of nurses in India, 12 lakhs are Kerala nurses (Iqbal, 2012). Many doctors who have trained or worked abroad have returned to India to work here. Their reputation has led to the growth of the medical tourism industry in Kerala. The excellent hospital facilities, pre and post- operative care and pleasant climate make medical treatment and recovery in Kerala a positive experience.

Purpose of the study

The purpose of the present study was to explore aspects of hospitals in terms of medical tourism business in Kerala with reference to modern medicine.

Methodology

This is an exploratory qualitative study where Consensual Quality Research(CQR) method is used as especially good for studying events that are hidden from public view, are infrequent, occur at varying time periods, have not been studied previously, or for which no measures have been created" (Hill et al., 1997,p.18.). "In developing the interview protocol, Hill et al. (1997) encouraged researchers to review the literature to determine what has been done before so that they can build on previous research" (p.8).

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In this research, literature review and pilot study provided information about the data that are likely to be obtained from each question.

Of the 25 studies in the corpus involving individual participants, the range of participants was from 7 to 19 (Hill et al., 2005). In this study, 22 in-depth interviews were conducted among the medical tourism hospitals in Cochin out of many medical tourism hospitals located in Kerala. Out of the 22 in-depth interviews, 5 interviews were excluded as it couldn't reveal much of the information because of the confidential nature of the industry. 17 interviews were taken for analysis using CQR. Each interview followed a semi structured protocol, was 30 to 60 minutes long, and was conducted in English. Interviews were conducted as a team; members comprised of interviewer members of the research and the other as the note taker. Immediately after the interview, the interviewers created a single case record. In as much as possible, these transcript-like narratives reflected the words and perspectives of the interviewee and not the interpretation of the interviewers.

Data Analysis

For data analysis, domains (i.e., topics used to group or cluster data) are used to segment interview data. Here the major domains were medical services and tourism services. Core ideas (i.e., summaries of the data that capture the essence of what was said in fewer words and with greater clarity) are used to abstract the interview data within domains. Hill et al. (1997) noted that the "results and conclusions of the data analysis need to be logical, account for all the data, answer the research questions and make sense to the outside reader" (p. 558).

In terms of characterizing the frequency of occurrence of the categories while allowing better description of the data, Hill et al.(2005) suggested that 'General' include all or all but one of the cases, Typical would include more than half of the cases up to the cutoff for general (given that half does not seem typical), variant would include at least two cases up to the cutoff for Typical. With samples larger than 15, Hill et al., (2005) suggested adding a new category of 'Rare', which would include 2–3 cases, to allow more differentiation among categories. Finally, as before, findings emerging from single cases should be placed into a miscellaneous category and not reported in the data analysis. Hill et al(2005) recommended to fully and richly describe at least the general and typical categories and provide at least one example (using the core ideas or quotes) to illustrate each category in the text. Unless important for some reason, variant or rare data can be left in a table so that the Results section is not cluttered with too much information".

For this research n=17 and hence Category and sub-category are considered as General (G) if applied to 15-17 cases; Typical (T) if applied to 9-14 cases; Variant (V) if applied to 4-8 cases, Rare(R) if applied to 2-3 cases and Miscellaneous(M) if applied to 1 case.

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Results and Discussion

Summary of Domains, Categories, Subcategories, and Frequencies

Domain	Category/ Subcategory	Frequency	Respondents
Medical Services			
Separate Dept. for MT	Yes	V	5
	No	T	12
Language Interpreters	Yes	T	9
	No	V	5
	MTFs	R	3
Provision of Ethnic Food	Yes	V	5
	No	T	12
Accommodation	Own accommodation	V	5
of Accomplice	No accommodation	T	10
	Hotel Tie –up	R	2
Privileges	Fast Track System	T	10
	Pick-up and Drop	V	5
	Lab visits	R	3
	Local SIM card	V	4
	Separate wing	R	2
	No privileges	V	5
Aftercare	Handing over case history	T	7
	E-mail Follow-up	T	8
	Training by-stander	M	1
	Help-line numbers	R	2
	Tie-ups with domestic doctors	R	2
	No aftercare	V	5
Tourist Services			
Travel Desk	No	G	17
MT Packages	No	G	17
Patient's enquiry for	More than 80%	T	6
tourism	30 to 80 %	V	6
	Less than 30 %	R	2

Typical observation is that most of the allopathic MTHs have separate departments. However dental clinics do not have separate departments as MT

is a small niche of their health service. But there are two clinics which have a very different set up for foreigners and the facilities provided are to cater MTs. They are costly clinics because of this where locals are also treated. More than 60% of their patients are foreigners who come mainly from European countries, Canada and US. They do not entertain Middle East MTs as they perceive mutual communication and understanding is necessary for treatment. In addition, they do not entertain MTFs.

Another category emerged from the data is Language Translators. Typical observation is that translators are available on-call in languages such as Arab, Russian, French, Israel and Spanish. There are many nurses and doctors returned from Middle East countries who act as translators in many hospitals. Three hospitals responded that MTFs act as translators especially in Arab language.

Another category emerged from the medical services is ethnic food. Generally dental and eye care clinics don't provide ethnic food as the time spent is limited and appointment-based. Variant response is that few hospitals have cooking division or other arrangements to provide ethnic food at hospital. Typically most of the allopathic hospitals provide Arab food on request. It is observed that only the Arab MTs are particular about ethnic food.

Typical observation is that the hospitals do not arrange accommodation for the accomplice. It is obviously not required in the case of dental or eye procedures as the time spent is limited and appointment-based. However few allopathic hospitals have either tie-ups with hotel or own arrangements such as suite rooms, guest rooms etc. Only one bystander is allowed in the patient's room. Others are admitted in suites or guest rooms in the hospital if

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they are interested. Some of them will undergo health screening while at the hospital. Some patients stay outside and consult doctor when admission is not required.

Another category emerged from the data is privileges offered to MTs. Typically, most of the hospitals follow fast track system especially dental clinics as they work purely on appointment system. However variant observation is that most of the allopathic hospitals are crowded with local patients and so MTs have to wait.

It is variantly observed that some of the allopathic planned MTs are offered airport pick-up and drop facility. SIM cards, AC Ambulance services for pick up and drop, foreign exchange facility, separate floors and guest rooms etc. are other privileges offered to MTs.

Three most successful dental clinics in MTs give complimentary visit to Ceramic Lab, Muvattupuzha which is Asia's best dental lab to the patients requiring dental implants as they believe that clinical skill and technical skill are essential requirements for the success of dental implants and this visit is to 'show and let them believe' (Dental Doctor, Cochin). However, it is observed variantly that some hospitals and clinics are not offering any privilege to the MTs.

After-care

Typical observation is that most of the hospitals handover the case history to the patient. Emails and courtesy calls are typically used to contact MTs after treatment. Training by stands how to do after surgical procedures, help-line numbers etc. are the other methods of after-care. The following statements manifest these findings;

"We advise long rehab period of at least one week and then only we will send them. We hand over complete case history and diagnostic reports with recommendation to the domestic doctor. They have access to the international patient-desk 24 hours through even video conferencing" (Hospital Manager, International Marketing, Cochin)

But for a few dental clinics, "we will do treatments which can be completed here itself and does not treatments which does not require aftercare" (Dental Doctor, Cochin).Few dental clinics have international affiliations and tie-ups to support international patients.
The following statements manifest these findings;

"We have tie-ups with US Clinics. Those who are not able to afford the cost will be referred to Kerala. So we will give a quote and a planned visit on tourist visa. Aftercare will be taken care of by the US Clinics" (Dental Doctor, Cochin).

There are other after care modes such as technical support of implant manufacturers which are acknowledged by the dental clinics. Following statements manifest these findings;

"Implants will have bar code and ensures lifelong warranty.it is serviced free of cost anywhere in the world. Implant manufacturers have tie-ups with hospitals around the globe" (Dental doctor, Cochin).

Tourism Services

None of the hospitals have travel-desks and medical tourism packages as such. Only the treatment is taken care of. The typical response is that more than 80% of MTs enquire about tourism potential in Kerala. Generally, they are aware of the tourism potential and enquire about tourism possibility

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depending upon the health condition and treatment. Dental patients are more favorable to tourism. The general observation is that none of the hospitals excel in offering medical tourism packages though some are planning to have expansion of their tourism services.

Conclusion

There should be a patient-focused approach which can ensure caring and after-caring the patient without legal problems. Cross cultural sensitivities must be handled with utmost care. Medical services including service quality of the hospitals and tourist services including leisure assistance at the destination are to be improved for achieving higher degree of patient satisfaction. There should be a conscious effort from the stakeholders especially hospitals of each destination to market and promote the unique and appropriate tourism products to each medical tourist to have a convenient and comfortable rest and relaxation after their treatment. There should be a proper protocol for standards, quality and cost which will eventually lead to a sustainable development.

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UNVEILING THE WEB OF THE SPIDERWOMAN THEATRE: AN INSPECTION INTO *WINNETOU'S SNAKE OIL SHOW FROM WIGWAM CITY*

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Abstract

A challenge to the mainstream theatre and performance, the Spiderwoman Theatre was founded by the indigenous female trio of America: Lisa Mayo, Gloria Miguel and Muriel Miguel. By actively performing till date, this theatre addresses in depth the native female experience of cultural, social and political stereotypes. This paper entitled 'Unveiling the Web of the Spiderwoman Theatre: An Inspection into *Winnetou's Snake Oil Show from Wigwam City*' attempts to inspect the techniques used by these artists that facilitate the examination of the contemporary topics in historical contexts. Through the analyses of the methodology used in the play, this paper also seeks to show how the audience become entangled in the Spiderwoman's web of rituals, tradition and story-telling.

Taking its roots in the 1970's, the Spiderwoman Theatre began as an outcry against the bias towards women in radical political movements. Gradually, this theatre began to imbibe issues of the indigenous communities, collaborating native women and their perspective on gender roles, cultural stereotypes, sexual and economic oppression. Founded by Muriel Miguel, the theatre is composed of a diverse company of Native American women including two of Miguel's Kuna sisters: Lisa Mayo and Gloria Miguel.

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Ideologically, this theatre could be compared to the Theatre of Roots Movement, a post-Independence attempt to "decolonize the aesthetics of modern Indian Theatre"(Mee 5). According to Erin B. Mee, the Roots Movement sought new ways of structuring experience; new ways of perceiving the world and new modes of social interaction that were not dictated by the values and aesthetics of the colonizers (5). Similarly, the Spiderwoman theatre's techniques aim at reinstating their historically suppressed and contaminated native identity, simultaneously injecting the indigenous arts and culture into the mainstream.

The legend of Winnetou was written by the German novelist, Karl May who has neither gone to America nor has met an American Indian but has managed to create "a romantic stereotype of the Indian as a 'Noble Savage'" (Jayanti 21). The legend concerns a German man named Gunther who goes to America to seek a fortune, gradually befriending Winnetou, a noble savage. Winnetou and Gunther become blood brothers and save each other's lives but in the end, Winnetou dies casting the Indian race into doom. Though Winnetou is a fictional character, for most Europeans, the character is a true representative of an American Indian.

The legend is reworked in the play and becomes entangled in a thread of stories, which the artists of this theatre call as the technique of 'story-weaving'. Strategically, the play could be divided into ten sections, with each section becoming intertwined with the other. To begin with, the first section introduces Wild-Eyed Sam, a racist American and Gunther, the German tutor who kills a bear ruthlessly. This section is followed by the entry of Winnetou, showing uncivilized, animalistic behavior. Winnetou and Gunther decide to become blood brothers. In the second section, the witches engage in the preparation of Yataholay Indian Snake Oil. In the following section,

three genuine Indian princesses, Princess Pissy Willow, Princess Mother Moon Face and Princess Ethel Christian Christiansen are introduced. They are accompanied by an expert bull whipper and opera singer Minnie Hallrunner. The women involve in the exhibition of their talents at the end of which they endorse the Yataholay Indian Snake Oil. In the next story, three demons enter and begin to recount memories of their fathers and their belief in ancient traditions and practices. In the fifth section, Gunther is captured by the natives. The sixth story speaks about the inherent psychic powers of Native American women which is followed by the sale of the Yataholay Indian Snake Oil by the three Indian princesses. They also initiate a new member from the audience into the Indian tribe with an elaborate naming ceremony. The ninth story focuses on the episode of the death of Winnetou. The play ends with Lisa, Gloria and Muriel appearing as themselves, to draw attention to the common thread of the stories which is the need to resurrect the Indian spirituality.

It could be seen that the play embodies a very powerful capacity to expose the stereotypes constructed by the American Subject. Drawing from the metaphor of the boomerang, these constructed stereotypes on the 'Indian Self' strike back at the audience thereby initiating reason.

Gunther : Are there any Indians around here?
Wild-Eyed Sam : If there was, you'd smell them. (237).

It is evident when Winnetou and the three princesses accommodate to the fixed notions that the non-Indians have, regarding the natives. Winnetou exhibits uncivilized manners; the ritual where Gunther becomes a blood-brother ends in confusion and disgusting items are used in the preparation of the Snake Oil, mirroring the preconceived ideas that the audience have on the

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Indians and their tribal practices. The third story also becomes very crucial in this respect because the three Princesses work unanimously to entertain the audience, like the clowns of Shakespearean theatre, thereby showing their inferiority:"Now, ladies and gentleman, for your edification and pleasure…" (244). On the surface level, this scene highlights the current predicament of the natives who are reduced to only sources of exotic pleasure and entertainment, but considering the tone and purpose of this theatre it shows that the third story works to undermine the abilities of the Americans who invariably resort to native culture to remember the past. Also, it is seen that the three Princesses have unique talents symbolizing the unknown qualities that are yet to be discovered by the dominant subject. Consequently, the audience is set into a dynamic process of thought. If, in the third story, the horses are shown as exceptionally intelligent, in the fifth section, the Indians are compared to animals, thereby inadvertently showing that the Indians are as intelligent as the animals described in the former section.

The most vital characteristic of this theatre is that all the actors are women. Partha Chatterjee in his *Nationalist Thought and the Colonial World* has recorded that "once we match the new meaning of the home/world dichotomy with the identification of social roles by gender, we get the ideological framework within which nationalism answered the women's questions." (Yegenoglu 125). The nationalist context with which Chatterjee spoke of could be applied for the Spiderwoman Theatre also, because as Spivak would call it, women are 'doubly in shadow' (122). The colonial invasion into the native American soil had also included the possession of women. In the eighth section, Hortensia speaks of her grandmother, who had married a man from Spain. The adulteration of the native culture gradually led to a generation where the natives were unfamiliar with their own culture

and spirituality. The thread of connection between the Indians is cut which is symbolized in the third story where Minnie Hallrunner snaps the rolled-up tube of newspaper that is held by the other two princesses.

Therefore, this theatre could be seen as a call by women to remember one's true identity. The actors also use props that belong to the domestic area of women such as coconut shells, mop etc signifying the need to disclose the hidden world of the suppressed race.

Demon 2: Digging, digging, digging bones.

> This is the bone of our ancestors.
> This is the bone of our relations.
> Digging, digging, digging for bones.
> He went down to the land below.
> Down to the land of the dead.
> To bring back the bones… (248)

The Spiderwoman group believes in the possibility of reclaiming the lost spirit. This is hinted in the first section of the play itself where the bear after being killed quietly crawls off leaving its costume behind, symbolizing the prevailing native spirit.

The methodology of this theatre group resembles the Performance Group of America that was created in 1967. John Hawkes believed that the power of the symbol rests in the "assumption that manifest reality had only a second-order status, theme implied a hidden structure; setting, a context whose social associations leached into the figures it contained." (Bigsby 244). Hawkes felt that theatre would become effective if it is able to break up action into small fragments, to separate form from function and to offer a collage of simultaneous events creating what he called 'overlays of visual

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correspondences' (245). A similar perspective is also found in this play as there is no coherence in the narrative. The stories are independent narratives which contain immense possibility for the audience to feel and experience beyond the surface and become aware of the 'reality' that never made its way fully into language.

In order to reaffirm their native spirit, the play includes songs and dialogue sequences that are sung in an operatic style. According to Murray, most anthologies of native American literature begin with what is called "Oral Literature". Some songs have special significance of being elements of ritual as the chanted words are expected to "exert a strong influence in the singer, his fellow beings, in nature and even in the universe" (155). This foregrounds the spirituality of the Indians that cannot be easily adopted by the non-Indians through outward manifestations of the native culture such as clothes, jewelry, dancing etc.

The title of the play is also seminal in a panoramic understanding of the play. According to Fee, a white speaker is always impelled by a desire to know about the past, familial, native or national which is resolved by forming a relationship with an object, image, plant, animal or person associated with the natives. Fee then continues to note that the vision obtained is often quasi-mystical, culminating in a poetic and emotional identification with the natives (Jayanthi 21). In this respect, the Snake Oil in the play could be considered as an attempt to demolish the illusory concepts centered on Native Americans by acting as a cure for the malaise that has affected the 'American' psyche. As Muriel and Gloria assert in the final section of the play, the Indians are not a dying race. They have grown from Indian princesses to women possessing political awareness using a deep spiritual commitment.

The Spiderwoman Theatre's unique capacity for comedy, impersonation, satire and ritual has facilitated to expose racism and espouse women's rights, apart from addressing complex factors that form their ethnic heritage. "Our homes are not in museums. We are not defeated. We are still here"(262). As Jayanthi notes in her doctoral thesis, writing for the native women is an act of historical solidarity (131). Likewise, performance for the Spiderwoman group is their mode of helping the native Americans gain respect for their culture and themselves.

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REVISITING FAIRYLAND: ENROUTE DISNEYLAND AND 'DAHL-OPIA'

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Abstract

The therapeutic potential of folk-tales and fantasy stories is precisely because they were always there, imparting significant messages to the collective psyche of the community in general and civilizing their unconscious. The strange and the most familiar locations in which a fairy tale takes place suggest a voyage into the interior of the mind and into realms of unawareness and the unconscious. Children who read them are rewarded by assistance in understanding themselves and their world and the satisfaction of the pleasure principle.

Many fairy tales, before their 'Disneyfication' of a 'happily-ever-after' future, had realistic violent closures of murder, death or tragedy in their original versions. Disney's versions of historical fairy tales not only adjust the main elements of a story, but alters the point of view and the narrator. Roald Dahl perhaps the most popular children's book author has also retold some of the most popular fairy tales, demystifying the classic tales thus.

The manifold function of narrative even from pre-literate cultures is the same: preserving accumulated knowledge, articulating meaning, offering pleasure and cathartic release and promoting 'healing' by reassurance. Myths, religious stories and fairy tales answered and appeased the inquisitive and imaginative quest of a young mind. The therapeutic potential of folk-tales and fantasy stories is precisely because they were always there,

imparting significant messages to the collective psyche of the community in general and civilizing their unconscious chaotic pressures through "spiritual explorations" (Lewis, qtd in Bettelheim, 24).

Historically, fairy tales were shared orally in a "sacred space" as a collective form of communication in a group setting, consisting of both adults and children. From Perrault to the Brothers Grimm, most historical fairy tales have a common theme and moral in them, regardless of the story teller. Saturated with meaning, they were often the holders of moral values, warning or admonition. Psychoanalytic interpretations of folktales and fairytales show that their themes that effect children include duality of human nature, comprising of animal-spiritual and the good-evil dichotomies, movement toward autonomy and birth and death. The strange, most ancient and at the same time the most familiar locations in which a fairy tale takes place suggest a voyage into the interior of the mind and into realms of unawareness and the unconscious. Children who read them are rewarded by assistance in understanding themselves and their world, a better comprehension of good and evil, and the satisfaction of the pleasure principle.

The non-threatening conditions of folk and fairy tales allow them to try out different approaches and to adopt difficult perspectives. Children want to see evil adults punished and good rewarded; they need a fairy godmother or a benevolent king; they want their animal cravings satisfied; they wish their uniqueness be discovered and recognized; they hope their mistakes would not result in drastic punishments. Fairy tales vicariously provide child readers with these pleasures and reassurances because the child does not need to keep secret his feelings about what goes on in the tale or feel guilty about enjoying such thoughts (Bettelhiem 57). The dominant culture wishes

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to pretend, especially where children are concerned, that the dark side of man does not exist, and professes a belief in an optimistic meliorism. Developmental psychologists such as Lawrence Kohlberg support the notion that children must actually work through difficulties of moral conflict to have a better sense of ethical problems and solutions.

Duality is a frequent motif in fairy tales. Dual parents represent a child's dual feelings about his parent. Since children find the duality too complex for their understanding, they separate the despised parents who discipline and ignore from the idealized parents who love and care and protect. This allows them to destroy the evil aspect of their parents without guilt, while remaining loyal to the beloved ones. The grandmother and the wolf in Red Riding Hood represent the two sides of the parental figure. By splitting up her personality, the child can preserve the good image, uncontaminated, while the temporary evil manifestation passes over (66). Similarly the perfect mother of one's infancy must be left behind for the child to achieve independence and selfhood; hence the dead mother and orphan motif in most fairy tales. The psychological purpose of transformation and splitting up of personalities through these figures is therapeutic for the child reader to manage contradictory feelings which would otherwise overwhelm him.

To a child who is able to integrate the world of reality and the world of imagination, fairy tales reveal truths about mankind and oneself by juxtaposing complex and ambiguous characters of great polarity. The sudden replacement of the kindly grandmother in 'Little Red Riding Hood' by the rapacious wolf is not anymore scary to a child than the sudden transformation of his own mother into a threatening ogre when she is angry. A child, when in emotional need, may split even himself into two people. This provides him with a basis for understanding that there are great

differences between people and that, therefore, one has to make choices about who one wants to be – the villain or the good guy.

The only way a child can get hold of his inner pressures is to externalize them. Bettelheim observes that "[w]hen all the child's wishful thinking gets embodied in a good fairy; all his destructive wishes in an evil witch; all his fears in a voracious wolf; … then the child can finally begin to sort out his contradictory tendencies. Once this starts the child will be less and less engulfed by unmanageable chaos (66). Fairy tales take very seriously existential anxieties and dilemmas such as the need to be loved, the fear of rejection and worthlessness, the fear of death and the love of life, and address to them directly.

Realistic portrayals of death and grieving, separation, abuse etc. can help foster intelligent responses to real-life moral questions. Most fairytale heroes and heroines are people who have experienced death. This helps the child readers to cope with the loss while feeling protected from their own mortality. "Those predecessors of the hero who die in fairy stories are nothing but the hero's earlier immature incarnations" (181). The failure of the dead is the success of the hero, as the motif suggests. Many fairy tales, before their 'Disneyfication' of a 'happily-ever-after' future, had realistic violent closures of murder, death or tragedy in their original versions. Children heard stories about the unjust and sometimes even the just, being punished or treated badly: the Wolf gobbles up Red Riding Hood's grandmother (and in some versions little Red Riding Hood herself); Hansel and Gretel pushes the evil witch into the cauldron and their wicked stepmother is cast out; the Wolf eats up the two Little Pigs; the Little Mermaid ends up a tragic heroine, the pregnant Rapunzel is cast out and so on.

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Folklorists who support the recreation and revision of historical folklore for preserving and popularizing ancient wisdom to ensure that the current generations retain their interest in the past, support Disney's retelling of fairy tales. Jack Zipes, in *Breaking the Disney Spell*, says that Disney has violated the sanctity of fairy tales and have stripped them of their psychological potentials. Disney versions of fairy tales are " … an attack on the literary tradition of the fairy tale. He robs the literary tale of its voice and changes its form and meaning" (Zipes 344) and has permanently hindered the message and the psychological lessons which are inherently present in the original stories.

Complying with the dominant culture, Disney's cinematic adaptations of the fairy tales sugar coat the grey areas of life, thus avoiding straightforward discussions about death and violence. Mitigating the dark elements of fairy and folk tales takes away their power to reassure children that they are not alone in their fearful imaginings and that they can be addressed. Psychologists recommend it at an early stage, as children with a continuing relationship with their deceased parent cope better with death loss and such other life changes.

Disney's versions of historical fairy tales not only adjust the main elements of a story, but alters the point of view and the narrator. Often, instead of being told from a female point of view and being about women, Disney projects a patriarchal view on the story and makes it obvious to viewers that a woman's life is meaningless without a man to guide her. The classic fairy tales often involve feminine strength and an urging of women to be able to outsmart her predators. If a girl is not able to outsmart her attacker, she is simply killed. The smart girl in Brothers Grimm tale of 'Little Red Cap' outwits her predator, and escapes with her life. Contrarily, the heroine of Perrault's 'Little Red Riding Hood' is not quite clever enough, and

therefore is gobbled up. The Brothers Grimm depict Snow White coming back to life by her coffin being jarred, which dislodged the apple in her throat. In another version, it is the king's new wife who saves Snow White by picking the ice out of her forehead and palms (94). Disney, however, shows Snow White as a weak female who waits in her "sleeping death" for love's first kiss to break the spell and save her. Such portrayal of princesses or young girls as weak and frail in the animated movies leads one to doubt whether Disney "perpetuated a male myth" (Zipes 348).

How children take control of their lives is metaphorically represented in many ways in fairy tales. Disney's retellings of fairy tales have hindered these messages inherently present in the original versions and have altered their moral and core message. For instance, the original story of *Little Mermaid* has as its theme sacrifice, love and the individual's striving to gain an eternal soul. But Ariel, Disney's little mermaid is pouting all the way to receive the kiss of true love in an action packed, suspense-filled drama of shape-shifting, intrigues and power politics. The moral of Perrault's *Cinderella* is that, ' beauty is a treasure but graciousness is priceless'. 'Rapunzel' is a warning against one of the Seven Deadly sins and human craving, a lesson in fortitude and a celebration of freedom, while *Tangled* is a typical Hollywood action packed thriller of Girl Power, meant for pure entertainment. Rather than a story about Belle learning to overlook appearances, as the original folktale was, there is an imbalance in the message sent by Disney's *Beauty and the Beast.* We are both led to notice and appreciate Belle's appearance and to disregard the Beast's animal appearance, setting a double standard in which beauty is a vital asset for a woman but unnecessary for a man. This seems to contradict the message that Disney set at the beginning, that one should not be deceived by appearances.

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"[E]very story has its lessons, as does every emotional experience… the experience itself teaches [the child] something about life and himself…. The stories that live inside us and shape us as we grow are those that engage our passions and turn us into someone else for a little while"(Jones 221). These therapeutic and psychological potentials of our common fairy tale heritage, which helps the child reader to invent stories on his own so as to cope with life's challenges are lost in the retold fairy tales of Disney.

Roald Dahl perhaps the most popular and best-selling children's book author has also retold some of the most popular fairy tales in his collection *Revolting Rhymes* , demystifying the classic tales thus. His "irreverent fairy-tale adaptations in verse are a good antidote to the saccharine presentations often found in children's editions"(Hasse 398), particularly in the Disney versions. A parody of traditional folk tales in verse, Dahl gives a re-interpretation of well-known fairy tales, featuring surprise endings in place of the traditional happily-ever-after. The poems perfectly complemented with New- yorkish illustrations by Quentin Blake, gives several traditional fairy tales a deliciously nasty twist that are unforgettable. Dahl's tampering of the familiar folk-tales is revolting! Bathroom humour, violence and name-calling predominate. The poems are apparently adult satire at its most destructive, of childhood's best loved fairy tales. The book had been challenged fulfilling more than fifteen of the twenty five reasons put forth by Edward Jenkinson for banning books!(qtd.in Winkler 49).

Dahl's re-reading of the fairy tales are told from the point of view of a child. The details are very close to reality or even exaggerated wildly, "to get through to the child", as Dahl says. Typical of Dahl, the adult characters in the stories are often the villains or are just plain stupid, with maybe one good adult, depicting the good-evil dichotomies prevalent in fairy tales . A

frequent motif of Dahl is, that people are not, what they appear to be, showing the duality of human nature that fairy tales presents.

The stories are a thrilling mixture of the grotesque and comic- with a lot of black humour and gruesome violence. Known for his twisted imaginings and macabre sense of humour, Dahl is able to combine his often-savage wit with a lovely rhyming ability to re-tell these classic fairy tales. Few have been able to add the truly unique twists and clever language of Roald Dahl. His rhymes often have a penchant for bodily functions and nasty behavior, with merciless portrayals and grisly descriptions, grossing out the real for the child reader. Dahl was not perverted or disgusting, merely revolting .and in *Revolting Rhymes*, fairy stories are given the Dahl treatment.

The poem Cinderella, starts in the typical Dahl fashion: Dahl opens by telling his readers : "I guess you think you know this story./You don't. The real one's much more gory" as opposed to the "phoney" interpretation, which has been made "all soft and sappy/just to keep the children happy" (5). Written in comic rhyming couplets, the poem offers a contemporary, and a significantly darker twist to the original tale to which Dahl stays true until half way through. The Prince grasps her dress to prevent her from leaving at the stroke of midnight and the garment is "ripped from head to toe,"(8)- obviously! Cindy runs from the ballroom in nothing, but her underwear. The macabre and surprising dénouement of the typically Dahl-esque ending of the story demands that the ugly sisters' heads be hacked off, which is instantly done "with one big whack." Realizing that the Prince has the rather twisted hobby of hacking off heads, the disgusted Cinderella, wishes to be married to a decent man and her fairy godmother grants her wish and she marries a simple jam-maker. Dahl leaves the reader with a non-traditional outcome, yet retains the well established fairy tale ending: "Their house was

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filled with smiles and laughter/And they were happy ever after." The outcome paints the poem's heroine as an empowered young woman with dignity, typical of the original classical tales, who refuses to conform to the conventional fate of her fellow Disney tale princesses. With wicked sense of humour, sharp wit and tongue firmly placed in cheek, Dahl twists the tale's myth elements of unjust oppression and triumphant reward, and implies that true happiness can be obtained without pomp and circumstance.

In Jack and the Beanstalk, Jack's mother displays all the vileness which Dahl typifies in the adult world- cheating, meanness, greed and dishonesty. We laugh out loud at the mother's response when Jack claims that he had heard the giant snorting that he smelled an English man.! " And well he might!/ I've told you every night /To take a bath because you smell.' (17). The mother who says she " shrinks" because of his "unholy stink" is, in turn, eaten up by the Giant, and Jack concludes " I had a hunch that she was smelly." (19). This horrible ending of the mother presented in a factual way provides vicarious satisfaction and an outlet for pent up aggression of the child reader, which fairy tales provide. Undeterred, Jack decides to bathe, climbs up and collects the golden bean leaves himself, as the giant was unable to smell him anymore. The instant millionaire-turned Jack resolves to bathe every day because 'A bath…does seem to pay."(20).

Snow White and the Seven Dwarfs also creates situations that cause actual loud belly laughs beginning familiarly with the King's search for a new wife. 'At least ten thousand girls replied /… The king said with a shifty smile,/ 'I'd like to give each one a trial.'(21). The conventional tale meanders through the jealous queen, the pretty Snow white, the graphic violence plotted against the lovely maiden and the kind huntsman. After the huntsman spares her life, Snow White hitches a ride to the city and takes a job as a

cook and maid for seven jockeys in the city. " She'd found it easy, being pretty"(24). Snow White resolves to help the 'stony broke' dwarfs and steals the queen's magic mirror, which can correctly predict the winning horses. The Mirror makes the seven jockeys (and Snow White) millionaires, and the story ends with the Dahl-ian moral that "Gambling is not a sin / Provided that you always win"(28).

In Goldilocks and the Three Bears, the story is told from the mother bears' point-of-view, a typically genial 'house-proud wife' who prides in her well-kept and tidy house and who is justified in her distress and anger at Goldilocks - a'brazen little crook',a 'nosey thieving little louse',a 'delinquent little tot'and a 'little toad' whose actions are felonies. The Mother Bear, feels no qualms in quenching the hunger of her darling Baby Bear by prompting him to send Goldie to a sticky end, since the baby bear's porridge was inside her. Lessons in etiquette, personal hygiene and social behavior are imparted to the child reader in the most gruesome and wicked way possible only to Dahl.

There's a big surprise waiting in those dark woods in Little Red Riding Hood and the Wolf. The wolf, as usual, enters the grandmother's house and devours her before putting on her clothes in order to eat Little Red Riding Hood next. In comes the little girl in red, smiles, whips a pistol from her knicker's and shoots the wolf *bang! bang! bang*! — yields herself a new wolfskin coat. Ms. Hood becomes the heroine in the next story of The Three Little Pigs threatened by the wolf who resolves to come back that evening with dynamite. Ever the sharpshooter, Red Riding Hood comes to their rescue and gains not only a second wolfskin coat but also a pigskin traveling case!

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Dahl was not merely a pied piper but a "genuine subversive". " In his world, kids are fit to rule. They understand cruelty and unfairness and… are capable of relishing it. They also have a rather raunchy idea of what's funny"(Hitchens, Periodical 439). Those who complain that Dahl's books "do not teach moral values" just don't grasp the powerful appeal of " a good yucky tale". Hitchens, a journalist says,"…while you may want less of it, the kids are unanimous. They want more. They also wish for more and better revolting rhymes…" (139).

The current media has changed children's brains, making them impatient with 'linear' gravitating toward the 'non-linear'. They can think in terms of overlapping lines of simultaneous actions, alternative routes a story could take and multiple points of view. They also know stuff previously considered adult- sex, war, violence, addictions, prejudice etc, thus experiencing several " lifetimes". Dahl's creative story- telling has the power to influence a child positively forever. He keeps "chidren enthralled, agreeably disgusted and pleasurably afraid.'(143). Stories written with truth and wisdom should not be let to die out. Roal Dahl's re-reading teaches children that they can make fairy tales their own by creating and recreating their own versions.

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Roberto Esposito and Affirmative Biopolitics: A Critical Inquiry

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Abstract

The notion of biopolitics underwent a radical change with the treatment of the term by Roberto Esposito, one of the towering figures among contemporary philosophers. His thought-provoking ideas are put forward in his 2008 work Bios: Biopolitics and Philosophy. It constitutes the last of his trilogy, the first two being Communitas and Immunitas respectively. In this book, he builds upon his philosophy of biopolitics on the basis of his reflections on the dialectics of community and immunity. He finds the extant biopolitical analysis of the link between life and power inadequate. Therefore, he employs the language of immunity to dislodge and scrutinize the prevalent ideas on the concept. He centres his analysis on "the paradigm of immunization" (Esposito 45) which he believes is embedded in the realm of modern politics.

Introduction

The notion of biopolitics underwent a radical change with the treatment of the term by Roberto Esposito, one of the towering figures among contemporary philosophers. His thought-provoking ideas are put forward in his 2008 work Bios: Biopolitics and Philosophy.

It constitutes the last of his trilogy, the first two being Communitas and Immunitas respectively. In this book, he builds upon his philosophy of biopolitics on the basis of his reflections on the dialectics of community and immunity. He finds the extant biopolitical analysis of the link between life and power inadequate. Therefore, he employs the language

of immunity to dislodge and scrutinize the prevalent ideas on the concept. He centres his analysis on "the paradigm of immunization" (Esposito 45) which he believes is embedded in the realm of modern politics. Esposito identifies an essential paradox in the interpretation of biopolitics by various theorists and detects a want of adequate verbalization of the two poles: life (bios) and politics. The problem with their analysis is that they regard these constituents as two separate entities which in reality belong to a single semantic block that makes up the notion of biopolitics. Even in Foucault's works, the two layers of meanings are never integrated into a whole but on the contrary are split into two equally incomplete parts or at the most, were congruent only through the violent domination of the one over the other. In this perspective, either life is reduced to biological matter by a power that controls it, or politics is subjugated under the supremacy of life.

Biopolitical dominion in the first case closely resembles the sovereign one and the sovereign regime is displaced by a new system of power that takes its formation when politics is subordinated to life. Esposito points out that Foucault himself oscillated between these two alternatives and never reached a resolution. Foucault's analysis takes on another turn with the transformation of biopolitics into thanatopolitics which occurs at the problematic point where biopolitics traverses sovereignty. His hypothesis comes to a standstill as he is caught between two contradicting possibilities. On one level, he upholds the notion that the relationship between sovereignty, biopolitics, and totalitarianism is indistinct as one regime subsequently overlays the other. This assumes that genocide is the indispensable result of all three forms. But this approach would ultimately stand in opposition to his idea of the historical

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genealogy of biopolitics which is in fact the product of certain distinctions. This signifies a view of absolute 'power over life'. On another plane, if he were to believe that there is a borderline drawn between all the three regimes, it dismisses the very idea of biopower as it fails to account for the element of death that is ingrained in life. This implies the idea of a supreme 'power of life.' Foucault seems to advocate both concepts concurrently which leaves his resourceful meditations on the bond between life and politics incomplete. Esposito attempts to link these two apparently divergent interpretations of biopolitics through his concept of immunization which Foucault seemed to miss out
(Esposito 43).

While relying on such a belief which facilitates an interlocking of life and politics,

he reconstitutes the ancient political theory. In this complex relationship between life and politics, immunity assumes a complicated position. Though it basically protects and promotes life, at times in specific cases, it is held responsible for restricting the progressive and productive power of life. In Bios, he lays the groundwork for the development of his thesis by citing the texts of various philosophers who ponder on the relationship between politics and biology, especially that of the medical domain. These theorists assign major two roles to the politics of life: one, it locates certain 'tumours that grow in the tissues of the state' (Esposito 18) that cause anarchy and finally exterminate the state; two, biopolitics proposes certain defense mechanisms against them. This is where the notion of immunity is found in its full swing in the political realm. Following the thought of these theorists, Esposito cites the existence of

certain anti-bodies in the body of the state which are intended to nurture life,

but on the contrary, lead to the dissolution of the state in time. The most extraordinary part of these analyses is the similarity found between the defensive dispositifs (the agencies that defend our lives and simultaneously control our bodies) of the state and the immunitarian system of the body. This comparison urges one to regard the human body as an intricate social being and the social body as an individual, both of which are vulnerable to potential dangers that give rise to the thought of immunity (Esposito 19). The central concern of immunity is the protection and preservation of life but it inadvertently has some detrimental effects. Esposito traces the seed of the conception of immunization in Nietzsche where he supposes the soul as the immunitary apparatus that simultaneously protects and imprisons the body. The concept of immunity thus engenders two contradictory stances. It simultaneously assists the improvement of life and allows for its annihilation. In other words, while it seeks to preserve life,

it consequently reduces life to a mere biological subsistence thereby negating life. Although he echoes Agamben here, his thought gains prominence as he pins down the notion of immunity as the tool which produces bare life.

Esposito reflects on the paradigm of immunity along with the concept of community which he believes takes on a diametrically opposite stance. At the end of the Eighties in France and Italy the perception of community was drastically deconstructed which then came to stand for a binding force that connects the subjects by ascribing a common identity to them. A mutual belonging characterizes community which is abstractly

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linked to the term 'proper' that has two meanings; either 'making one's own' what is common or 'making common' what belongs to one's own. What constitutes the common is essentially 'one's own' identity which creates an illusion of the members' belonging in a community. Considering the situation from another viewpoint, the common suggests its contradictory factor 'proper' or 'one's own' (Esposito 1). He finds it convenient to establish his hypothesis by tracing the origin of the word community to the Latin term 'munus'. Etymologically 'munus' denotes 'going out', 'reaching out to the other than oneself', or 'giving a gift'. Thus, there is a kind of going out, a sacrificial element associated with the idea of a community where an individual becomes a part of the other members of the society that brings them together in a collective sense. Community thus links its members together based on an obligation to give away the valuable essence of individual identity. The immunitarian aspect stands in stark contrast to this concept of community which unburdens the subject from this commitment. It focuses on the particularity of a situation which takes away the element of the 'common' in them. Immunity is a concept that Esposito borrows from the medical-biological domain which he tries to apply in the juridical context. When placed in the medical or biological framework immunization refers to the capacity of the organism through natural or induced means to resist the intrusion of certain pathogens which are likely to cause diseases. It is the power to protect life by the method of vaccinating the inflicted body with a part of the very same pathogen from which the body seeks resistance. This helps to obstruct and oppose the natural growth of the harmful element. For example, the vaccination for smallpox actually contains elements that are damaging to our body, but it is a method employed in

immunology to raise the chances of our survival (Esposito, 48). The immunization of the political body more or less happens in the same way through the imposition of a contradictory dispositif to preserve our lives that in turn make our lives confined. Sovereignty can be considered as an induced immunitary dispositif for instance.

If human life is left to its internal powers, it is likely to be self-destructive. Therefore, in order to save itself, life seeks the orders of a transcendent, sovereign power. A sovereign state thus makes laws that are enforced on the subjects from which the subjects cannot escape, for if they resist they would be resisting themselves. This is the paradox of sovereignty that makes it a negative form of immunization (Esposito 59). Nonetheless, in a positive sense, political or juridical immunization signifies an exception of the individual from the bounds of an authority or a common law that concerns all other citizens. It privileges a person by giving him the protection of the law when the other members are susceptible to it.

When both these senses converge, the principle of immunity comes in direct opposition to the very concept of community. That is, when the community suggests a break in the defensive circle of an individual's identity, immunity tries to formulate protective barriers against foreign elements that threaten the body (be it individual or collective) from outside. For instance, American society as a whole is somehow immunized against terrorism, a lethal affliction in a sense, which is not the case with a country like India which is very much vulnerable to terrorist attacks. The immunitarian project of Nazi Germany is reflected in its eugenic practices where they tried to preserve the purity of their race by preventing the mixing of foreign blood. The immunitarian

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dynamics can be found in the modern period where the communitarian - immunitarian discourse is embedded in it. To cite an example, let us take the case of Colonialism where the colonizers are educated, progressive, and civilized whereas the colonial subjects are considered as barbarians. The latter category is exposed to the conditions of the law that society itself creates while the cultured are immunized against such exposure.

However, a contradiction arises when immunity is forced beyond a certain limit. Though it seeks to preserve life, it takes on a negative form when it is intensified. In that case, immunization curbs our freedom, and our existence becomes a sort of prison where it is relegated to bare life. Foucault's concept of 'panopticon' which was a system of prison houses in the middle ages may be pointed out as a concrete example, where the rigid surveillance of the state extends the lives of the prisoners to a phase where it becomes Zoë. The extensive immunitarian projects of the state that impose excessive control over the body may endanger life or reduce the qualified life to bare life – when life becomes bare biological matter.

The principle of immunity thus gains biopolitical significance as it is inscribed within the framework of politics of life. Esposito situates the policies of the Nazi regime as the extreme form of immunitarian ideology where thanatopolitics overshadows the politics of life.

He considers Nazism as the exemplar of modern political thinking parallel to the concepts of Foucault and Agamben. The difference in their theories lies in the fact that Esposito deviates from Foucault who rests his ideology on the reconstitution of the sovereign and Agamben whose central thesis lies in his hypothesis of the state of exception as the norm. For Esposito, it is the immunitarian objective to advance life that eventually brings about disastrous consequences (Lemke 90). In the

modern period, it is the immunitarian characteristic that intensifies biopolitics which later drifts into thanatopolitics in the totalitarian period. Thanatopolitics can be best described as the situation that arises when life defends itself and seeks progression through death which is in fact a paradoxical situation. This becomes a point where biopolitics converges with sovereignty. Foucault traces the cause of this superimposition in racism. However, Esposito goes a step beyond in his analysis and does not stop with the sovereign conception that imposes the supreme power of killing in the hands of the monarch or the state. He conceives of the idea that the 'power to kill' is equally distributed among the social body and as a result, anyone can kill everyone since the 'killing' is legitimized. Esposito presumes Nazism as the rampant point where biopolitical mechanisms are at work. It is not a philosophy but rather a realized biology where its object is the preservation of life, its jargon biological, and its subject race (Esposito 110 – 112). Here, politicians employ biological processes to guide their own actions and carry the procedures to the extreme point of forceful power where it is reversed into thanatopolitics. More than the biological implications of National Socialism, Esposito draws one's attention to the indispensable role of medical verification in every stage of the production of death. He indicates the inevitable responsibility of Nazi doctors in the execution of the German doctrines, for instance, the vivisection carried out by the Japanese doctors after the Pearl Harbour, "Euthanasia" or Mercy killing where doctors play a significant part. Above all, these acts of extermination performed by the doctors were legalized and extensive power over life and death was bestowed on them as they carried the sceptre of the sovereign (Esposito 114).

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At this point, Esposito formulates an entire theory on degeneration. Degeneration can be defined as a pathological state of being which may even slip into abnormality in specific cases. A person is called a degenerate when he deviates from the normal type or the accepted behavioural standard; his degenerate characteristics are determined by the answer to the question, of how far he moves away from the norm which is primarily physical or psychological. This means that a degenerate person behaves in a biologically abnormal way which signals a more general aberration that differentiates him from the other individuals of his own species. With that emerges a problematic point where the degenerate is incapable of forming a juridical subjectivity as he is simultaneously included and excluded in the human genus. A wide range of social categories like alcoholics, homosexuals, and prostitutes are produced as a result of the incompatibility between biological norms and juridical–political norm. The state of degeneration is essentially contagious as the process does not stop within the same body but spreads formidably from one body to the other, intensely reproducing degenerate bodies through internal and external transformation. It is a comprehensive illness that affects both the superior and inferior races alike. Esposito establishes a connection between madness and genius which are certain states of degeneration, considering the fact that both conditions signify a deviation from the norm. Genius is actually another variant of degeneration, an extreme point of eccentricity that is the one that is echoed in life in Nazi politics. Quoting Gina Ferrero Lombroso, Esposito highlights the immunitarian paradigm that underlies the state of degeneration. She stresses the advantages of degeneration where it becomes a sort of evolution and many of the phenomena thought to have a degenerative

connotation actually have a useful, evolutionary dimension. Accordingly, degeneration should not be taken in an entirely negative sense, but its contribution to the progressive steps brings out its positive aspects. It undertakes the process of decomposition and regeneration at the same time. The system of degeneration which paradoxically stimulates progression affects the whole of the civilized world. Nevertheless, in order to save the world from degeneration Esposito advocates an immunitarian apparatus to reinstate health and goodness through eugenics (Esposito 122 – 124).

If degeneration is a natural phenomenon that occurs within the area of bios, eugenics is a process that takes place in the technical sphere which is constitutively an artificial procedure. It is chiefly concerned with the restoration of nature that is negatively influenced. The concept of eugenics gains significance as the state takes an interest in the production of the strongest bodies and minds. As a result, the power of the state is directly imposed on the biological life processes of the subjects and uses 'racial hygiene' as its immunitarian tool to safeguard the lives of the subjects. (Esposito 127 - 128) Esposito makes a distinction between negative and positive eugenics both of which are directed to the sources of life. In order to prevent the spreading of the degenerative syndrome, special attention was paid to the areas of matrimony and immigration which were regulated by rigid racial norms. The most substantial tool of immunization that can be categorized as positive eugenics is the sterilization of the inferior races which stunts the very genesis of life. When sterilization marks the 'end of the beginning', another immunitarian procedure falls into the distinction of negative eugenics: 'euthanasia' stands for 'good death' of 'those who exist without life'. It is

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a project that justifies the extinction of 'life unworthy of life', 'life without any value'. The practice of mercy killing involves two parties; one is the individual who has the right "to receive death" and the other is the state which possesses the right "to give death". In this process, it is the victim himself who benefits from the extermination as it liberates him from existence which is devoid of any life (Esposito 132 – 134).

However, when euthanasia is extended to include a wider range of people for the common good of the state, it is termed genocide. During the Nazi regime, thousands of children who were detected with "serious hereditary illnesses" such as idiocy, mongolism, and malformation were killed by vernal injection or with deadly doses of morphine. Later the same decree was extended to adults, which was called the T4 program (Esposito 136). Genocide is the power of killing a homogeneous group of people for biological and not political or economic reasons. As mentioned earlier it involves a therapeutic purpose of cleansing the German race by 'killing the presence of death' in life. In that case, death becomes both the infectious pathogen and the immunitarian agent. As Hitler remarked before he committed suicide, "the only way to be saved from death was to die". This double marked the culmination of the Nazi regime.

In addition to the Nazi idea of thanatopolitics, Esposito identifies three Nazi immunitarian dispositifs. Agamben refers to dispositif as 'apparatuses' which he calls "literally anything that has in some way the capacity to capture, orient, determine, interpret, model, control or secure the justice, behaviours, opinions or discourses of living beings". Esposito describes the first as an "absolute normativization of life" (Esposito 138) which is characterized by an association of the medical power and the juridical-political power. With the enforcement of this apparatus, doctors

seemed to enjoy a significant position in the domain of law where they accompanied the magistrates in the implementation of certain norms. The biologization of the juridical sphere is much more evident in cases where the state directly interfered in the biological life processes of the subjects by imposing various laws like sterilization. "The double enclosure of the body" is the second apparatus of Nazism. It represents a situation where there is an indistinction between our ego and body. In this sense, when the body becomes the essence of the ego, the biological becomes one with the spiritual life. Whatever the case, one may have to stick to that natural layer from which escape is impossible. This is what denotes a double enclosure. This is a state which is reflected in Nazism where apart from the focus on the biological, there was a tendency for a sort of 'spiritual racism' which reckons the "soul as the body of the body, the enclosing of its closing". It is the point when the body identifies with itself, where it denies the possibility of any transcendence and focuses on the spiritualization of the biological and the biologization of the spirit" (Esposito 142). This is where racism emerges significant which comprises of a superimposition of the spiritual character of the body and the biological aspect of the soul. It allowed them to protect the ethnic mass by exterminating its decadent elements and conserving the racial character of the people. In this perspective, in order to have the perfect experience of the double enclosure of the body, genocide became a kind of spiritual demand of the people that enabled the amputation of the infected part. "The anticipatory suppression of birth" makes up the third immunitarian dispositif of Nazism. It functions not only in the lives of the people but also at the very origin of their lives. Sterilization was one such mechanism that checked the very idea of birth. The other mechanisms

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were the castration of homosexuals and mandatory abortion for degenerate mothers. The imposition of such apparatuses extended to a level that resulted in the frightful suffering and death of a large number of people. However, from the workings of the Nazi ideologies we comprehend that it is not that they were against procreation, but their emphasis was on the qualified procreation where eugenic practices play a key role. They intended to subject birth to death and therefore aimed to nullify life in advance (Esposito 139 – 144).

Even though Esposito perceives Nazism as the terrifying form of applied biopolitics, he does not believe that it ends with the closure of National Socialism. On the contrary,

the concept is deep-rooted in modernity and lies beneath the ever-increasing questions like the prominence of ethnicity in relations between the state and its subjects, the significance of the health care affairs in the functioning of the economic system, the mass of men and women deprived of juridical identity whose lives are reduced to bare existence. A radical transformation was marked from a period in which the biological was politicized to an age that featured the biologization of the political. However, along with this transition, Esposito cites a particular immunitary tendency that was carried into the modern period. The defense of biological life became the prominent concern of domestic and foreign affairs both of which are traversed into a single issue – a world without distinctions which is wholly the result of the biopolitical and immunitarian convergence. The relevance of an immunitary discourse accounts for the increasing search for safety from the threatening attacks of terrorism which has intensified after the events of September 11, 2001. The more pertinent point here is the conversion of the immunitarian

dynamic into an auto-immunitarian discourse in which all the contestants take part in the stimulation of extreme violence. This turn of biopolitics is at its zenith in the wars fought to avoid wars; that is, in the case of preventive wars life is held at a higher stake (Esposito 147 – 148). What poses a great threat to the body, be it social or individual is the excessive security imposed upon it. In that case, life itself bears the fatal tool of death and therefore becomes reckless, dangerous, and potentially self-destructive. This is where his flow of thought takes a diversion from that of his predecessors Foucault and Agamben. Esposito theorizes the concept of immunization with the support of his concrete arguments to prove that the defensive mechanisms employed to protect and nurture lives paradoxically end up encompassing death.

Esposito meditates on the implication of such a situation in contemporary philosophy and mulls over the possible response of the philosophy of the time on the questions of life and death posed by biopolitics. In order to create a philosophy of bios, one must not limit oneself to the Nazi interpretation of biopolitics but should analyse the concept within a broader framework. Drawing on the three Nazi dispositifs mentioned earlier, he tries to generate affirmative biopolitics in which the contemporary philosophy comes to terms with the elemental figure of immunization that triggers modern biopolitics. He anticipates the initiation of positive biopolitics in the Nazi dispositif of the absolute normativization of life. By reversing the Nazi Thanatopolitics where life remains subjective to the transcendence of a norm,

he alludes to ‘a norm of life’ in which the norm is no longer the transcendent principle, but an embedded impulse of life (Esposito 182). Here, he integrates Agamben’s negative vision of biopolitics with the

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notion of the 'common' propounded by Hardt and Negri. Esposito states that this common which is difficult to describe has been held by a general immunitarian dispositif for a long time. He tries to develop a new thinking on bios – a qualified form of life, by the inversion of the negative immunitary dispositifs that characterized Nazi thanatopolitics. Rather than limiting himself to the paradigm of immunization that preserves and protects life from death, Esposito moves on to contemplate the possibility of extending the immunitarian discourse to the "continual rebirth of all life in different guises". As he alludes to the theories of Spinoza and Gilbert Simondon, he expands the concept of birth to the movements in the lives of the individuals where he/she moves past each threshold experiencing a new kind of individuation and thus instigating a 'cycle of genos' that encompasses them in common bios. Based on this assumption that all living beings share common bios, he suggests that there is no life incapable of individuation through birth so that, even Zoë (bare life) is inscribed within bios (Campbell, xxxii). That is, even if biopolitics includes the preservation of life and the propagation of death simultaneously, with this idea of individuation, Esposito finds the scope for the commencement of affirmative biopolitics.

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GROWTH OF CURRENCY FUTURES IN INDIA

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Abstract

A currency future is a financial derivative first introduced at the Chicago Mercantile Exchange (CME) in 1972. National Stock Exchange (NSE) was the first exchange in India, permitted by SEBI, to set up a separate currency derivative segment with trading starting on 28 August, 2008 in NSE. Similarly the BSE and MCX started trading the currency futures from 1st and 7th October, 2008 respectively. Initially Currency futures on USD-INR were introduced for trading and subsequently the Indian rupee was allowed to trade against other currencies such as Euro, Pound sterling and the Japanese Yen. Now India has passed a journey of six years in the field of Currency Futures. The main theme of the study is to evaluate the growth of currency futures, the number of contracts traded and open interest at NSE and MCX have been inclusively compared.

Key Words: Currency Futures, NSE, MCX, Open interest, Contract traded.

Introduction

The introduction of liberalised policy has driven our economy towards a free market economy. Integration of financial markets – both domestic and international, utilisation of multi currency transactions, increase in the increase in the international trade , high volatility in stock market etc are the

resultant features of this liberalised economy. This has exposed the traders, manufactures, banks, and others to various risks. Interest rate risk, foreign exchange risk, counters party risk, economic risk, political risk are some of them. For example, when countries adopt floating exchange, traders have face risk due to fluctuations in exchange rate. Deregulation of interest rates cause interest risk. Currencies, shares and commodities are also subject to depreciation (or fluctuations) in value. Companies and traders would like to protect their profit by shifting some of the risks to those who are willing to take up. This process of sharing and reducing the risk is risk management. Derivatives have emerged as the most influential tool in risk management system.

Derivatives are of two types – Commodity derivatives and Financial Derivatives. This classification is mainly based on the type of underlying assets. Currency futures are come under the category of financial derivatives.

"***By far the most significant event in finance during the past decade has been the extraordinary development and expansion of financial derivatives***."

Alan Greenspan (Former Chairman, Board of Governors of the US Federal system)

Mr. Greenspan spoke before the Futures Industry Association where the topic of his speech was financial derivatives.

Mr. Greenspan explains, "The reason that growth has continued despite adversity, or perhaps because of it, is that these new financial instruments are an increasingly important vehicle for unbundling risk." Later, he adds, "In short, the value added of derivatives themselves derives from their ability to enhance the process of wealth creation." Mr. Greenspan also makes the claim

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that "derivatives are mainly a zero sum game: One counterparty's market loss is the other counterparty's market gain."

A currency future is a futures contract to exchange one currency for another at a specified future date at a predetermined price (exchange rate). Investors use these futures contracts to hedge against foreign exchange risk. The future contract specifies the price at which a currency can be brought or sold on a future date and the currency pair is exchanged on the delivery date. It is type of financial futures. Currency futures are also called foreign exchange futures FX futures. They are futures contracts having foreign currencies as underlying assets. Currency futures are used by hedgers to reduce their exposure to foreign exchange risk and by speculators to make short term gains from exchange rate fluctuations.

Related Literature

Anuradha Sivakumar and Runa Sarkar in his research **paper entitled "**Corporate Hedging for Foreign Exchange Risk in India" he evaluate the various alternatives available to the Indian corporate for hedging financial risks. He suggests that forwards and Options are preferred as short term hedging instruments while swaps are preferred as long term hedging instruments.

Dharan Kumar Pandey in his study 'Currency Futures in India- an Introduction' describes the evolution of Currency Futures in India. He also made through analysis as regards the growth of the Currency Futures in India with help of open interest and number of contracts of NSE and MCX. As per his opinion the Indian Currency Futures will witness tremendous changes in the coming future.

Dr. Devajit Mahanta in his article entitled 'Indian Currency Futures: An Analytical study of its Performance make detailed discussion as regards Currency Futures. The Study deals with growth of currency future in India. The future prospects of the currency futures is also form part of the study

Dr. Shailesh Rashtogi in research paper entitled Impact of currency futures on Spot market Volatility. The main purpose of the study was to find out whether the introduction of currency future in India has impacted the volatility of spot foreign exchange market or not. He finished this study with a conclusion that the introduction of currency future in India has positively impacted the foreign exchange market in terms of volatility.

Mohd. Shamim Ansari in his study he gives a detailed study as regards Indian Capital Market. He also makes a detailed analysis as regards Indian derivative market. The strength of Indian derivative market and future opportunities portrays in the study.

Rinu George and Rahul Misra in their studies explain the relevance of currency future in Indian context and also how it can be for used for hedging the forex risk. He explained the context with simple language and with simple illustrations too. The various factors affecting the exchange rate risk is also form part of the study.

Objectives of the Study

The present study entitled with the following objectives

1) To analyse the growth of the Currency futures in India
2) To study the recent trends in Currency futures in India

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Methodology of the study

The study is analytical in nature and purely based on secondary data. The data were obtained from websites of various government agencies i.e. from SEBI, RBI, NSE.BSE, MCX-SX etc...

Results and Discussions

1. To analyse the growth of the Currency futures in India

The growth of the currency futures in India has been assessed by measuring the growth in two variables which are open interest and contracts traded.

a) Open Interest

Open Interest is the total number of outstanding contracts that are held by market participants at the end of the day. It can also be defined as the total number of futures contracts or option contracts that have not yet been exercised (squared off), expired, or fulfilled by delivery. By monitoring the changes in the open interest figures at the end of each trading day, some conclusions about the day's activity can be drawn. Increasing open interest means that new money is flowing into the marketplace. The result will be that the present trend (up, down or sideways) will continue. Declining open interest means that the market is liquidating and implies that the prevailing price trend is coming to an end. Knowledge of open interest can prove useful toward the end of major market moves. A levelling off of open interest following a sustained price advance is often an early warning of the end to an up trending or bull market.

The relationship between the prevailing price trend and open interest can be summarized by the following table.

Table 1: Relationship between price trend and open interest

Price	Open Interest	Interpretation
Rising	Rising	Market is strong
Rising	Falling	Market is weakening
Falling	Rising	Market is weak
Falling	Falling	Market is strengthening

As I mentioned earlier growth of currency future market can be measured in terms of the movement in the form of open interest. The table No. 2 gives us a clear picture as regards the Open interest in Currency Futures of NSE.

Table 2: Business growth in currency derivative segment (NSE)

Month/ Year	No. of trading days	Open Interest at the end	
		No. of Contracts	Turnover (Rupee Crores)
2008-09	139	2,57,554	1,313
2009-10	240	4,27,873	1,964
2010-11	249	30,20,562	13,690
2011-12	240	29,59,055	15,328
2012-13	243	36,57,304	20,101
2013-14	207	11,30,108	7,385

Source: SEBI Bulletin

While analysing the Table No. 2 we can find that for the last five financial years the open interest is increasing in an explosive manner. While during the last financial year the increasing trend of open interest moves downwards due to numerous fluctuations in the currency market.

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Table 3: Business growth in currency derivative segment (MCX- SX)

Month/ Year	No. of trading days	Open Interest at the end	
		No. of Contracts	Turnover (Rupee Crores)
2009-10	240	4,23,314	1,951
2010-11	249	7,94,788	3,706
2011-12	240	8,44,086	4,494
2012-13	243	13,34,662	7,389
2013-14	207	3,99,885	2,646

Source: SEBI Bulletin

While we analysing the Table No. 3 we can simply identify the growth of Currency futures in the Initial years. The same issue what was happened to NSE currency Futures in the year 2013-14 was faced by MCX- SX. The year 2013-14 shows a decrease in the open Interest of MCX- SX currency Futures. Global recession is an important factor at this time.

b) Contract Traded

The number of contracts traded on a stock exchange shows the total volume of contracts traded. An increase in the number of contracts traded on a stock exchange expresses the growth of trade in that particular stock exchange for currency future. The number contracts traded (Table-4) in the NSE decreased to 701371974 contracts on 2011-12 from 712181928 contracts on 2010-11.The same decrease has been following since the last financial year. In spite of having decrease in the number of contracts, the Turnover is increasing smoothly. The last financial year witnessed a dip in the number of contracts and Turnover value too.

Table 4: Business growth in currency derivative segment (NSE)

Month/ Year	No. of trading days	Currency Futures		Average Daily Trading Value
		No. of Contracts	Turnover (Rupee Crores)	
2008-09	139	3,27,38,566	1,62,563	1,167
2009-10	240	37,86,06,983	17,82,608	7,428
2010-11	249	71,21,81,928	32,79,002	13,855
2011-12	240	70,13,71,974	33,78,489	19,479
2012-13	243	68,41,59,263	37,65,105	21,528
2013-14	207	**43,53,92,323**	**26,62,902**	NA

Source: SEBI Bulletin

The number of contracts traded on a stock exchange shows the total volume of contracts traded. An increase in the number of contracts traded on a stock exchange expresses the growth of trade in that particular stock exchange for currency future. The number contracts traded (Table-5) in the MCX- SX decreased to 561148090 contracts on 2011-12 from 770325229 contracts on 2010-11.The same decrease has been following since the last financial year. In spite of having decrease in the number of contracts, the Turnover is increasing smoothly. The last financial year witnessed a dip in the number of contracts and Turnover value too.

Table 5: Business growth in currency derivative segment (MSX- SX)

Month/ Year	No. of trading days	Currency Futures	
		No. of Contracts	Turnover (Rupee Crores)
2009-10	240	40,81,66,278	19,44,654
2010-11	249	90,31,85,639	41,94,017
2011-12	240	77,03,25,229	37,32,446
2012-13	243	56,11,48,090	31,05,036
2013-14	207	**32,35,41,637**	**19,72,257**

Source: SEBI Bulletin

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2. Recent Trends In Currency Futures

Currency Derivatives at NSE, MCX-SX, USE and BSE

During February 2014, the monthly turnover of currency derivatives at NSE decreased by 22.5 percent to 1, 61,726 crore rupees from 2, 08,564 crore rupee in January 2014. Further, at MCX-SX, the monthly turnover of currency derivatives also decreased by 28.2 percent to 72,031 crore rupee in February 2014 from 1, 00,374 crore rupee in January2014. The turnover of currency derivatives at USE however increased by 12.8 percent from 21,669 crore rupee in January 2014 to 24,440 rupee crore in February 2014. The turnover of currency derivatives at BSE, which started in November 2013, increased by 76.8 percent to 74,944 crore rupee in February 2014 from 42,396 crore rupee in January2014.

The figure 1 gives the trends of currency Derivatives at NSE, MCX-SX, USE and BSE.

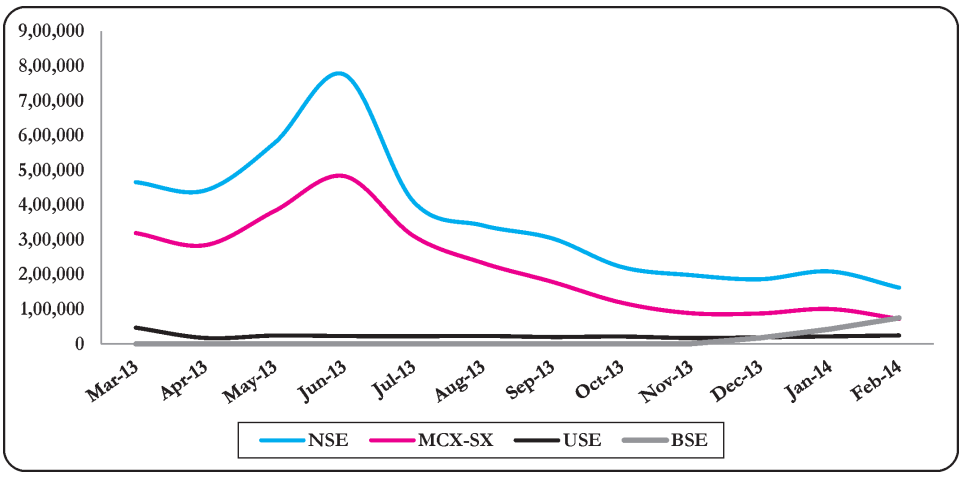

Fig. 1: Trends of currency Derivatives at NSE, MCX- SX, USE and BSE (Rupee Crores)

The currency futures contracts during the 2012-13 shows lot of fluctuations, however the following five currency futures and options are done well during that time. The Table No.6 gives a clear picture on the same.

Table 6: Top Five Currency Futures and Options

Rank	Contract Name			Total Traded Value (in Rs Crores)
	Instrument Type	Contract Symbol	Expiry	
1	FUTCUR	USDINR	29-Jan-13	363,639.41
2	FUTCUR	USDINR	29-Oct-12	352,291.09
3	FUTCUR	USDINR	27-Dec-12	333,182.00
4	FUTCUR	USDINR	27-Mar-13	330,473.73
5	FUTCUR	USDINR	27-Jul-12	323,266.78

Source: NSE

Conclusions

The Indian Currency future market has been witnessing so many changes since its inception in 2008.The currency derivatives segment on the NSE and MCX has witnessed consistent growth both in traded value and open interest since 2012-13. Currency futures are permitted in US Dollar- Indian Rupee, Euro- Indian Rupee, Japanese Yen Indian Rupee , Greater Britain Pound (GBP) Indian Rupee. Lot of fluctuations were witnessed during last financial year especially in the case of rupee devaluation. Currency future market shows lot of downward trend during same financial year. Hence the market cannot show its potential, any way we can expect lot of changes in the currency future market either by the introduction new currency pairs or something else by the new government.

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IMPACT OF ORGANIZATIONAL COMMUNICATION ON EMPLOYEE SATISFACTION; AN EMPIRICAL EVIDENCE FROM MANUFACTURING INDUSTRIES IN KERALA (INDIA)

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Abstract

Organizational communication refers to the communications and interactions among employees or members of an organization. Employee satisfaction is defined as "the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs". Previous empirical studies show that an efficient organizational communication would produce a cohesive corporate identity by increasing employees' knowledge about the overall philosophy of their organization and its strategic direction, and this brings satisfaction to employees. An empirical research conducted to explore the impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala and to compare the impact of organizational communication on employee satisfaction in public and private sector manufacturing firms in Kerala. The study reveals that there is a positive impact of organizational communication on employee satisfaction in manufacturing firms in Kerala and impact of organizational communication on employee satisfaction in private sector higher than public sector. In addition, study also reveals that there is no positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala.

Keywords: organizational communication, Employee satisfaction

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Introduction

This empirical research paper discusses the role of organizational communication on employee satisfaction in manufacturing industries in Kerala both public and private sector and its sector wise differences

Theoretical Framework and Literature Review

Organizational Communication

Organizational communication refers to the communications and interactions among employees or members of an organization. This includes: 1) The formal communication efforts of the organization (planned products and services typically produced by communication professionals, e.g., newsletters, Intranets and prepared executive videos); 2) group communications that occur within, among and across work teams and units; and 3) leader and supervisor verbal communications and behaviors.[1]

Communication includes technique of information transfer and human's thoughts and behaviors from a person to other person. Word communication is represents all the currents that by them a thought can be affect the another thought (Moghimi, 2005).

Employee satisfaction

Employee satisfaction is the terminology used to describe whether employees are happy and contented and fulfilling their desires and needs at work. Many measures purport that employee satisfaction is a factor in employee motivation, employee goal achievement, and positive employee morale in the workplace. “employee satisfaction is defined as "the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs"

Problem discussion and research questions

An efficient organizational communication would produce a cohesive corporate identity by increasing employees' knowledge about the overall philosophy of their organization and its strategic direction, and this brings satisfaction to employees (ambler and barrow, 1996). Employees would be satisfied with the organization if there is a positive feedback both vertically involving managers and employees and horizontally between workers (emmert and taher, 1992; abugre, 2010)

Organizational communication is linked to organizational commitment in several ways. For example, Vandenberg, and Wilson, (2006) found that organizational communication, work schedule flexibility through effective interpersonal communication, and opportunity for learning affect organizational commitment. Effective organizational communication leads to organizational commitment to total quality management (allen, 1992) and effective organizational communication is key to employee satisfaction (De rider, 2004). So the researcher wants to explore the impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala and its sector-wise comparison

This study seeks to provide answers to the following two research questions

1) What is the impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala?

2) Is there any differences in the impact of organizational communication on employee satisfaction in public and private sector manufacturing firms in Kerala?

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Objectives of the study

1) To explore the impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala
2) To compare the impact of organizational communication on employee satisfaction in public and private sector manufacturing firms in Kerala

Significance of the study

Communication is one of the most dominant and important activities in organizations because relationships grow out of communication, and organizations function and survive based on effective relationships among individuals and groups. Communication helps individuals and groups coordinate activities to achieve goals, make decisions, solve problems, share knowledge and manage change processes.

Internal communication also provides employees with important information about their jobs, organization, environment and each other. Effective communication can help motivate, build trust, create shared identity and spur engagement; it provides a way for individuals to express emotions, share hopes and ambitions and celebrate and remember accomplishments. The study aimed to find out the impact of organizational communication on employee satisfaction in manufacturing industries both public and private sectors in Kerala and its differences in both sectors

Scope of the study

The study was conducted among the ISO Certified large-scale manufacturing firms both public and private sectors in Kerala.

Methodology

Secondary data

The secondary data is collected from review of existing literatures and published sources such as information of enterprises, journals, articles, PhD thesis, websites etc.

Primary data

Primary data collected for this study from the Top level managers of ISO certified, Large Scale manufacturing organizations in Kerala with the help of a pre-tested questionnaire.

Research strategies

The study carried out with descriptive type of research. The survey conducted among the ISO certified Large-Scale manufacturing firms both public and private sectors in Kerala. Likert scale was adopted to measure the questions of organizational communications and employee satisfaction. The questionnaire has been designed on 5-point scale (Strongly Agree to Strongly Disagree). Convenience sampling method was adopted to select the organizations for the study both public and private sector undertaking. 60 organizations are selected as sample firms which contain 24 from public sector and 36 from private sector. 2 Top level managers (GM/MD/CEO's, DGM etc.) from the each firm were the respondent of the survey. 120 top level managers are selected for the study from both sectors (48 from public sector and 72 from private sector).

Tool used for data analysis

To exploring the impact of organizational communication and employee satisfaction in both public and private sector manufacturing firms in Kerala

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and it's sector-wise comparison, the statistical tool, correlation co-efficient was used.

Limitation of the study

Data collected for assessing organizational communication and employee satisfaction was from the top level managers of the firm, not from employees directly. The study reflects, only the perceptions of top level managers regarding the organizational communication and employee satisfaction in manufacturing firms in Kerala. So this secondary nature data may leads to the biased results.

Analysis of The Data

Impact of organizational communication on Employee Satisfaction

The following hypothesis was made to assessing the impact of organizational communication on Employee satisfaction.

H0.1: there is no positive impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala

H1.1: there is a positive impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala

Independent factor	Dependent factor	Correlation	P Value
Organizational communication	Employee satisfaction	0.565	<0.001

From the above table the correlation between organizational communication and employee satisfaction is 0.565 and is significant at 1% level. So it can be concluded that there is a positive impact of organizational communication on employee satisfaction in manufacturing firms both public and private sectors in Kerala

Sector-wise comparison

H0.2: impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala not higher than private sector

H1.2: impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala higher than private sector

Attribute	Sector	Correlation	P. Value
Organizational communication	Public	0.447	0.001
	Private	0.502	0.001

The above table indicates that the impact of organizational communication in the Public sector manufacturing firm is 0.447 at 1% significant level is less than the private sector which is 0.502 at 1% significant level. So it can be concluded that impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala not higher than private sector. From this analysis, it is clear that there is no positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala

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Findings, Suggestions And Conclusions

Findings

1) Organizational communication has a positive impact on employee satisfaction in manufacturing firms both public and private sectors in Kerala
2) Impact of organizational communication on employee satisfaction in private sector higher than public sector manufacturing firms in Kerala
3) There is no positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala

Suggestions

The study reveals that there is no positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala. Whereas, there is a positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala. So the private sectors need to make more effective organizational communication system for achieving higher employee satisfaction level

Conclusion

This paper discussed the role of organizational communication on employee satisfaction in manufacturing industries in Kerala both public and private sector and its sector wise differences. The study reveals that there is a positive impact of organizational communication on employee satisfaction in manufacturing firms in Kerala and impact of organizational communication on employee satisfaction in private sector higher than public sector. In addition, study also reveals that there is no positive impact of organizational communication on employee satisfaction in public sector manufacturing firms in Kerala

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Table 1 Damage location accuracy

Sl.No	Predicted location(m)	Actual location(m)	Error (%)
1	1.54	1.53	0.002
2	1.98	1.67	0.006
3	1.87	1.61	0.224

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