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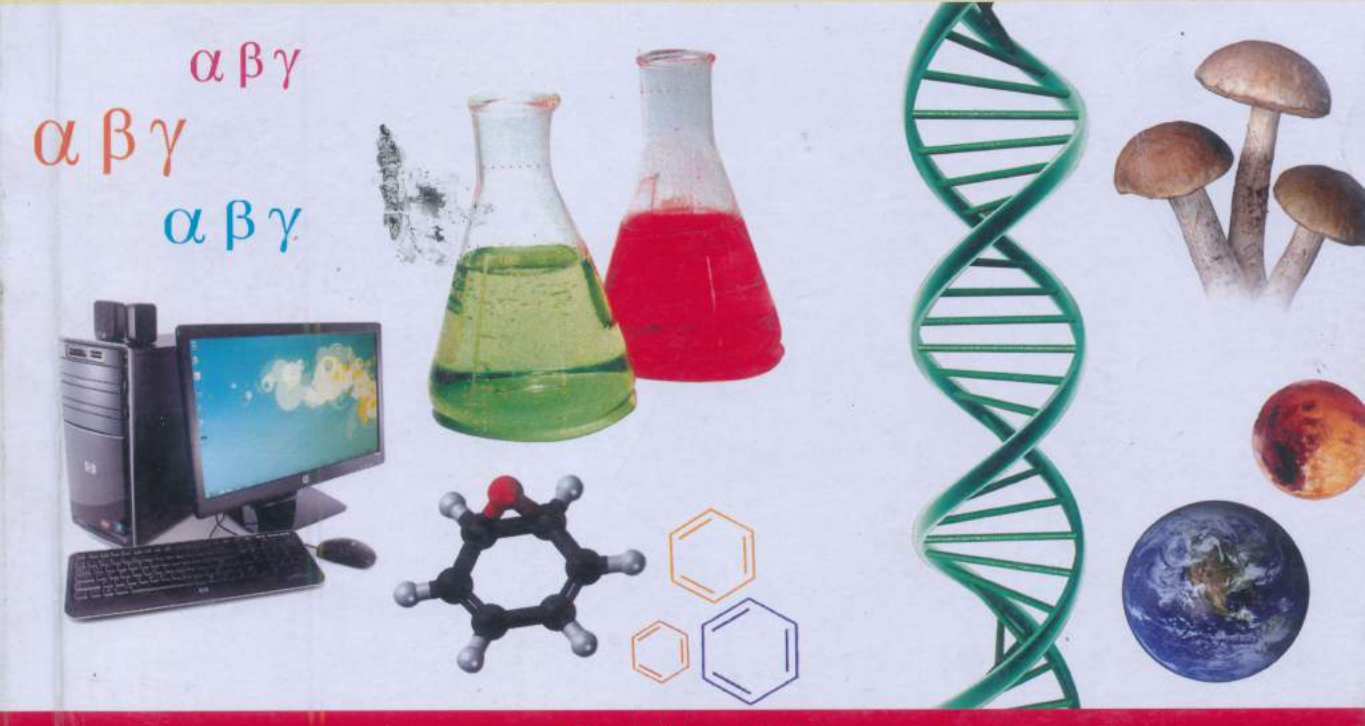

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A STUDY OF ZERO DIVISOR IN RINGS

Chandra Kanta Uzir, Asstt. Prof.
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Abstract:

In this paper, we study the notion of zero divisor in rings. We illustrate them with examples and prove some interesting results about them.

Keyword: Zero divisor, zero as zero divisor, zero divisor on a modulas, zero product property.

Introduction: Throughout this paper, R denote a ring. Zero divisors are defined for a general ring. We also introduce about zero as zero divisor, zero divisor on a module, zero product property in this paper.

Zero divisor in ring

Definition1: Let R be a ring. An element a of R is called a left zero divisor if there exists a non zero element x s.t. ax=o or equivalently if the map from R for that sends x to ax is not injective. Similarly an element a of R is called a right zero divisor if there exists a nonzero element y s.t. ya=0. This is a partial case of divisibility in rings. An element a that is both a left and a right zero divisor is called a two sided zero divisor or Zero divisor .

Note: If the ring R is commutative than the left and right zero divisors are the same.

Definition2: An element of a ring R that is not a zero divisor is called a regular or a non-zero divisor.

Definition3: A zero divisor that is non-zero is called a non-zero zero divisor or a non-trivial zero divisor.

Remarks1: If the ring R have no non-trivial zero divisors then R is a domain.

Remarks2: Every ring has 0 as identity element and 0 absorbs all ring elements under multiplication.

Zero as a zero divisor

Definition 4: If R is a ring other than zero ring then 0 is a (two sided) zero divisor because 0.1=0 and 1.0=0.

* *Corresponding Author*

Definition 5: If R is the zero ring which 0=1, then 0 isn't a zero divisor because there is no nonzero element that when multiplied by 0 yields 0.

Statements:

1. In a non zero commutative ring R the set of non zero divisor is a multiplicative set in R.
2. In a commutative noetherian ring R, then set of zero divisor is the union of the associated prime ideals of R.

Zero divisor on a module

Definition 6: Let R be a commutative ring and let M be an R-module and let a be element of R. Then a is M-regular if the multiplication by a map M'!M is injective and that a is a zero divisor on M. Otherwise the set of M-regular elements is a multiplicative set on R.

Zero product property

Definition 7: The zero product property states that the product of two non zero elements is non zero. In other words, it is the following assertion, If ab=0, then a=0 or b=0.

Integral domain

Definition8: A commutative ring R with unity 1‘“0 that has no zero divisors is an integral domain.

Remark 3: The zero product is also known as the rule of zero product, the null factor law, the multiplication property of zero or the nonexistence of nontrivial zero divisors.

Remark4: All of the number systems studies in elementary Mathematics in the integer Z, the rational Q, the real R, the complex C-satisfy the zero product property.

Remark5: A ring which satisfies the zero product property is called a domain. A commutative domain with a multiplicative identity element is called an integral domain. Any field is an I.D.; in fact any subring of a field is an I.D. Similarly any subring of a skew field is a domain. Thus the zero product property for any subring of a skew field is an integral domain.

Example 1: In the ring z/4z, the residue class2 is a zero divisor since 2x2=4=0.

Example 2: A nilpotent element of a non zero ring is always a two sided zero divisor since $a^n=0, b^n=0$ and $a^n b^n=0$.

Example 3: An idempotent element e‘“1 of a ring is always a two sided zero divisor since e(1-e)=0=(1-e)e.

Example 4: The ring of 2x2 matrices have a zero divisor since

$$\begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ -1 & -1 \end{pmatrix} \begin{pmatrix} 1 & 1 \\ 2 & 2 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

&

$$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$$

Example 5: If p is a prime number, then the ring of integers modulo p has the zero product property (in fact it is a field).

Example 6: The Gaussian integers are an integral domain., because they are a subring of the complex numbers.

Example 7: The set of non negative integers {0,1,2,…,3} is not a ring, but it does satisfy the zero product property.

Example 8: (Zero divisor)

In ring Z_{12}={0,1,2,……,11}. The elements 2,3,4,6,8,9,10 are all zero divisors because

2x6=6.2=03.4=4.3=03.8=8.3=04x6=6x4=0

4.9=9.4=06x6=6x6=06x8=8x6=06x10=10x6=0

8x9=9x8=0

We see that all these points are not relatively prime to 12.

Example 9: For any positive integer 'n' the zero divisors in Z_n are exactly those nonzero elements that aren't relively prime to n.

Exm-10: If P is a prime then Z_p is an integral domain otherwise if P is composite the Zp is not an ID.

Deduction 1: Further if n is prime i.e. n=p then Z_p has no zero divisors.

Then

$$AB=\begin{pmatrix}1 & -1\\ 0 & 0\end{pmatrix}\begin{pmatrix}0 & 1\\ 0 & 1\end{pmatrix}=\begin{pmatrix}0 & 0\\ 0 & 0\end{pmatrix}=0$$

Yet neither A nor B is zero.

Noon Examples

Non example 1: The ring of integers module a prime number has no zero divisor other than 0.

Non example 2: A division ring has no zero divisor except 0.

Non example 3: A non zero commutative ring whose only zero divisor is 0 is called an integral domain.

Properties

Property 1: In the ring of nxn matrices over a field, the left and right zero divisors coincide j they are precisely the singular matrices.

Property 2: In the ring of nxn matrices over an integral domain , the zero divisors are precisely the matrices with determinant zero.

Property 3: Left or right zero divisors can never be units, because if a is invertible and ax=0, then $0=a^{-1}.0=a^{-1}ax=x$, whereas x must be nonzero.

Problem 1: Find all the zero divisors in the rings $Z\oplus Z$, $Z_3 Z_3 \oplus$ and $Z_4 \quad Z_6 \cdot \oplus$

Sol: In general if $R_1 \oplus$ and R_2 be the ring with unity, then So is $R_1 \oplus R_2$. The unit element in $R_1 R_2$ is (I_R, I_{R2}). The additive identity element in $R_1 \oplus R_2$ is $[0_{R1}, 0_{R2}]$.

Suppose that (a_1,a_2) is an element of $R_1 \oplus R_2$. Then (a_1,a_2) is a zero divisor if and only if then exists an element (b_1,b_2) in $R_1 \oplus R_2$ such that

$(b_1,b_2) \neq (0_{R1},0_{R2})$ and $(a_1,a_2)(b_1,b_2) = (0_{R1}, 0_{R2})$.

The second equation just means that $a_1b_1=0_{R1}$ and $a_2b_2=0_{R2}$. Also $(b_1,b_2)\neq(0_{R1},0_{R2})$ means that $b_1\neq 0_{R1}$ or $b_2\neq 0_{R2}$. Consequently, it follows that if (a_1,a_2) is a zero divisor in $R_1 \oplus R_2$, then either a_1 is a zero divisor in R_1 or a_1 is a zero divisor in R_2. For the converse, suppose that a_1 is a zero divisor in R_1. Then $a_1b_1=0_{R1}$ for some nonzero element $b_1 \in R_1$. It follows that

(b_1,b_2)‘“ $[0_{R1},0_{R2}]$ and $(a_1,a_2)(b_1,b_2) = (0_{R1},0_{R2})$

Therefore (a_1,a_2) is a zero divisor in $R_1 \oplus R_2$. A similar argument shows that if a_2 is a zero divisor in R_2 then (a_1,a_2) is a zero divisor in $R_1 \oplus R_2$. In summary we shown that (a_1,a_2) is a zero divisor in $R_1 \oplus R_2$ if and only if either a_1 is a zero divisor in R_1 or a_2 is a zero divisor in R_2.

The only zero divisor in Z is 0. The only zero divisor in Z_3 is 0. The zero divisor of Z_4 are 0 and 2. The zero divisors in Z_6 are 0,2,3 and 4. The above remarks shows that

The set of zero divisors in $Z \oplus Z$ is $\{(a,0)|a \in Z\} \cup \{(0,b) \mid b \in Z\}$

The set of zery (o divisors in $Z_3 \oplus Z_3$ is $\{(a,0)|\ a \in Z_3\} \cup \{(0,b) \mid b \in Z_3\}$

The set of zero divisors in $Z_4 \oplus Z_6$ is $\{(a,b)|a \in Z_4,\ b=0,2,3 \text{ or } 4\} \cup \{(a,b)|b \in Z_6,\ a=0 \text{ or } 2\}$

Problem-2: Find all units and zero divisors in Z7 and Z8.

Sol.: Since $1(1)=2(4)=3(5)=6(6)=1 \bmod 7$, so there are no zero divisor in Z_7 and all non zero elements in Z_7 are units. Similarly as $1(1)=3(3)=5(5)=7(7)=1 \bmod 8$ and $2(4)=6(4)=4(4)=0 \bmod 8$, the units are 1,3,5,7 and the zero divisors are 2,4,6.

Problems-3: Show that a commutative ring with the cancellation property (under multiplication) has no zero divisors.

Sol: Let $a \neq 0$ and suppose that $ab=0$ for some b in the ring. Since we are in ring, $a0=0$, so we have $ab=a0$ and by cancellation property we see that $b=0$. Thus there are no zero divisors in the ring.

Problems-4: Find all units, zero divisors idempotent and nilpotent elements in Z_3Z_8 $\oplus$

Sol-: 1) The units of Z_3 are 1 and 2, since $1x1=1$ and $2x2=1$. Similarly the units of Z_6 are 1 and 5 since $1x1=1$ and $5x5=1$. So the units of $Z_3 \oplus Z_6$ are (1,1) (1,5), (2,1), (2,5).

2) There are no zero divisors of Z_3 but Z_6 has three zero divisors 2,3 and 4. This means that, for example, the pair (a,2) is a zero divisor of $Z_3 \oplus Z_6$ where a is any element of Z_3 (we can multiply by (0,3). The zero divisors are $\{(a,b)|a \in Z_3,\ b \in \{2,3,4\}\}$.

3) An element of a ring is called idempotent if $a^2=a$. The idempotent of Z_3 are the elements 0,1 and the idempotent of Z_6 are the elements 1,3,4. So the idempotent of $Z_3 \oplus Z_6$ are $\{(a,b):a=0,1;\ b=1,3,4\}$.

4) An element of a ring is called nilpotent if $a^n=0$ for some integer n. The only nilpotent element in either Z_3 or Z_6 is 0, So the only

nilpotent element of $Z_3 \oplus Z_6$ is 0, So the only nilpotent element of $Z_3 \oplus Z_6$ is[0,0]

Problems-5: Find a non zero element in a ring that is neither a zero divisor nor a unit.

Sol: In the ring Z, 2 is neither a zero divisor nor a unit (because Z is an Integral Domain and hence has no zero divisor).

Theorem1: Let R be a commutative ring with unity. Prove that every non zero element of R is either a zero divisor or a unit. What happens if we drop the finite condition on R?

Proof: Let a□ R be a nonzero element and suppose that a is not a zero divisor. First 1 will prove the cancellation property just for a. If ab=ac then ab – ac=0 and

A (b-c)=0. Since a is a zero divisor therefore b-c=0, so b=c.

Theorem-2: The zero divisors of Z_n, are precisely the non zero elements that are not relatively prime to n.

Proof: Case1: Let gcd (m,n) = d>1.

Then we have

M (n/d)= n (m/d)=0 and m is a zero divisor.

Case2:Let gcd (m,n) = 1, Then assume that mk=0 in Z_n i.e. n/mk. Since m is relatively prime to n, We have n/k i.e. k=0 in Z_n. We see that m is not a zero divisor.

Theorem-3: The cancellation holds for a ring if and only if R has no zero divisor.

Sol:1st Part: Assume that the cancellation law hold but ab=0 for since a,b≠0. Then we have ab=0=a0 but b‘“0, which is a contradiction.

2nd part: Assume that R has no zero divisor. If ab=ac=0 and a(b-c)=0. Since R has no zero divisors and a is assumed to be non zero, we have b-c=0 and thus b=c.

Theorem-4: Every field is an integral domain.

Proof: Suppose that a,b□ F such that ab=0. We need to show that if a≠0 then b=0. By the associativity of multiplication. We have 0= a-!(ab) = (a-!a)b=1b=b.

This proves the theorem.

Conclusion: The result in this paper gives the structural properties of zero divisors in a ring many more applications can be expected.

Acknowledgement: The authors gratefully acknowledge their thanks to the references for their suggestions.

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TITLE : SYNTHESIS OF POLYURETHANE MACROINIFERTERS AND STUDY OF LIVING RADICAL NATURE BY BLOCK COPOLYMERISATION WITH ACRYLONITRILE

P. K. Bhuyan*

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Abstract :

Attempt was made to synthesise the high molecular weight poly(ether- urethane) macroiniferters.That macroiniferters based on diphenyl methane- 4,42 -diisocyanate (MDI), polypropylene glycol(PPG), M.W 1000 and 1, 4-Butanediol (BD) and 1, 1, 2, 2- Tetraphenyl ethane diol (TPED) as chain extender have been synthesized using methyl ethyl ketone (MEK) as solvent. The reactions were catalysed by dibutyl tin dilaureate (DBTDL). Several polyurethane macroiniferters(PUMI) were synthesized by varying the amount of TPED in the mixture of chain extender diols. These polyurethane macroiniferters were then used to synthesize polyurethane–block–polyacrylonitrile copolymers (PU-b-PAN) through thermally induced living radical polymerization. The homopolymers, polyacrylonitrile (PAN) were also removed by partial dissolution technique and finally soxhlet extraction with acetone. Polyurethane macroiniferters and the corresponding block copolymers were characterized by FTIR, H^1NMR, C^{13}NMR, SEM measurements. The thermal behaviour of the resultant polymers was also studied by TGA.

Key words: Iniferter, Block copolymer, Living polymerization, TGA, SEM.

1. Introduction:

Modification of polymeric materials to improve their performance as well as to widen their field of application has been a fascinating field of research. The scope of utility of polyurethanes can be widened by its modifications. One way of modification may be its block and graft copolymerisation with vinyl monomers. For controlled incorporation of vinyl blocks into polyurethane blocks, iniferter concept developed by Otsu[1] can be employed. Linear segmented polyurethanes, which are essentially block copolymers made

up of hard and soft chain segments in an alternating fashion, exhibit many of the properties of crosslinked elastomers and are of particular importance.

In recent years, a number of polymeric system based on reversible termination of growing radicals were reported in order to improve the radical polymerization, such as iniferters [2] where the same species served the purpose of initiator, transfer agent and/or terminator.

Iniferters may be activated both by thermal and photochemical means. So far, several important types of iniferters such as thiuram disulfides, dithiocarbamates and tetraphenylethane derivatives have been used to initiate living radical polymerization reaction[3-5].

Furthermore, polymethacrylic acid and polymethyl methacrylate prepared with the polyurethane iniferter have been reported[6-7]. Most of the thermal iniferters containing carbon-carbon bonds are symmetrically disubstituted tetraphenylethane derivatives which were reported in the earlier work[8]. The living radical nature of a kind of polyurethane iniferter prepared from diisocyanate and 1, 1, 2, 2-tetraphenyl-1, 2-ethanediol (TPED) was reported by some workers.[9-10]

In this paper, we describe the synthesis of variety of polyurethane macroiniferter (PUMI) by varying the percentage of 1, 1, 2, 2-tetrapheny l-1, 2-ethanediol (TPED) and 1, 4-butanediol (BD) with 4,42 - diphenylmethanediisocyanate (MDI). Tetraphenyl ethane and its derivatives having a sterically hindered carbon-carbon single bond are known to act as thermal iniferters in free radical polymerisztion. The polyurethane macroiniferters having varying percentage of tetraphenyl ethane moieties were then used to synthesise a series of polyurethane-block-polyvinyl copolymers. The vinyl monomers used is acrylonitrile (AN). The living radical nature of PUMI is confirmed by the successful synthesis of block copolymers with acrylonitrile (AN) and characterization of polymeric materials are also described.

2. Experimental :

2.1 Materials and methods:

1, 1, 2, 2- tetrapheny l-1, 2-ethanediol (TPED) was prepared from benzophenone and 2-propanol and recrystallised from ethanol. 4, 42-diphenylmethanediisocyanate (MDI; Aldrich), acrylonitrile (AN; E.Merck), 1, 4-butanediol (BD; E. Merck), polypropylene glycol, M.W. 1000 (PPG; Aldrich), were distilled under reduced pressure before their use. Dibutyltindilaurate (DBTDL; E. Merck) was used as received. Dimethylsulphoxide (DMSO; E. Merck), N, N-dimethylformamide (DMF; E. Merck) were dried over barium oxide, distilled under reduced pressure and stored at 0-4°C. Ethylmethylketone (MEK; E. Merck) was also distilled before its use. Other analytical grade reagents were used as received.

2.2 Synthesis of polyurethane macroiniferters: For its synthesis MDI,PPG,BD and/or TPED were taken in the molar ratio 3: 1: 2 respectively. MDI and PPG

were reacted at 70°C for 1.5 h under dry nitrogen atmosphere. The reaction mixture was cooled to 50°C and TPED dissolved in 25 ml MEK was added drop wise through the pressure equalizing funnel into the flask with a magnetic stirring bar at 50°C (table 1). This was followed by the addition of catalyst DBTDL (two drops). After 5 h, the resultant polymer was precipitated from water and it was then dried in a vacuum oven at 40°C for several days.

Table 1 shows the amounts of MDI,PPG,BD and TPED taken to synthesise polyurethane macroiniferters.

PU- X%	Amounts of MDI (g)	Amounts of PPG (g)	Amounts of TPED (g)	Amounts of BD (g)
PU- 100%	2.00	2.66	1.95	Nil
PU- 80%	2.00	2.66	0.78	0.05
PU - 60%	2.00	2.66	0.59	0.09
PU - 20%	2.00	2.66	0.19	0.19

2.3 Synthesis of polyurethane-block-polyacrylonitrile copolymer:

The block copolymers were synthesised with polyurethane macroiniferter. The polyurethane macroiniferters having different percentage of TPED were taken in a 100 ml round bottomed flask and dissolved in DMF (25 ml) under nitrogen atmosphere. The acrylonitrile (AN) was then added and the mixture was heated at 74°C for 12 h, in constant agitation (table 2). At the end of the reaction, the products were precipitated by pouring the mixture into large volume of water. The block copolymers were then freed from polyacrylonitrile (PAN) homopolymers by partial dissolution technique. Finally these were soxhlet extracted with acetone to remove any impurity. The purified product was then dried under vacuum for several days.

Table 2 Synthesis of Polyurethane-polyacrylonitrile block copolymers.

Sl.No.	PU-b-PAN	PU-X%	A(g)	B(g)	C(g)
1	PU_{100} -b-PAN	PU – 100%	1.0101	3.0202	1.5897
2	PU_{80} -b-PAN	PU – 80%	1.0101	3.0202	1.4802
3	PU_{60} -b-PAN	PU – 60%	1.0101	3.0202	1.3501
4	PU_{20} -b-PAN	PU – 20%	1.0101	3.0202	1.1194

(PU-b-PAN)= Polyurethane-block-polyacrylonitrile copolymers.
(PU–X%)= Polyurethane macroiniferters.
A= Amount of PU – X%
B= Amount of acrylonitrile (AN).
C= Weight of dry product (PU-b-PAN copolymers) after removal of homopolymer (PAN).

Results and discussion:

All the synthesis were carried out by the prepolymer method where MDI and PPG were reacted first followed by chain extension with short-chain diols BD and TPED. Polyurethanes with tetraphenylethane moiety are known to act as thermal iniferters in free radical polymerisation. The polyurethane macroiniferters (PU-X%) having varying percentage of the tetraphenyl ethane moieties were synthesised and these thermal macroiniferters were then used to synthesise a series of polyurethane-b-polyacrylonitrile copolymers.

The conversion (%) AN during the block copolymerisation with polyurethane macroiniferters (PU-X%) was calculated[11-12] as follows.

Conversion (%) = M / (X+Y) x 100

Where, X and Y are the weights of polyurethane macroiniferters (PU-X%) and monomers respectively and M is the weight of block copolymers after the removal of homopolymers. The results are tabulated in table 3

Table 3 Block copolymerisation of AN with PU-X% at 74° C in DMF.

Name of PU-b-PAN	Weight of PU-X% (g)	Weight of AN(g)	Weight of PU-b-PAN after removal of homopolymer (g)	Conversion (%)
PU_{100}-b-PAN	1.0101	3.0202	1.5897	39.44
PU_{80}-b-PAN	1.0101	3.0202	1.4802	36.73
PU_{60}-b-PAN	1.0101	3.0202	1.3501	33.49
PU_{20}-b-PAN	1.0101	3.0202	1.1194	27.77

It was observed that the conversion (%) of AN was directly proportional to the number of initiating sites present in the macroiniferter.

Figure1 indicates the FTIR spectrum of PU100-b-PAN copolymer. The absorption band at 3428.2 cm-1 represents N – H stretching in the urethane group in PU100-b-PAN copolymer. The peak at around 1720 cm-1 represents the carbonyl (C=O) group in the urethane. Moreover, an intense peak at 2241.8 cm-1 appeared in the spectrum of PU100-b-PAN copolymer **13**. This was due to the presence of C - N group

from acrylonitrile incorporated in the polyurethane backbone. The peak at 1635.2 cm-1 was due to the C=C in the aromatic ring. The band at 1450.6 cm-1 represented the bending mode of C – H in CH2 group. The band appeared at 1312.2 cm-1 was due to the presence of C – N stretching mode. The C– O – C stretching mode at 1081.5 cm-1 also appeared in the PU100 -b-PAN copolymer.

Figure 2 shows 1H-NMR spectrum of PU100-b-PAN copolymer synthesised from PU-100% and acrylonitrile (AN). The signal due to methylene protons (2.05 ppm) of the PAN appeared as a broad peak or closed multiplets due to overlapping of several spin coupled signals. Because of the mixed tacticity of PAN, there may be additional minor signals in the region due to coupling between the geminal protons. The methine signal of PAN appeared as a broad peak centred at 3.13 ppm. Earlier reports **14** indicated that in the γ -ray canal PAN, only one peak was observed at 3.15 which implied highly isotactic configuration. In our case there is expected to be less regularity in the structure of PAN, which is why a broad peak was observed. Further in the present study signals due to –OCH3 protons of the PPG which appeared in the same range had a broadening effect on the peak. The peak at 9.5 ppm was due to the presence of urethane N – H proton in the polymer chain. Other peaks were the ones present in the polyurethane macroiniferter.

Figure 3 shows the TGA-thermograms of the polyurethane macroiniferters PU-100%. In this case the weight loss was found to be a three-step process. The initial weight loss was about 14%, which occurred at 196.67 0C, which was followed by another weight loss at around 309.99 0C. The final weight loss occurred at around 363.32 0C. Since it has been indicated that the initial degradation occurs in the hard segments**15**, this may imply that the hard segment which is composed of TPED in place of BD degrade much before the over all degradation of the polyurethane. The two weight loss may be due to degradation of segments of different lengths containing the TPED units.

The figure 4 shows the TGA-thermograms of PU-b-PAN based on polyurethane macroiniferters PU-100% . The thermogram showed an initial weight loss at around 260.43 0C and the rest of the curve showed apparently one step weight loss process. However, DTG showed it to be consisted of three different weight loss processes at around 296.67 0C, 363.37 0C and 426.64 0C respectively. The thermogram of PU100-b-PAN is different from that of polyurethane macroiniferter (PU-100%) indicating different chemical composition of the two which implied the successful copolymerisation process. It is possible that TPED hard segments containing

polyacylonitrile segments of different lengths degraded at different temperatures. The final weight loss at 426.640C is evidently due to degradation of polyacrylonitrile segments as this was absent in the thermogram of the polyurethane macroiniferter. The block copolymer appeared to have a better thermal stability than that of the polyurethane macroiniferter.

Figure 5 shows the scanning electron micrograph of PU-100% macroiniferter. The use of TPED as chain extender diol should increase the size of the hard domain structure in comparison to polyurethane hard domains from MDI and BD. Spherulitic hard domain structures with the width (1.74 to 3.48 μm) was observed.

Figure 6 shows the scanning electron micrograph of PU100-b-PAN copolymer. The scanning electron micrograph is different from that of the polyurethane macroiniferter. Which indicated a change in morphology as a result of block copolymerisation. The domain structure observed in case of the iniferter was replaced by continuous, layered structure. It seems that the nucleation process of the polyurethane hard segment was influenced by the growing chain of the polyacrylonitrile. This resulted in higher coalescence among the spherulitic structures leading to the marring of the well defined spherulitic boundaries.

Conclusion:

The polyurethane macroiniferters having varying percentage of tetraphenyl ethane moieties were synthesized and these were also used to synthesise PU-b-PAN copolymers. The conversion (%) AN during the block copolymerisation with polyurethane macroiniferters (PU-X%) was calculated. The resultant polymers were successfully characterized by FTIR, 1H-NMR, TGA and SEM. The TGA-thermogram of PU-b-PAN copolymer indicated a better thermal stability than that of the polyurethane macroiniferter. The scanning electron micrograph of PU100-b-PAN copolymer showed different surface morphology from the macroiniferter.

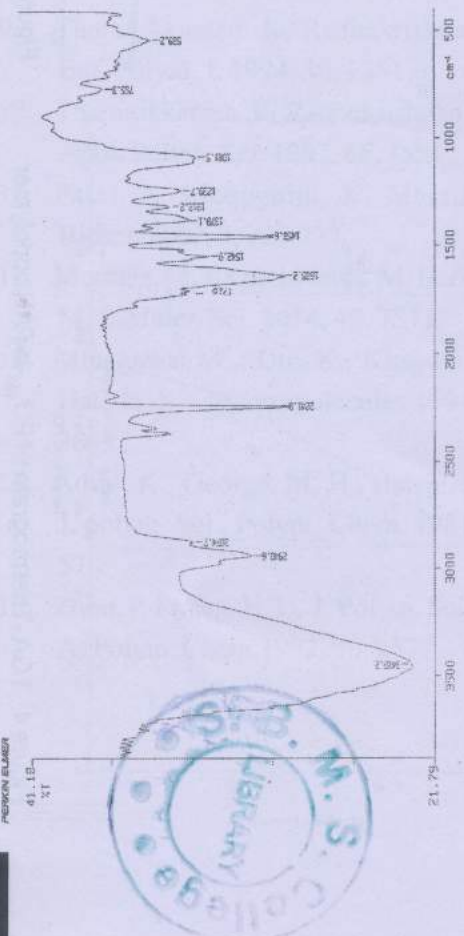

Figure 1. FTIR Spectrum of PU_{100}-b-PAN copolymer

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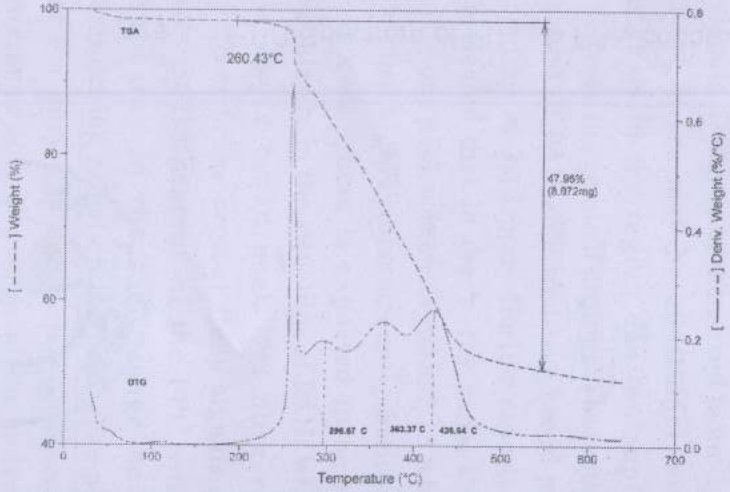

Figure 4. TGA-Thermogram of PU_{100}-b-PAN copolymer

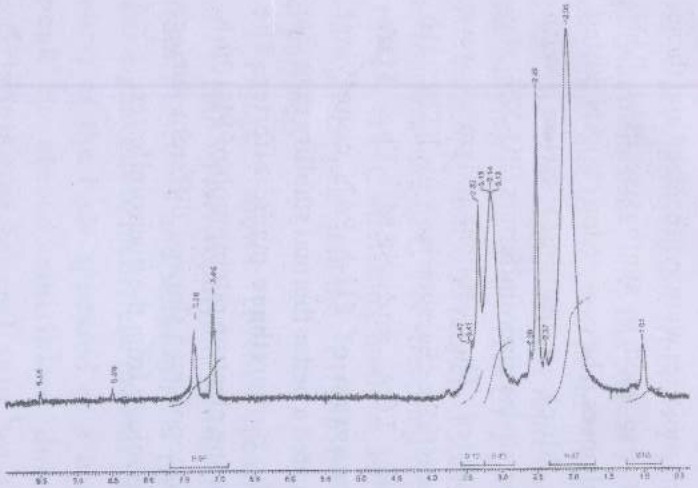

Figure 2. ^{1}H-NMR Spectrum of PU_{100}-b-PAN copolymer

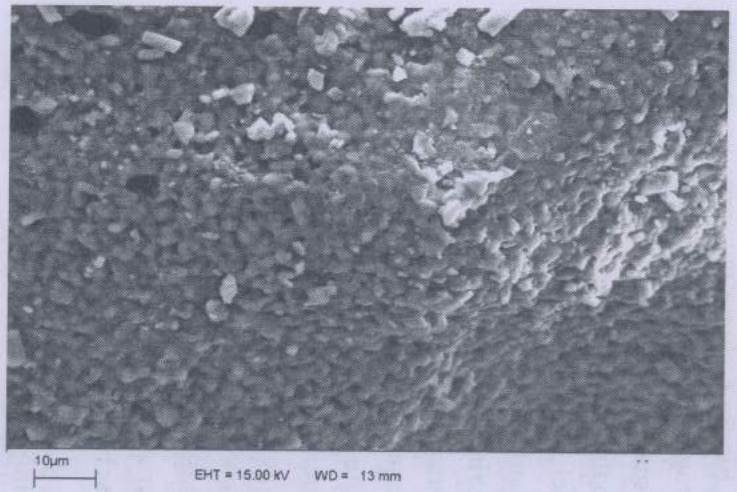

Figure 5. Scanning electron micrograph of PU-100%

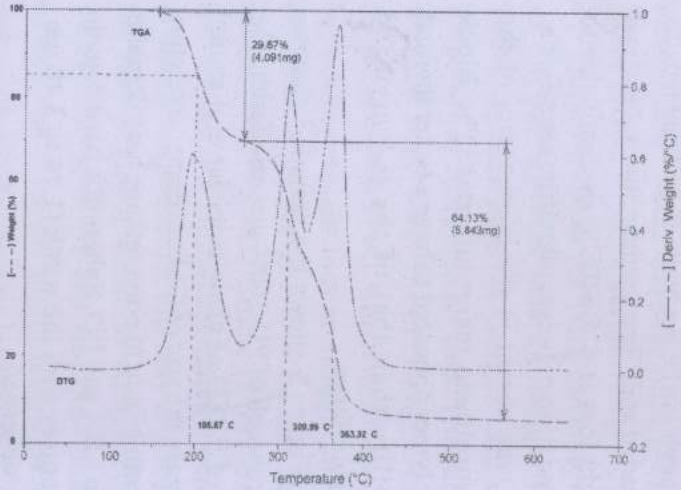

Figure 3. TGA- Thermogram of polyurethane macroiniferter (PU-100%)

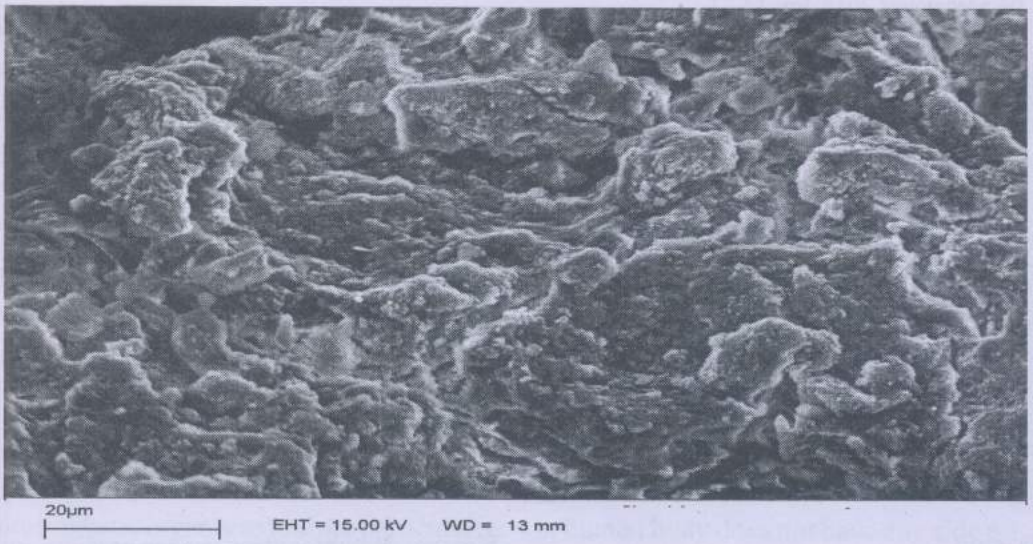

Figure 6. Scanning electron micrograph of PU_{100}-b-PAN

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POTENTIAL ROLE OF CAROTENOIDS IN HUMAN HEALTH AND DISEASE PREVENTION: A REVIEW

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Abstract:

In human beings carotenoids can serve several important functions. The most widely studied and well-understood nutritional role for carotenoids is their provitamin activity. Carotenoids also play an important role in human health by acting as biological antioxidants, protecting cells and tissues from the damaging effects of free radicals and singlet oxygen. Other health benefits of carotenoids that may be related to their antioxidative potential include enhancement of immune system function, protection from sunburn, inhibition of the development of certain types of cancers and coronary heart disease. In this review effort has been made to highlight the beneficial (protective) effects of dietary carotenoid intake in exemplary wide-spread modern civilization diseases, i.e., cancer, cardiovascular or photosensitivity disorders, in the context of carotenoids' unique antioxidative properties.

Keywords: antioxidant, cancer, cardiovascular disease, β-carotene, carotenoid,

Introduction:

Carotenoid is a class of natural fat-soluble pigments found principally in plants, algae and photosynthetic bacteria, where they play a crucial role in the photosynthetic process. They also occur in some non-photosynthetic bacteria, yeast and moulds where they may carry out a protective function against damage by light and oxygen. Although animals appear to be incapable of synthesizing carotenoids, many animals incorporate carotenoids from their diet. Within animals, carotenoids provide bright colouration, serve as antioxidants and are source for vitamin A activity (Britton et at., 1995). According to IUPAC, "carotenoids are a class of hydrocarbons (carotenes) and their oxygenated derivatives (xanthophylls) consisting of eight isoprenoid units joined in such a manner that the arrangement of

isoprenoid unit is reversed at the center of the molecule so that the two central methyl groups are in a 1,6- positional relationship and the remaining non terminal methyl group are in a 1,5- positional relationship. All carotenoids may be formally derived from the acyclic C40H56 structure, having a long chain of conjugated double bonds, by (i) hydrogenation (ii) dehydrogenation (iii) cyclization or (iv) oxidation or any combination of these processes (IUPAC, 1971)".

Carotenoids are present in all the photosynthetic organisms and are particularly diverse in algal photosynthesis. Carotenoid-less organisms can survive only under a very low light intensity, because carotenoids are essential for protection of a light-induced damage to organisms. Carotenoids have at least four kinds of functions in photosynthesis, (i) quenching of the triplet state of chlorophyll, (ii) quenching of singlet oxygen formed by various metabolic and photochemical reactions, (iii) quenching of the singlet state of chlorophylls, and (iv) sensitizing of the singlet state of chlorophylls. Radical scavenging is the fifth function. (Mimuro and Akimoto, 2003).

Role Of Carotenoids In Human Health And Disease Prevention

1. Vitamin A activity: Vitamin A is important for the eyes and skin, and for normal growth. It is essential for the maintenance of healthy epithelial tissue of the skin, eyes, respiratory system, gastro-intestine and urinary tracts. Carotenoids have long been known because some of them play an important role as precursors of vitamin A (Krinsky, 1994). Although vitamin A has been known as an essential micronutrient for almost 90 years, vitamin A deficiency is still a major health problem in much of the world. It has been estimated that 52,500 children become blind and between 1, 10,000 and 1, 32,000 become partially blind in India every year due to Vitamin A deficiency (Dandona and Dandona, 2003). Excess of vitamin A causes hyipervitaminosis-A, but excess of carotenoids in human body does not have any side effect. The nutritional function and biological activity of carotenoids and conversion of ?-carotene into retinol is necessary for growth, health and life of higher animals (Moore, 1930). Karrer and Jirgensons (1930) established the structure of ?-carotene and retinol was confirmed as a true precursor of vitamin-A. The structural similarities between ?-carotene and retinol led to the suggestion that the central double bond of ?-carotene undergoes hydrolytic cleavage to produce two molecules of retinol. On growth test the biological potency of ?-carotene was found to be twice showing the formation of two molecules of vitamin-A from one molecule of ?-carotene. In animal system conversion of carotenoids into vitamin-A takes place in the intestine. Lever is the site of the deposition of carotenoids (Glover et al., 1948). Vitamin-A appears in the intestine within 15 minute after the carotene is fed while it can be found in the liver much later usually after about 1 hour (Thompson et al., 1950). The

vitamin A content in early stages of cephalopods was not much different from that observed in other marine molluses and fish larvae and is expected to come from the carotenoid pool in their crustacean prey (Villanueva et al., 2008)

2. Carotenoids and cancer: Almost twenty years ago Peto et al., (1981) proposed that ?-carotene might reduce the risk of certain types of cancer. Since then, a compelling amount of epidemiological evidences has suggested a role for fruits and vegetables, rich in ?-carotene, in the prevention of lung carcinogenesis. ?-Carotene is both a chain breaking antioxidant and a quencher of singlet oxygen. Because it accumulates in human lung tissue, investigators speculated that β-carotene, the most widely distributed carotenoids in fruits and vegetables, might be the protective factor. Epidemiological studies on normal and at risk populations have shown that high intake of tomatoes and tomato products and the risk of various types of cancer, including oral cancer and breast cancer as well as high blood level of lycopene are associated with decreased risk for prostrate cancer. Lycopene is the predominant carotenoid in tomatoes and tomato product and is also a potent scavenger of singlet oxygen in vitro (Di Mascio et al., 1989). In a recent study, the intake of daily lycopene capsules effectively improved oral leukoplakia lesions in a group of cancer patients. In vitro findings do support a role for β-carotene in prostate carcinogenesis. Williams and co-workers (2000) have recently shown that β-carotene inhibits growth of three human prostate cancer cell lines in vitro. Additionally this group has shown that β-carotene undergoes intracellular conversion to retinol by prostate cancer cells, suggesting the ability of cancer cells to locally convert β-carotene to retinol, bypassing normal regulation of tissue retinol uptake. Astaxanthin supplementation in rats was found to inhibit the stress-induced suppression of tumor-fighting natural killer cells.

Lycopene exhibits chemo preventive activity in rodent models, where it can inhibit mammary tumor formation, liver preneoplasia, lung neoplasia, and buccal pouch squamous cell carcinomas in hamsters. It is proved that daily intake of lycopene effectively improved oral leukoplakia lesions in a group of patients. In a recent study, the intake of daily lycopene capsules effectively improved oral leukoplakia lesions in a group of cancer patients. Lycopene reduces the proliferation of cancer cells and induces apoptosis (Kanagaraj et al., 2007).

3. Carotenoids and the eye: Age related muscular degeneration (AMD) is currently the leading cause of blindness in persons older than age 65 in the world today. Age related carcinogenesis (ARC) is also common in older adults, affecting 55 to 85% of the people older than 75 years of age (Klein et al., 1992;). Although both AMD and ARC are multifactorial disease, a strong body of scientific evidence supports a protective role for lutein and zeaxanthin in the prevention of age related diseases of the eye. High intake of leafy green vegetables-rich sources of lutein

and zeaxanthin has been associated with reduced risk of cataracts and muscular degeneration (Seddon et al., 1994). Over the course of a lifetime the eye is exposed to the damaging affect of light and oxygen. Lutein and zeaxanthin absorbs blue light and may act as filters to protect photoreceptor of the eye and retinal pigment epithelium from damage. In addition, their antioxidant activity may limit the creation of reactive species that many attack lipids, carbohydrates and DNA.

Vitamin-A has special implication for the function of the photoreceptor and much is already known about the importance of this vitamin for the development of neuronal and ocular tissues. Furthermore, lutein and zeaxanthin the main carotenoids present in the human muscula and the only carotenoids present in the human lens. These oxycarotenoids are distributed throughout the neuronal retina (Levin et al., 1997), and it is proposed that their major fraction is concentrated in the plasma membrane of the rod outer segment. A linear relation between the regional ratio of lutein and zeaxanthin and the regional ration of rods and cones was shown (Terao, 1989). Thus, zeaxanthin is dominant in the foveal center, whereas lutein is more abundant further out in the periphery; Both carotenoids are proposed to serve as an optical filter, by absorbing blue light and reducing chromatic aberration and as antioxidants. The retinal photoreceptors of rats, which were fed astaxanthin were less damaged by a UV-light injury and recovered faster than control animals. Therefore, it can be inferred that deposition of astaxanthin in the eye could provide superior protection against UV light and oxidation of retinal tissues pointing to the potential of astaxanthin for eye health maintenance. Lutein and zeaxanthin are concentrated at the macula, where they are collectively known as macular pigment (MP), and where they are believed to play a major role in protecting retinal tissues against oxidative stress. Lutein and zeaxanthin prevent age-related maculopathy, or arrest its progression. The disruption of cellular processes by oxidative stress may play an important role of Age-related Maculopathy (ARM). Manipulation of dietary intake of lutein and zeaxanthin, might prevent, delay, or modify the course of ARM *(Flood et al., 2006)*.

4. Carotenoids and skin: Mathews-Roth and co-workers (1993) were able to demonstrate a protective role of β-carotene in erythropoietic protoporphyria, a photosensitivity disease resulting in itching and burning of the skin on exposer to visible light. It was hypothesized that β-carotene acts to disease of photosensitivity by quenching light-activated species and thereby preventing cellular damage, which account for the symptoms of these diseases. Since then, ongoing research investigating the potential role of carotenoids in UV- induced skin damaged, has been driven by the wide use of β- carotene supplements as sun-protectants. UV-irradiation of the skin leads to acute sunburn reactions and erythema (premature

ageing of the skin), and is associated with an increased risk for skin cancer. These detrimental effects are thought to be associated with the UV light induced formation of reactive oxygen species that are capable of damaging cellular lipids, proteins and DNA. Since carotenoids are efficient scavengers of singlet oxygen and peroxyl radicals (Sies and Stahl, 1995), they are speculated to provide the skin with protection from acute and chronic exposure to UV light. In particular, the positioning of hydrophobic carotenes, such as β-carotene and lycopene in the core of membranes parallel to the surface may enhance protection through layer of the skin and aid in retention of membrane fluidity and biological functioning. β-Carotene protects the skin from oxidative damage by quenching the free radical generated due to U.V. exposure of skin. Astaxanthin has an excellent potential as an oral sun-protectant. The animal or clinical studies are inconclusive in case of skin cancer. Lutein protects the skin from the damage induced by UV-B radiation by inhibiting DNA damage and diminishing its inflammatory effects. Furthermore, the data indicate that the oral ingestion of lutein may have the potential to act in a chemo-preventative manner against UV-B induced skin cancer, at least in the animal model evaluated, suggesting its possible therapeutic role in skin cancer prevention (Santocono et al., 2007).

5. Carotenoids and cardiovascular disease: Cardiovascular disease (CVD) remains the major cause of mortality in developed countries. Although conclusive evidence has not been elucidated for a role of carotenoids in CVD, Several epidemiological studies have investigated the relation between carotenoids intake and CVD risk. The role of carotenoids in the prevention of CVD has been reviewed recently. with variable results between in vitro and in vivo studies In addition, several prospective epidemiological studies, case-control, cross-sectional, and clinical studies report variable results. In 1992, Princen et al., reported that ?-carotene did not protect LDL from lipid peroxydation in vitro. Similarly, Gaziano et al., (1995) demonstrated that supplementation with ?-carotene in vitro and in vivo did not enhance the protection of LDL against metal ion-dependent and ion independent oxidation. Several human studies have found positive association between carotenoids intake and reduced risk of CVD. In a large prospective study of 2974 middle aged men in Switzerland, an increased risk of death from coronary heart disease (CHD) was observed among those in the lowest quartile of plasma carotene level (Gey et al., 1993). The Arteriosclerosis Risk in communities study involving 12,773 participants, aged 45-64 years, reported that those in the highest quintile of carotenoids composition had a lower prevalence of plaques than those in the lowest quintile of carotenoids consumption. It was suggested that carotenoids of other plant-derived compound might play a role in preventing arterial plaque formation. Higher

plasma lycopene concentrations are associated with a lower risk for cardiovascular disease and cell oxidative stress Thus, growing evidence suggests that lycopene, has a significant in vitro antioxidant potential and higher plasma lycopene concentrations are associated with a lower risk for CVD and cell oxidative stress (Carrapeiro et al., 2007).

6. Carotenoids and immune response: Interest in the study of carotenoids and the immune response was sparked in the 1930s when Green and Mellanby reported that deficient rats fed β-carotene did not developed infection. Thus, the role of carotenoids in modulating host defense system was originally thought to be due to their provitamin-A activity. Conditions that suppress immune function such as low vitamin-A status, increase the risk of infectious disease and have been associated with increased cancer risk in animals and human. Whereas most of the work on carotenoids and immune response has focused on β-carotene, the influence of various carotenoids on immuno-enhancement has been investigated in recent years. Although studies on immune-modulation with non-provitamin-A carotenoids are limited, evidence shows that both provitamin-A and non-provitamin-A carotenoids enhanced many aspect of immune function. Studies with various carotenoids have demonstrated significant immune-modulating actions relative to humoral immune response to T-dependant antigens. Jyonouchi et al., (1994) reported an enhancement of antibody production by lutein, astaxanthin and β-carotene in response to T-dependants antigens in vitro and in vivo. In a subsequent study by the same group, astaxanthin increased human immunoglobin production in response to T-dependant stimuli. The β-carotene increases production of tumor necrosis factor alpha (TNF-a), which helps to kill cancerous and virus-infected cells. Immune response cells are particularly sensitive to oxidative stress and membrane damage by free radicals because they rely heavily on cell-to-cell communications via cell membrane receptors. Furthermore, the phagocytic action of some of these cells releases free radicals that can rapidly damage these cells if they are not neutralized by antioxidants (Santocono et al., 2007).

Conclusion:

Life presents us with a kaleidoscope of colours. From the green, green grass of home to forests ruddy autumn hues, we are surrounded by living colours. Living organisms obtain their colours, with few exceptions, from natural pigments. In addition to their role in colouration, natural pigments carry out a variety of important biological functions. Among the natural pigments carotenoids are efficient scavengers of reactive oxygen species and there is increasing evidence that these natural pigments play a role in the protection against photooxidative damage.

Due to advances in carotenoids analytical methods in the past two decades, the structural determination and identification of a number of new compounds have been reported. More

research is necessary to provide insight to potential role of carotenoids in human health and disease prevention.

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IMPORTANCE OF MATHEMATICS ON OTHER DISCIPLINES

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Introduction:

Mathematics may be defined as the science of logical reasoning. According to New English Dictionary, "Mathematics, in a strict sense, is the abstract science which investigates deductively the conclusions implicit in the elementary conceptions of spatial and numeric relations." In Hindi or in some regional languages such as Assamese, Punjabi etc. Mathematics is also called as 'Ganita' which means the science of calculation. Mathematics is a systematized, organized and exact branch of science. According to Roger Bacon, "Mathematics is the gate and key of the sciences." Mathematics is the knowledge of truth and realities.

Mathematics has played a very important role in building up modern civilization by perfecting all sciences. It has been very properly said about Mathematics, "It is a science of all sciences and art of all the arts."

For glimpses of its relationship with our sciences, for knowing its contribution to other sciences or for understanding the dependence of other sciences on it, here I wish to throw some light on various relations of Mathematics with other subjects such as Physics, Chemistry, Biology,Engineering, Economics, Logic etc.

A. Mathematics and physics:

Perhaps no other science is as close as physics is. Only mathematical mind can take up Physics with confidence. If we observe any standard book of Physics, we will see that every rule and principle ultimately takes the mathematics form. Mathematics gives the final shape to the rule Physics. E.g.

I. The law of gravitation gives in the form of an equation,

$F=GmM/r^2$

II. Newton's second law of motion is given in the form of an equation,

$F=ma$

III. Mass energy equivalence principle is given by the relation,

$E=mc^2$

IV. Kinetic energy of a body is given in the form of an equation,

$K.E.=1/2mv^2$

Etc. prove the dependence of Physics on Mathematics. Besides this we can give countless examples to prove the dependence of Physics on Mathematics.

B. Mathematics and Chemistry:

"It is almost impossible to follow the later development of Physics general Chemistry without a working knowledge of higher Mathematics."-Moller J.W.

All chemical combinations and their equations are governed by certain Mathematical calculations. E.g

i) Water compound (H_2O) formation is only possible when two atoms of hydrogen combine with one atom of oxygen.

ii) For estimation of elements in organic compounds, the use of percentage, ratio etc. has to be made.

iii) Molecular weight of compounds are calculated mathematically.

iv) Density functional theory for elucidation of chemical properties at atomic level is all based on pure mathematics.

C. Mathematics and Biology:

Mathematics has an important application on Biology also. Mathematical processes and calculation have been applied to advanced studies in heredity, nutrition, growth and branches of biology and physiology.

Rates of reparation, transpiration and supply of water in connection with living bodies have been mathematically interpreted.

Knowledge of mathematics is considered essential for a biologist. It is indispensable for a biophysics and biochemistry. Again, biomathematics is also growing as an important field of study for biologists.

The application of mathematics in biology can further be illustrated with interesting facts about human figure give by ted Medonald. According to Medonald, the proportions of human figures are strictly mathematical. The whole figure is six times the length of the foot. The hand, from the wrist to the middle finger is one tenth of the whole structure.

The application of mathematics to biology is not new; neither is evidence of impacts on mathematics. Robert brown, a botanist, discovered what is now called Brownian motion while watching pollen grains in water. Today, the mathematical description of such motion is central to probability theory.

D. Mathematics and Engineering:

Mathematics may be considered to be the foundation of engineering. The use of mathematics in engineering is very very essential. Engineering study deals with designing, surveying, estimating construction etc. In all these process mathematical application plays a very significant role. By the proper applications of geometric principles to designing and constructions, the durability

of construed things can be increased. Thus mathematics plays an important role in the study of engineering courses

E. Mathematics and economics:

Use of mathematics is now considered to be so essential for the study of economics. Mathematical language and methods are used frequently in describing economics phenomena.

The businessman, who is the leader in the field of economics system, depends on statistical procedures to know about economic conditions and market trends knowing of mathematics is necessary for understanding activities involving investment of money.

Popular literature and articles on economics make increasing demands on one's mathematical understanding and information. To keep one's knowledge up to date, one must study such literature as the mathematics applied in it.

F. Mathematics and logic:

"Symbolic logic is mathematic; Mathematics is symbolic."- C.J. Keyser

D' Alembert says, "Geometry is a Practical logic, because in it, rules of reasoning are applied in the most simple and sensible manner".

Geometry is a true demonstration of logic. Mathematics is the only branch of knowledge, in which logical reasoning or logical terms are applied.

The aim of mathematician and logician are practically the same.

Conclusion:

Form our discussion we conclude that Mathematics has a great importance in our day to day life. In every discipline of knowledge we have to apply Mathematics. Without Mathematics we cannot think about the development of a nation. Mathematics has a significant role in the development of a society. Hence we can conclude that, "All laws of universe are governed by mathematical laws or formulas". We can conclude mathematics as, "Mathematics is the mirror of civilization". Lastly our discussion can be summarized by the following pyramid.

Hierarchy of Science:

Mathematics

Astronomy

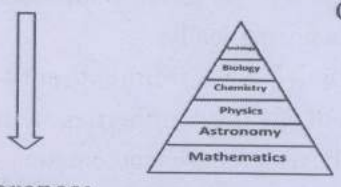
Physics

Chemistry

Biology

Sociology

Dependence



Complexity

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SEASONAL VARIATION OF RELATIVE INTENSITY (CRYSTALLINE INTENSITY) OF MUGA AND ERISILKFIBRES FOUND IN ASSAM (UNDEGUMMED) BY

Chandrama Kalita (Assistant professor dept. of physics, S.B.M.S. college, sualkuchi and research scholar of ADTU in dept. of physics, Dramaj. D. Sarma (Associate professor of ADTU, dept, of physics.)

Abstract:

There are two classes of silk mulberry and non-mulberry (Bombox mori) and no mulberry (Tasar,Eri and Muga).Anthers assamensis (A.Assama) is one of the wild verities of non-mulberrysilk worm,which produced Muga silk.Few other wild silks are Mopani silk from South Africa,saturniidae silk from Thailand and Assam silks.(Muga ,Eri and Pat) from India ,Tussah silk from china and Tasarsilk from India.

The aim of this paper is to study Relative Intensity of Muga and Eri silk in summer and winterseason in undegummed condition.

Introduction:

Muga wild silk is known for its natural shimmering colour prerogative of India and the pride of Assam state.

Different technique are used by many researcher to understand the crystal and molecular structure of domestic and wild silk fibre varieties.Eri silk comes from the caterpillar of SamiraCynthia ricin found in northeast India and some parts of china ,Japan and Thailand .The name Eri derived from theAssamese word ERA which means a" castor" as the silkworm feeds on castor plants .One of the common names the Ailanthus silk month,refers to the host plants.It is also known as Endi or errand in India.

R.I is the intensity at the highest point of the MSI peak for a peptide .Higher peak intensities mean that the mass spectrometer is registering higher reading for the peptides that is increased sensitivity.

Material and Method — The material for this study is cocoons of Muga and Eri is collected from central Research silk Board Boko.

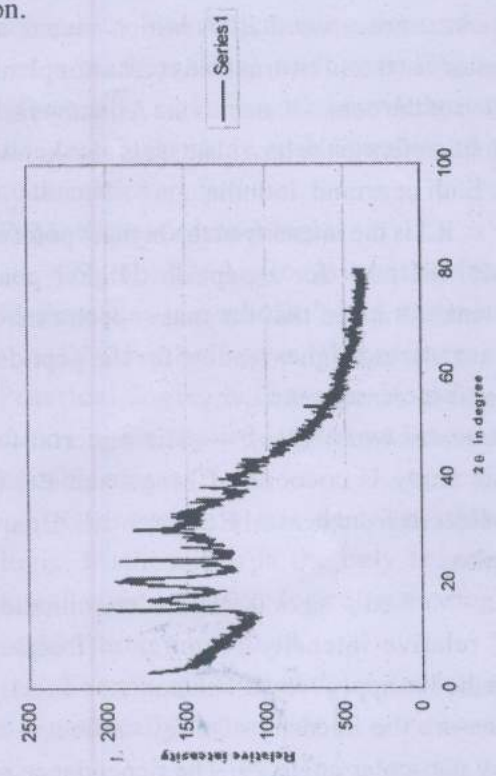
Method— For XRD or determination of relative intensity counter diffraction method is apply .The diffractometer directly measure the intensity of x ray diffracted at any particular angle 2θ .The dependence of

the diffracted rays on the angle 2θ is continuously recorded in the graphical from with the help of a strip –chart recorder.

The diffractogram gives relative intensities in terms of its height from the base line.Thus a measure of the crystalline intensity can be obtained from the Xrd.

summer		winter	
Muga	Eri	Muga	Eri
24.96	20.43	86	98

Result and discussion—Xrd of undegummed Muga and Eri silk in winter and summer season.



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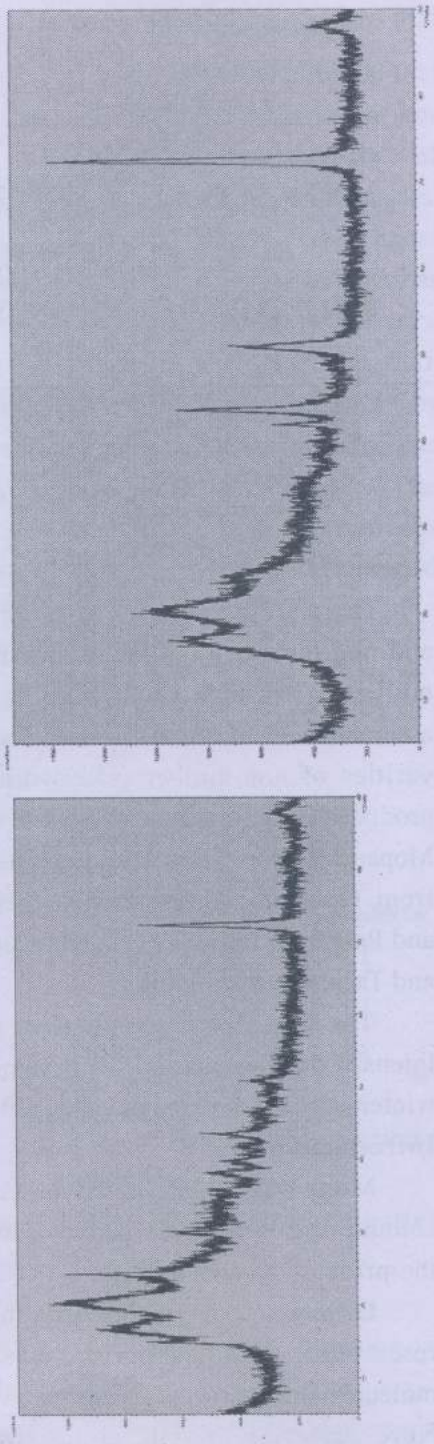

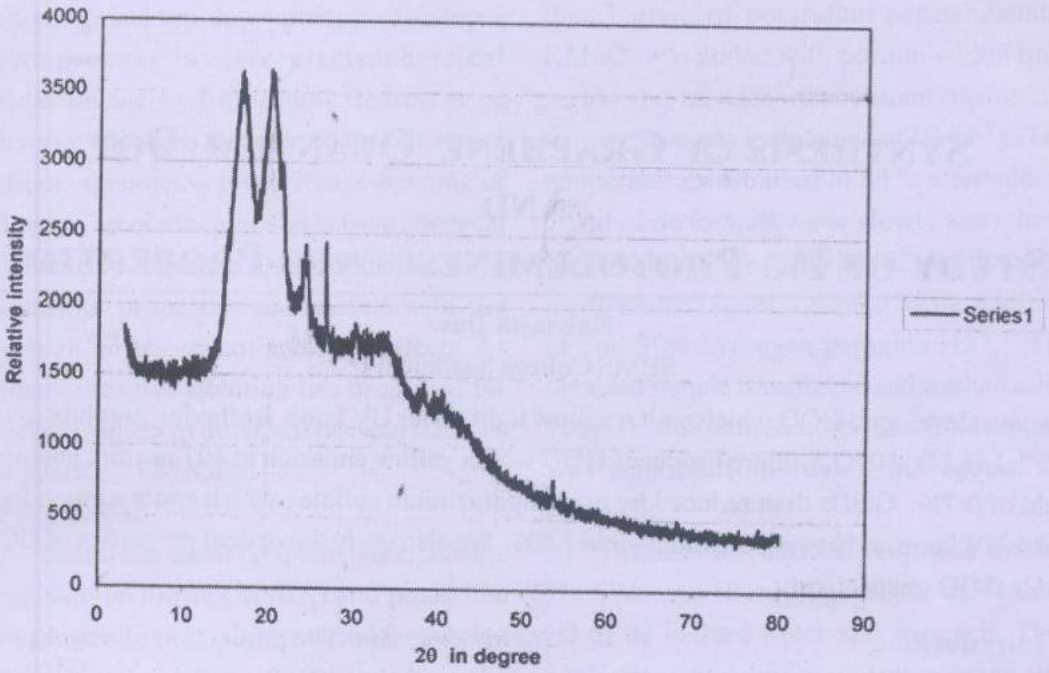

The R.I of Muga silk in winter season is 61.14% is more than the summer season and for Eri the R.I in winter season 77.57% is more than summer season.

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SYNTHESIS OF GRAPHENE QUANTUM DOT AND STUDY OF ITS PHOTOLUMINESCENCE PROPERTIES

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We have developed GQD which emit a yellow light under UV lamp. Refluxing graphite oxide in a 3:1 H_2SO_4-HNO_3mixture produces GQD with a yellow emission at 407 nm and quantum yield of 0.7%. GQDs than reduced by using hydrazinium sulfate , which emits a green light under UV lamp and having quantum yield 1.6%. We also study the optical properties of GQD and r GQD respectively

1. Introduction:

Carbon nanomaterials with the discovery of fullerenes in 1985 have opened a new dimension in the research field. Carbon nanotube (CNTs) by lijima in 1991, graphene by Novoselov and Geim in 2004 have emerged with the promises of wide applicability from optoelectronics to bioimaging. In the 21st century, nanotechnology has evaluated many process including biology, chemistry, physics and electronics. Graphene has unique physical properties and also have excellent application in nanotechnology due to which it has been attracted so much in research field. Graphene is lack of band gap as it is a zero-bandgap semiconductor .Due to zero bandgap , optical luminescence is not observed. However a bandgap can be engineered into graphene quantum dots (GQDs) because of quantum confinement. The production of new type of quantum dots (QDs) which have controllable properties providing best opportunities for fabrication and design of new devices with new properties and function. Graphite is one of the most readily obtainable sources of GQD's. On the other hand graphite is the mother source of many GQD precursors such as GO and rGO. Liu and Zhang have reported that GQD can be synthesized from graphite flake by the combustion of potassium-graphite intercalated compounds . Graphene quantum dots have one or few layered graphene sheets with lateral dimension less than 100 nm. Graphene quantum dots are different from carbon quantum dots. They have variety of application such as light emitting diodes, electroluminescence organic photovoltaic devices , and catalysis [16].GQD can be

synthesized by various methods, such as bottom-up and top-down process. The top – down process involve electrochemical oxidation, or hydrothermal treatment or microwave assisted reaction; on the other hand bottom –up process involve cage-opening of fullerene, aromatic compounds from chemical synthesis. Graphene quantum dots have incredible properties associated with the quantum imprisonment and edge effects. As a result dreadful attention has been paid for the development of different chemical methods for synthesis of GQDs.

2. Methods:

Materials used: Graphite flake, sulfuric acid, sodium nitrite ($NaNO_3$) and potassium permanganate ($KMnO_4$) was used for starting material preparation. For recording the fluorescence intensity, Hitachi F-2500 spectrophotometer using quartz cuvette. FT-IR spectra were recorded in SHIMADZU IR Affinity 1800, of range from 500 to 4000 cm^{-1} with KBr pellets. KBr pressure pellets was used for preparing the KBr pellets, applying a pressure of 3 ton .For recording UV absorption , (SHIMADZU, Japan) , UV 1800 spectrophotometer was used in the range of 200 to 800 nm.

Preaparation:

a) Synthesis of graphene oxide (GO) (starting material)

Graphene oxide was prepared by using modified Hummers method. In this method we used a mixture of 0.5 gram of graphite flake and 0.25 gram sodium nitrite, $NaN0_3$ finely grinded and 23 ml of H_2SO_4 was added. After that 3 gram of potassium permanganate, $KMnO_4$ was added with portion within time period a1-2 minutes with constant stirring and temperature was maintained at 10-15 ^{0}c. The temperature was raised to 90 ^{0}c after adding 50 ml of de ionized water slowly and stirred for 60 minute. We again added additional 50 ml de ionized water followed by the addition of 5ml 30% hydrogen peroxide H_2O_2 . The obtained sample was filtered and washed using 100 ml hot de ionized water. The solid product was separated and dried in vaccum for overnight.

b) Synthesis of reduced graphene oxide :

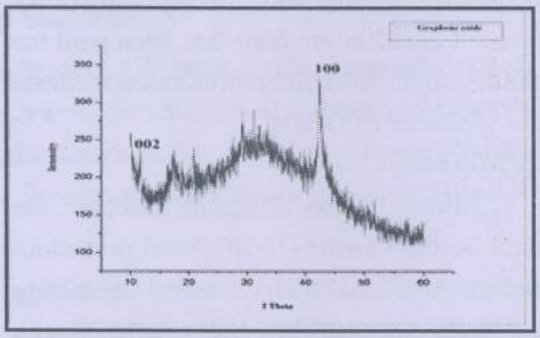
We take 50 mg of graphene oxide in 50 ml of de ionized water and stirred it. Then sonication was done for 5-10 minutes and after that we add 2.7 m mol of sodium thiosulfate (.6701 g). And stirred for three hour at 95^0 c. The resulting product is black suspension of mixture. The solid product was filtered and centrifuged for 1 hour, and finally collected.

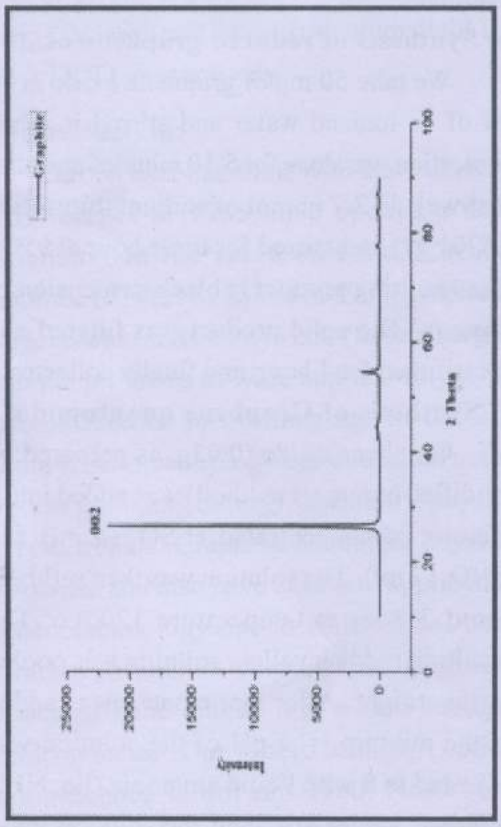
c) Synthesis of Graphene quantum dot :

Graphene oxide (0.03g, as prepared by modified hummers method) was added into a mixture of concentrated H_2SO_4 (6 ml) and HNO_3 (2 ml) .The solution was then refluxed about 3 hour at temperature 120 ^{0} c. The resulting reddish yellow solution was cooled for overnight .After that ethanol was added to the mixture. The pH of the solution was adjusted to 8 with liquid ammonia (liq. NH_3) solution. Under UV light the solution gives yellow fluorescence.

Characterisation:

The powder XRD pattern of were recorded from 10^0 to 80^0 2Ÿ on a Brucker D8 Advanced X-ray diffraction measurement system with CuKQ radiation (40 kV, ë=1.564 ú).Using Scherrer equation we can calculate the mean size particle.We found sharp peak for graphite in the XRD pattern at 2Ÿ= 26^0 and has crystal plane (002) , the same has disappear and a new peak appeared at 2Ÿ=11.74 ^{0} forXRD pattern of graphene oxide. This explains complete oxidation of graphite to graphene oxide (GO). Again the peak at 2Ÿ=11.74 disappeared which means the successful reduction. We also observed a crystal plane at (100) with diffraction angle2Ÿ= 42^0 which may be due to unreacted potassium permanganate according to library data .The change in XRD from graphite to broad GQD peak shows the change in interlayer spacing too. All the XRD data matched with the references .





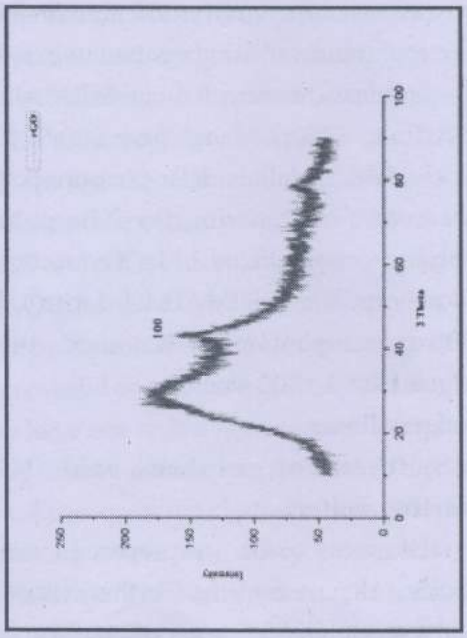
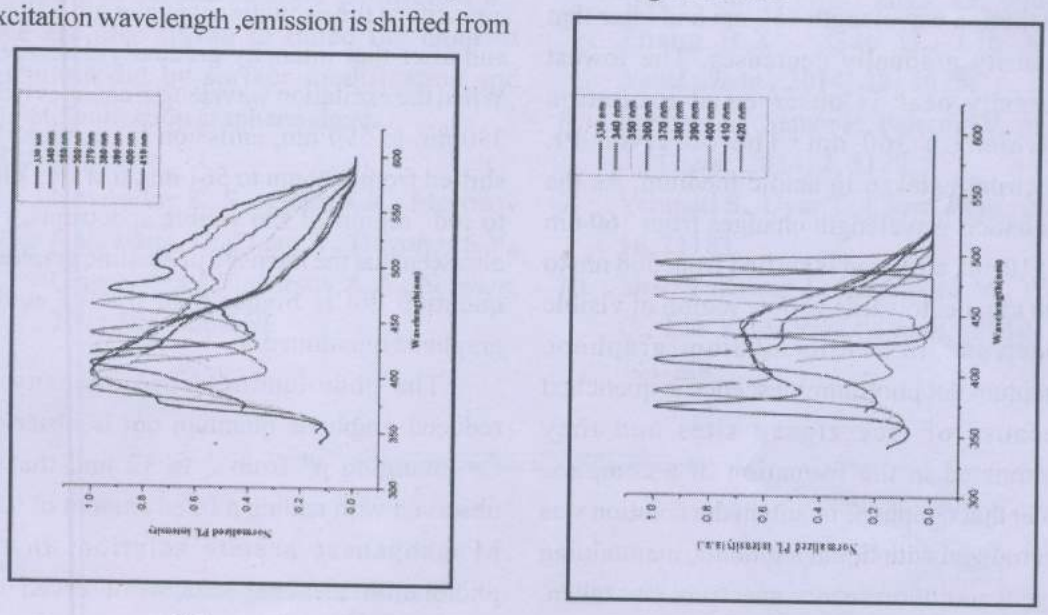


FIG: PXRD pattern of graphite flake, graphene oxide and reduced graphene oxide

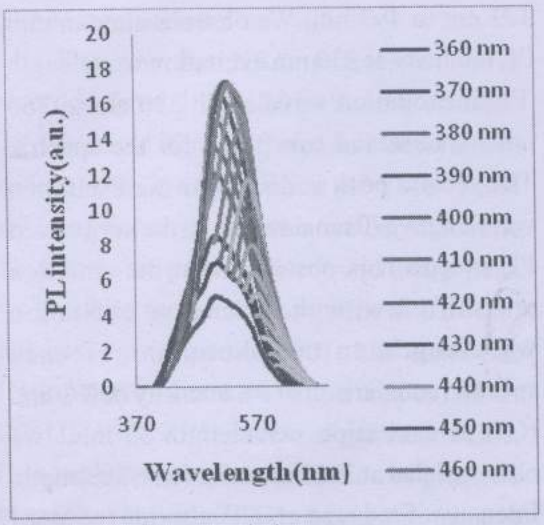
Results And Discussion:

GO can show fluorescence property due to recombination of electron hole pairs that are localized in electronic states. In this photoluminescence spectra, we observed maximum PL intensity peak centered at 330 nm .It is seen that as the excitation wavelength is increased from 330 to 410 nm , intensity gradually decreases. As the excitation wavelength changes from 330nm to 410 nm, the emission is shifted from 404 nm to 478 nm .In the normalized spectra the emission shift are clearly seen. In the photoluminescence spectra of rGO we observed that as the excitation wavelength increases from 330 nm to 420 nm , intensity gradually decreases and less than that of observed for PL intensity of graphene oxide(GO).With the change in excitation wavelength ,emission is shifted from 373 nm to 493 nm. We observe a maximum PL intensity at 330 nm excitation wavelength .From excitation wavelength 330 nm to 360 nm we observed two peaks for the spectra. The second peak is disappear the excitation wavelength 370 nm onwards.In the normalized PL spectra it is observed that the emission are shifted with the changing excitation wavelength. In the photoluminescence spectra,(comparison of PL intensity of GO and rGO at excitation wavelength 330nm) we observed that at 330 nm excitation wavelength, intensity of reduced graphene oxide (reduced with sodium thiosulfate) is lower than graphene oxide. The emission wavelength for graphene oxide and reduced graphene oxide are 403nm and 438nm respectively at excitation wavelength 330 nm.

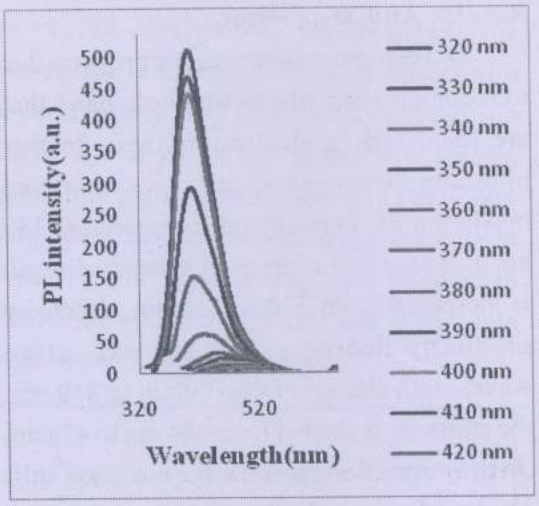


(A) (B)

FIG: NORMALISED PL SPECTRA OF (a) GO (b) r GO



(a)



(b)

FIG: PL SPECTRA OF GRAPHENE QUANTUM DOT IN (a)ACIDIC MEDIUM (b) ALKALINE MEDIUM.

In the photoluminescence spectra, we observed a maximum intensity peak at exicitation wavelength 450 nm and after that intensity gradually decreases. The lowest intensity peak is observed at excitation wavelength 360 nm. The observed PL spectrum is taken in acidic medium. As the excitation wavelength changes from 360 nm to 510 nm, emission is shifted from 508 nm to 600 nm, i.e. towards yellow region of visible spectrum. In acidic medium graphene quantum dot photoluminescence is quenched because of free zigzag sites and they protonated in the formation of a complex. After that Graphene quantum dot solution was neutralized with liquid ammonia, maintaining at p^H 8 and fluorescence spectrum was taken. In the photoluminescence spectrum, it is observed that with increasing excitation wavelength, there is a decrease in PL intensity. We observed a maximum PL intensity at the excitation wavelength 330 nm and after that intensity gradually decreases. When the excitation wavelength changes from 330 nm to 590 nm, emission is seems to be shifted from 409 nm to 561 nm, towards blue to red region of the visible spectrum .It is also seen that the intensity of alkaline graphene quantum dot is higher than that of acidic graphene quantum dot.

The photoluminescence intensity of reduced graphene quantum dot is observed for changing p^H from 2 to 12 and that of observed with adding a fixed amount of 0.01 M manganese acetate solution. In the photoluminescence spectra, we observed that at different p^H the PL intensity are different. When 0.01 M solution of manganese acetate

was added, the PL intensity are enhanced for respective spectra. The PL intensity is observed maximum enhanced at p^H 8, after that p^H 6, and p^H 12 also. It was reported that Mn^{2+} ions are bonded to carboxyl groups, as a result of which ions are placed close to sp^2 cluster. Due to this fact PL intensity is enhance

Conclusion:

We have prepared graphene oxide from graphite flake. We are also able to synthesize yellow luminescence graphene quantum dot by oxidation of graphene oxide.The PL spectra of graphene quantum dot studied in both conditions acidic and alkaline .We also studied the change in PL intensity at different p^H. We are also able to enhance fluorescence intensity of as prepared GQD binding with manganese acetate solution at different p^H. We are also trying to tuned the band of quantum dot by surface modification and functionalization graphene sheets.

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A Comparative Study On The Biological Characteristics Of Eri Silkworm From Two Different Species (Samia Canningi And Samia Ricini)

Dr. Kakali Talukdar and Priyanka Kalita

SBMS College, Sualkuchi

Abstract:

Samia ricini and *Samia canningi* is non-mulberry silkworm with multivolitine and bivoltine nature reared in different environmental condition. Eri culture for exploitation as a Cottage Industry" analyzed the position of eri silk industry in Indian economy as a cottage industry. The present study was to design the effect on the two speiec of eri silkworm *S. canningi* and *S. ricini* of the environmental factor during the rearing period. The results revealed that the temperature fluctuation was found to be a major factor in the rearing performance of eri silkworm. The rearing of silkworm was done by standard protocol of Grekov et al. (2005), fed on castor leaves at outdoor condition throughout the experimental period and morphological characters of two different silkworms species were observed under microscope and also the length, breadth of silkworm larvae were done by using scale and weight of the cocoon was measured by using digital balance in the laboratory. An Experimental finding reveals that rearing performance of *S. ricini* has shown better rearing performances than wild type variety *S. canningi.* The size of the larvae was found to be almost similar in both the silkworm with slight variation that *S. ricini* showed slightly bigger in size compared to *S. canningi*. Also, Cocoons are brick red or white in color, exceptionally no peduncle was present in *S. ricini* whereas in *S. canningi* have found peduncle. The color of the pupa was copper brown in both the species with slight variation in the size. The study revealed that the hybrid variety *S. ricini* is better for commercial use compared to wild variety *S. canningi.*

Keywords: Samia canningi, Samia ricini, Cocoon color, Pupal color....

Introduction:

Silk and sericulture has been a part of life and culture of India. The history of ericulture in India, particularly in North-East India is as old as Indian culture and today it is supposed to be the original home of eri silk from time immemorial (Devi, 1999). Dookia (1984) in his study entitled "Studies on Ericulture for Exploitation as a Cottage Industry" analyzed the position of eri silk industry in Indian economy as a cottage industry and discussed its role in the generation of employment and income in the rural economy. He concluded that agro-based "endi textile industry" could be used as aremedy to remove unemployment from the rural economy, as it is highly labor intensive. A total of 47 species of silkworm are recorded from India, out of which 24 reported from north east region and only 4 species of sericigenous insects are cultured which are muga, eri, tasar and mulberry. There are total 19 species of eri all over the world of which only three species are reported from India and out of which two from NE region they are *Samia canningi* which is a wild species and *Samia ricini*, a totally domesticated species. The Eri silkworm undergoes complete metamorphosis like other Lepidopterans and has four stages egg, larva, pupa and adult. It completes 5-6 life cycles in a year. The environmental factors play a major role in eri silk production. Since eri worms are quite delicate and sensitive to environmental conditions the prospect of obtaining silk production depends more on the food or host plant nutrition (Annonymous). In silkworms, the protein synthetic activity of the body wall and the midgut decreased when the larvae began to moult and increased again from the mid stage to moulting period (Nagota, 1976). Like all other animals, growth and development in insects is associated with protein metabolism (Man Singh and Baquaya, 1971). Eri silkworm, *Samia ricini* is a domesticated multivoltine sericigenous insect largely reared by the farmers of North Eastern states of India, particularly Assam because of its easy rearing and availability of food plants. *S. ricini* are susceptible to a disease flacherie. The productivity and quality of cocoon, however, depends upon quality food supply, favorable environmental conditions and utmost hygienic condition. Scientists around the world are looking for silkworms which can withstand all the environmental conditions, resistant to diseases and easily cultivable and high productivity as well. *Samia canningi* is a wild variety of Eri silkworm with bivoltine nature that is susceptible to a bacterial disease called gracherie. In this connection, the possibility of enhancing the silkworm and cocoon production was

experimentally attempted through crossing different variety of silkworms with selected traits. The present work was therefore designed to study the variation in morphology of *S. ricini* and *S. canningi* and also to study variation in productivity.

Methods And Materials:

Collection of sample and selection of food plants:

Healthy, disease free *Samia ricini* and *Samia canningi* were collected at the cocoon stage from the local rearer of Kamrup(R). Identification of the sample moth was done by the experts of Central Silk Board, Guwahati. Castor (Ricinus communis, Family: Euphorbiaceae) was taken as the food plants for the experiment.

Preparation and isolation of pure line:

Parental seed cocoons of both the *S. ricini* and *S. canningi* were collected and laying of the races were done by adopting the method described by Tazima (1962) and Rao and Mariswamy (1977) in Suwalkuchi Sericulture Farm at indoor medium. Rearing of silkworm was done following standard protocol of Grekov et al. (2005) with little modification. Eggs were disinfected with 2% formalin and washed with tap water and fed on castor leaves at outdoor condition throughout the experimental period (20016-2017). The morphological characters of two different silkworms were observed under microscope and also the length, breadth of silkworm larvae were done by using scale and weight of the cocoon was measured by using digital balance range- in the laboratory.

Study Area:

Sualkuchi is a multi-caste town under Guwahati sub-division of Kamrup district of Assam. The boundary of Sualkuchi is as follows:-

EAST: Bongshar Village

WEST: Village area & wetlands

NORTH: Hills and croplands

SOUTH: Brahmaputra River

Climate:- "Sualkuchi" has a mild subtropical climate. The chief characteristic of the climate of Sualkuchi are:-

* A cold & foggy winter from November to February.
* A warm spring.
* A fairly hot & very humid summer.
* A moderate rainfall.

The climate of Sualkuchi doesn't differ much from that of the rest of Assam valley. The temperature is neither very hot nor very cold. August is the hottest month of the year and maximum air temperature is 36°C. Sualkuchi experiences heavy monsoon rainfall during the month of May, June, July.

Result:

After the experimental work has done, the result are describe here under-

Different meterological parameters required for different stages of silkworm which were given in the following table –

Stage of silk worm	Temperature(°C)	Humidity (%)
Egg	26-27	80-85
1st instar	26-28	85-90
2nd instar	26-28	85-90
3rd instar	25-26	80-85
4th instar	24-25	70-75
5th instar	23-24	70-75
Pupa	23-24	70-72
Adult	23-25	70-72

Table: 1. Meteorological parameters of the study area during rearing periods.

LIFE HISTORY OF ERI SILK WORM:

Its life cycle consists of 4 stages as follows. Eri silk worm shows the following systematic position-

Adult moths are large with wings spanning about 10 cm. The wings are greyish brown in color with prominent eye spot. When the adult moth emerges from a cocoon it makes a hole to get out. Like other silk moths were also start mating activities following their emergence from pupal stage.

Following mating, the female starts egg laying that may continue up to 3 days. Each female can lay about 350-500 egg. Hatching depends on prevailing environmental conditions and may occur from 8-20 days. The egg colors of the silkworm viz., S. ricini and S. canningi were white in color. The ones that are dark are about to hatched and can see little black spots, which are the heads of the emerging silkworm.

The hair like newly hatched larvae were yellow in color. Initially they feed on soft castor leaves but at later stages, worms can feed on mature leaves. After moulting for 4 times by 30-32 days they spin the cocoon among the leaves. Caterpillars in their final stages start spinning the cocoons. The spinning is completed in 2-3 days. The cocoons are open mouthed, tapering at one end and flat rounded at the open end. Eri cocoons are stalk less, flossy, white or brick red in color, 5cm long in case of female and 4.6cm long in male. The larvae of s. ricini are body waxy powder on body was mild. The size of the larva was found to be almost similar in both

the silkworm. However, the larvae of S. ricini showed slightly bigger in size compared to S. canningi.

Pupal stages last for 15-37 days during when larvae change to pupa. Fifth instar larvae undergoes cocoon formation within which the cocoon pupa resides. Cocoon formations need 3 days in summer and 5 days in winter. Cocoons are brick red or white in color. The cocoon color of S. ricini, were found to be brick red and no peduncle was present in it whereas in S. canningi were found to be dull brown in color and 52-78mm sized peduncle was present.

The color of the pupa was copper brown in both the breed. However, slight variation in

the size (L × B) of the pupa was observed among the two groups.

The antenna was prominent and serrate located at anterior portion of the head. The moth silkworm of antennae (Male) are broad and size are (L × B) 13 x 5 mm and female moth antennae are slander and elongated and size are (L × B) 13 × 4 mm in S. ricini and in S. canningi has 11x4mm and 11x5mm respectively.

COLOUR FOOD AND OTHER MORPHOLOGICAL CHARACTERS OF ERI SILKWORM-

During the study, small variation in morphological characters such as color, size and weight in different stages of life cycle from egg to adult with specific adaptation and voltinism were observed.

Stage	Character	*Samia ricini*	*Samia canningi*
Eggs	Voltinism	Multivoltine	Bivoltine
	Color	White	White
Larva	Body Color	Yellow Pain	Greenish blue pain
	White waxy powder on body	Mild	High
Cocoon	Color	Brick red	Dull brown
	Peduncle	Absent	Present (52-78mm)
Pupa	Color	Copper Brown	Copper brown
	Abdominal Tergum	Suffused with white scales	brown color with broad white belt on 1st abdominal segment. Slender and elongated
Moth	Antennae (Male) broad size (L × B)	Broad 13 x5 mm	Slender and elongated 11x4mm
	Antennae (Female Size (L × B)	Slender and elongated 13 x4mm	Broad 11x5mm

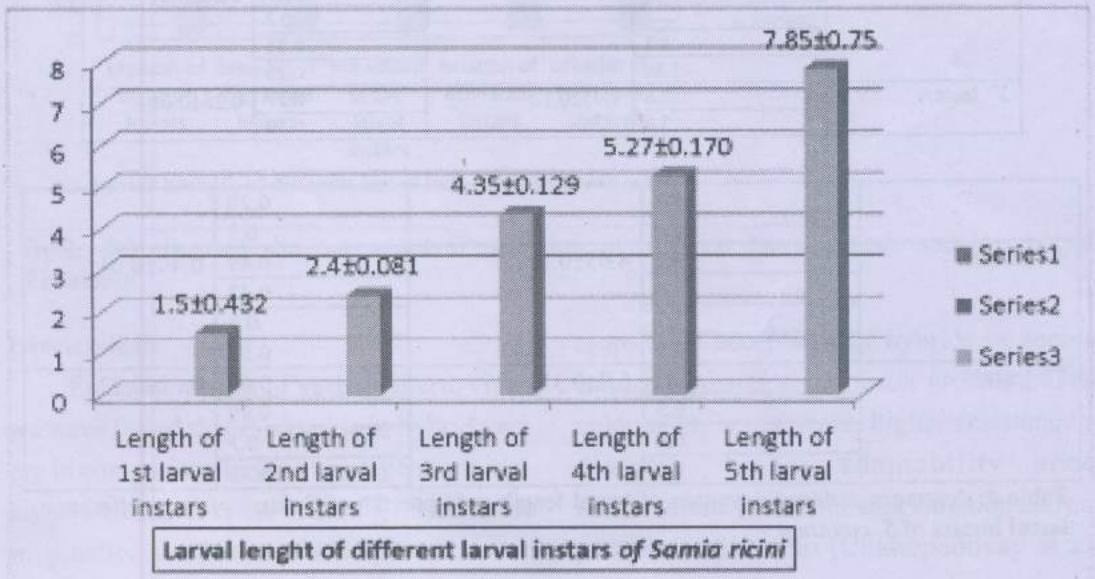
Table.2: Comparative morphological characteristics of *S. ricini* and *S. canningi*

MORPHOLOGITCAL CHARACTERS AND LENGTH AND BREADTH OF LARVA

Length and breadth also varies in each instar larval stage. Different length and breadth value of larvae that I got from experiment are given below-

Larval instars	Length (cm)	average±Standard deviation	Breadth (cm)	Standard Deviation
1st Instar	1.1	1.5±0.432	0.15	0.18±0.021
	1.3		0.18	
	1.5		0.20	
	2.1		0.19	
2nd Instars	2.4	2.4±0.081	0.28	0.30±0.021
	2.3		0.29	
	2.5		0.30	
	2.4		0.33	
3rd Instars	4.3	4.35±0.129	0.32	0.33±0.05
	4.4		0.40	
	4.2		0.28	
	4.5		0.34	
4th Instars	5.2	5.27±0.170	0.60	0.58±0.035
	5.5		0.58	
	5.1		0.53	
	5.3		0.61	
5th Instars	7.0	7.85±0.750	0.70	0.74±0.042
	7.5		0.73	
	8.7		0.80	
	8.2		0.76	

Table 3: Average±standard deviation of larval length anfd breadth of S.ricini of four different larval instars of *S. ricini*



Larval lenght of different larval instars *of Samia ricini*

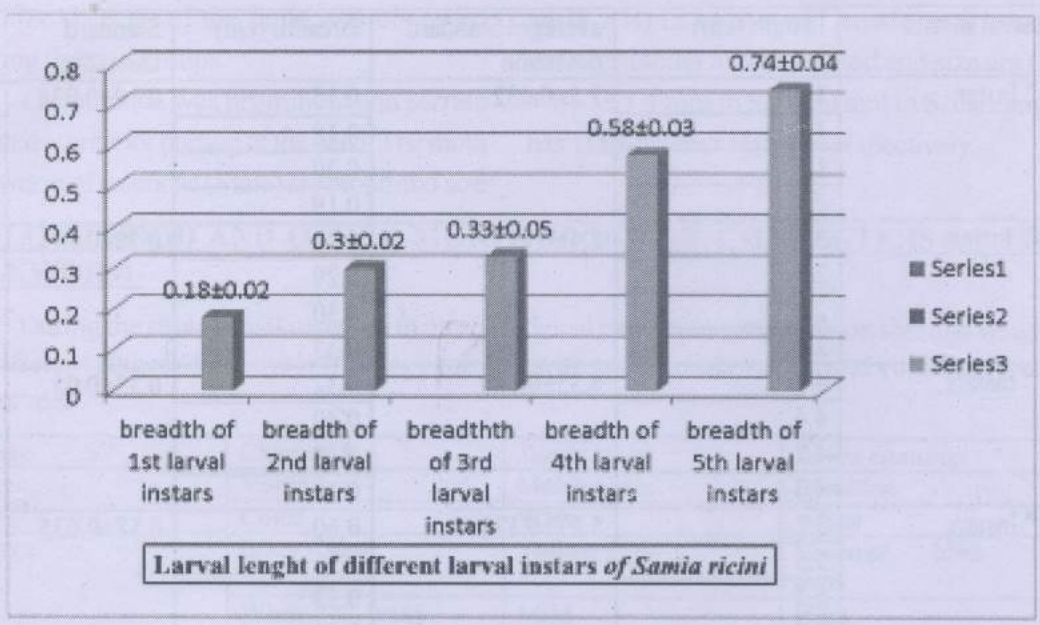
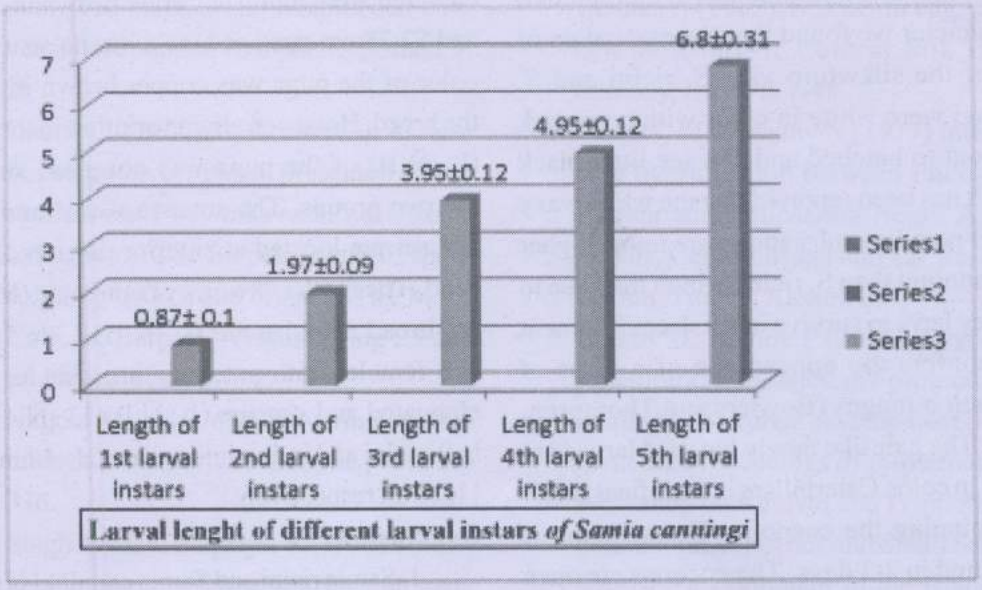


Fig 1: Bar diagram showing standard deviation of different larval length and breadth of *S.ricini*

Larval instars	Length (cm)	average±Standard deviation	Breadth (cm)	Standard Deviation
1st Instar	0.9	0.87±0.10	0.09	0.09±0.01
	0.8		0.1	
	0.78		0.08	
	1		0.11	
2nd Instars	1.9	1.97±0.09	0.19	0.20±0.01
	2		0.2	
	2.1		0.21	
	1.89		0.23	
3rd Instars	3.8	3.95±0.12	0.27	0.28±0.01
	3.9		0.29	
	4.1		0.28	
	4		0.3	
4th Instars	4.8	4.95±0.12	0.49	0.49±0.01
	5		0.47	
	5.1		0.5	
	4.9		0.51	
5th Instars	6.9	6.8±0.31	0.66	0.69±0.02
	6.5		0.69	
	6.6		0.7	
	7.2		0.71	

Table 4: Average±standard deviation of larval length anfd breadth of S.ricini of four different larval instars of *S. canningi*.



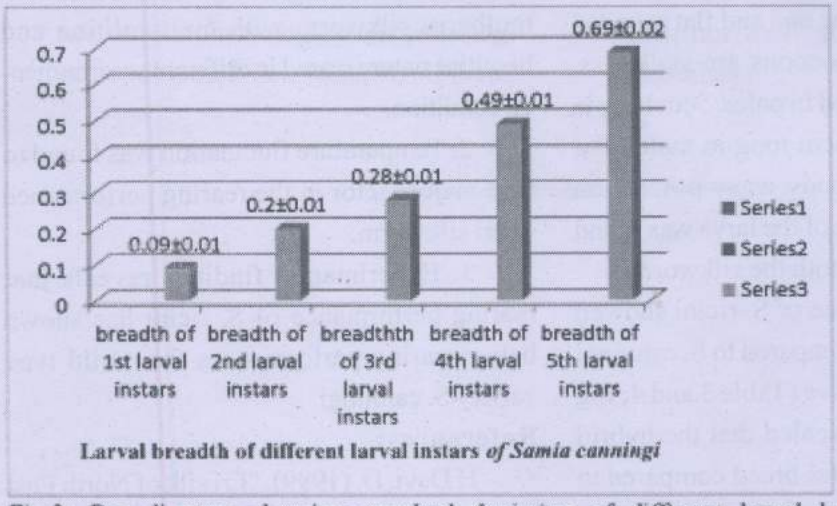


Fig.2: Bar diagram showing standard deviation of different larval length and breadth of *S.canningi*

Discussion:

From the search of various literic views we have found that S. ricini is in hybrid variety in comparison to wild variety S. canningi. Hybridization or cross breeding methods are in practice worldwide for improvement of crops. It is accepted that hybrids in general can have greater vigor, faster growth and development, better yield, higher resistance to diseases, higher adaptability under unfavourable environmental situation and can provide stable crop (Chattopadhyay et al.,

2001). From the result findings of morphological character we found that the egg colors of both of the silkworm viz., S. ricini and S. canningi were white in color with ones dark are about to hatched and can see little black spots. It has been reported that the white waxy powder powdery substance were found higher in S. canningi than S. ricini, which may due to that they have to survive in harsh environment as it confers the appearance of a mass of sporulation fungus (Bowlers and Thompson, 1965). The hair like newly hatched larvae are yellow in color. Caterpillars in their final stages start spinning the cocoons. The spinning is completed in 2-3 days. The cocoons are open mouthed, tapering at one end and flat rounded at the open end. Eri cocoons are stalk less, flossy, white or brick red in color. 5cm long in case of female and 4.6cm long in male. The larvae of s. ricini are body waxy powder on body was mild. The size of the larva was found to be almost similar in both the silkworm.

However, the larvae of S. ricini showed slightly bigger in size compared to S. canningi which have showed above (Table 3 and 4; Fig 1 and 2). The study revealed that the hybrid variety S. ricini is a better breed compared to S. canningi. According to Bandopadhyay, 1990, the ultimate objective of silkworm breeding is not only to synthesize new genotypes but also to identify sustainable silkworm hybrids for commercial exploitation. Cocoons are brick red or white in color. The cocoon color of S. ricini, were found to be brick red and no peduncle was present in it whereas in S. canningi were found to be dull brown in color and 52-78mm sized peduncle was present. The color of the pupa was copper brown in both the breed. However, slight variation in the size (L ¡Ñ B) of the pupa was observed among the two groups. The antenna was prominent and serrate located at anterior portion of the head. The moth silkworm of antennae (Male) are broad and size are (L ¡Ñ B) 13 x 5 mm and female moth antennae are slander and elongated and size are (L ¡Ñ B) 13 ¡Ñ 4 mm in S. ricini and in S. canningi has 11x4mm and 11x5mm respectively.

Conclusion:

1. Samia ricini and Samia canningi is non-mulberry silkworm with multivolitine and bivoltine nature reared in different environmental condition.

2. Temperature fluctuation was found to be a major factor in the rearing performance of eri silkworm.

3. Experimantal findings reveals that rearing performance of S. ricini has shown better rearing performances than wild type variety S. canningi.

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PRESENT ALGAL STATUS OF WATER LODGING AREAS OF SUALKUCHI VILLAGE, KAMRUP DISTRICT, ASSAM

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Abstract:

The study was carried out in water lodging areas of Sualkuchi village, Kamrup district, Assam to assess the present status of algae during the year March, 2017 - February, 2018. A total of 60 species and 38 genera belonging to three major algal groups namely Cyanophyceae, Chlorophyceae and Bacillariophyceae were recorded. Out of them Cyanophyceae formed the most abundant group with 30 species and 17 genera which was followed by Chlorophyceae with 20 species and 13 genera and Bacillariophyceae with 10 species and 8 genera. During the course of study Anabaena and Oscillatoria were observed as most abundant genera.

Key Words: Algal status, water lodging areas

Introduction:

Algae are relatively simple and are a heterogeneous assemblage of organisms ranging from motile unicellular to complicated heterotrichous thallus constitution with both prokaryotic and eukaryotic cellular organization differing from other thallophytes with the capability of photosynthesis Choudhury, 2004). Although algae are predominantly true hydrophytes, aerial and sub-aerial forms are also available (Dethier, 1994). In aquatic environment, algae act as primary producer of organic matter because of their photosynthetic activity (Bold & Wynne, 1978). Algal response to environmental change and nutrient fluctuation has been suggested in several studies (Frempong, 1981; Tilman etal., 1982). It is an established fact that blue-green algae are natural nitrogen fixers in the soil (Sing, 1961; Venkataraman, 1978). Subsequently, different workers have reported wide spread distribution of

different Nitrogen fixing cyanobacteria from different habitat (Watanabe, 1984; Roger and Watanabe, 1986). There are more than 100 species of blue-green algae have the ability to fix Nitrogen symbiotically or non-symbiotically (Santra, 1993). In aquatic environment algae also play a key role as primary producer and also support secondary productivity. Thus it is essential to study algal community of water bodies to conserve and manage an aquatic ecosystem (Kalita et. al, 2016).

Some notable works on this field has been recently done by Kumar and Sahu, 2012; Bharti and Niyog, 2015; Belkhode and Sitre, 2016; Kensa, 2017 etc. Some related works from NE region are confined to Dey, 1981; Goswami, 1985, 2001; Sharma, 2004, 2009, 2010; Kalita, 2017 etc.

Though there are enormous scopes for diverse work in the aquatic resonance of this locality, yet no systemic attempt has been made in regard to algal diversity. Therefore it has been aimed to investigate the algal diversity and seasonal variation of this area during March 2017 - February 2018.

Materials And Methods:

Study Area: - The present study is carried out at water lodging areas of Sualkuchi village, Kamrup District, Assam. Sualkuchi is situated at the north bank of the river Brahmaputra, about 35 km from Guwahati of Kamrup District, Assam and is located at 6.17°N latitude, 91.57°E longitude and 33 m altitude. It covers a total area of about 9.37 square Kilometers.

Methodology:- For this investigation random sample collections were done in selected sites of the area from March, 2017 to February, 2018 regularly at an interval of 15 days. The algal samples were collected from water lodging areas and moist soil surfaces. The samples were collected in sterilized plastic bottles, sealed tightly and transported to the laboratory. For algal analysis, the collected samples were preserved in acidified formaldehyde solution (20% formaldehyde solution + glacial acetic acid in 1:1 ratio). The microscopic analysis were done following Sourins (1978), Hosmani and Bharathi (1980). Identifications were done by using standard key and literature (Desikachary 1959, Prescott 1961, Bellinger and Sigee 2010).

Results And Discussion:

The algal species that were observed during the study period are listed in table (Table 1). Altogether 60 species belonging to 3 major classes of algae namely Cyanophyceae, Chlorophyceae and Baccillariohyceae were recorded. The class Cyanophyceae appeared as larger group with 30 numbers species under 17 genera, 5 families and 2 orders followed by Chlorophyceae with 20 species, 13 genera, 10 families and 6 orders followed by Baccilariophyceae with 10 species belongs to 8 genera under 6 families and 2 orders

(Fig. I). Table I:- Seasonal variations of algal species during investigation (Key: += present;- = absent WIN = Winter; PRM = Pre-monsoon; MON = Monsoon; POM = Post-monsoon)

ARRANGEMENT OF ALGAL TAXA	WIN	PRM	MON	POM
CLASS 1: - CYANOPHYCEAE				
Order 1 - Chroococcales				
Family 1 – Chrooccaceae				
1. *Chrrococcus pallidus* Nageli.	-	-	+	-
2. *Gleocapsa atrata* Kutz.	-	+	+	+
3. *G. polydermatica* Kutz.	-	-	+	+
4. *G. rupestris* Kutz.	+	+	+	+
5. *Aphanocapsa banarensis* Bharadwaja	-	+	+	-
6. *Mycrocystis aeruginosa* (Kutz.) Kutz.	+	+	+	+
7. *Gomphosphaeria* sp.	-	-	+	-
Order 2 – Nostocales				
Family 2- Nostocaceae				
8. *Anabaena azollae* Strasb	-	+	+	+
9. *A. doliolum* Bharadwaja	-	+	+	+
10. *A. orientalis* DC Dixit	+	+	+	-
11. *A. oryzae* EF Fritsch	+	-	-	+
12. *Nostoc muscorum* C. Agardh ex Bornet	+	+	+	+
13. *N. commune* Vaucher	-	-	+	+
14. *Aulosira fertilissima* SL Ghose	+	-	-	-
15. *Cylinrospermum tropicum* West & West, Trans.	-	-	-	+
Family 3 – Oscillatoriaceae				
16. *Oscillatoria sancta* Kutz.	-	-	+	-
17. *O. tenuis* C. Agardh	+	-	+	+
18. *O. terebriformis* C. Agardh	-	-	+	+
19. *O. rubscens* DC ex Gomont	+	-	-	-
20. *Phormidium subfuscum* Kutz.	-	+	+	-
21. *Lyngbya contorta* Lemmern.	+	+	+	-
22. *L. majuscule* Harv. Ex Gomont.	-	+	+	-
23. *Arthospira gomontiana* Setch	+	-	-	+
24. *Spirulina major* Kutz.	+	-	-	-
25. *S. gigantea* Schmidle	+	-	-	-
Family 4 – Rivulariaceae				
26. *Rivularia globiceps* GS West	-	-	-	+
27. *Calothrix brevissima* GS West	+	-	-	+
28. *C. fusca* Bornet & Flahault	+	-	-	+
Family 5 – Scytonemataceae				
29. *Scytonema simplex* Bharadwaja	-	-	+	+
30. *S. mirabile* Bharadwaja	-	+	+	-

CLASS: - 2 - CHLOROPHYCEAE **Order 1 – Volvocales** **Family 1- Volvocaceae**				
1. *Volvox aureus* Ehrenb.	+	+	+	+
Family 2 – Chlamydomonadaceae				
2. *Chlamydomonas gloeogama* J. Snow	+	-	-	-
Order 2 – Chlorococcales **Family 3 – Chlorococcaceae**				
3. *Chlorococcum diplobionticum* Fries.	+	-	-	+
4. *C. humicola* (Nageli) Rabenh.	+	+	-	-
Family 4 - Chlorellaceae				
5. *Chlorella vulgaris* Beij.	+	-	-	+
Family 5 - Coelastraceae				
6. *Scenedesmus dimorphus* (Turp.) Kutz.	+	+	-	-
7. *S. acuminatus* (Lagerh.) Chodat.	+	+	+	+
Order 3 – Ulotrichales **Family 6 – Ulotrichaceae**				
8. *Ulothrix moniliformis* Kuetz	+	-	+	+
9. *U. tenerrima* (Kuetz.) Kuetz	-	+	+	-
Order 4 – Cladophorales				
10. *Oedogonium gracilius* (Wittr.) Tiff	+	+	-	-
11. *O. globosum* Nordst.	-	-	+	+
Order 5 – Conjugales **Family 7 – Zygnemaceae**				
12. *Spirogyra elliptica* Jao	+	+	+	-
13. *S. exilis* W and G. S. West	+	+	-	-
Family 8 – Mougeotiaceae				
14. *Mougeotia Scalaris* Hassal	-	-	-	+
Family 9 – Desmidiaceae				
15. *Closterium diance* Ehrenb.	-	+	-	-
16. *C. lanceolatum* Kutzing	+	+	+	-
17. *Cosmerium granatum* Breb.	+	+	+	+
18. *C. mansangense* West & West	-	+	+	-
19. *Desmidium swartzii* Agardh.	-	+	+	-
20. *D. aptogonnum* Berb.	-	+	+	-
Order 6 – Charales **Family 10 – Characea**				
21. *Chara braunii* CC Gmel.	-	-	+	+

CLASS: - 3 – BACILLARIOPHYCEAE				
Order 1 – Pennales				
Family 1 – Fragilariaceae				
1. *Fragilaria brevistrata* Grun	-	-	+	+
2. *F. capucina* Dems.	-	-	+	+
Family 2 - Achnanthaceae				
3. *Achnanthes lanceolata* (Berb.) Grun.	-	-	+	+
Family 3 – Naviculaceae				
4. *Navicula radiosa* Kuetz	+	+	+	+
5. *N. rhynchocephala* Kuetz	+	+	+	+
6. *Pinularia viridis* (Nitz.) Ehr.	-	+	+	-
7. *Gomphonema parvulum* (Kuetz.) Grun	-	+	+	+
Family 4 – Nitzchiaceae				
8. *Nitzchia palea* (Kuetz) W. Smith	+	+	-	-
Order 2- Central				
Family 5 – Coscinodiscaceae				
9. *Cyclotella bodanica* Eul.	-	-	+	-
Family 6 -Malosiraceae				
10. *Melosira varians* Ag.	-	-	+	+

During the course of this investigation the variations of algal abundance in different seasons were noticed distinctly (Table I). The variations in algal availability that observed in different seasons of the year in the study sites were in following order:

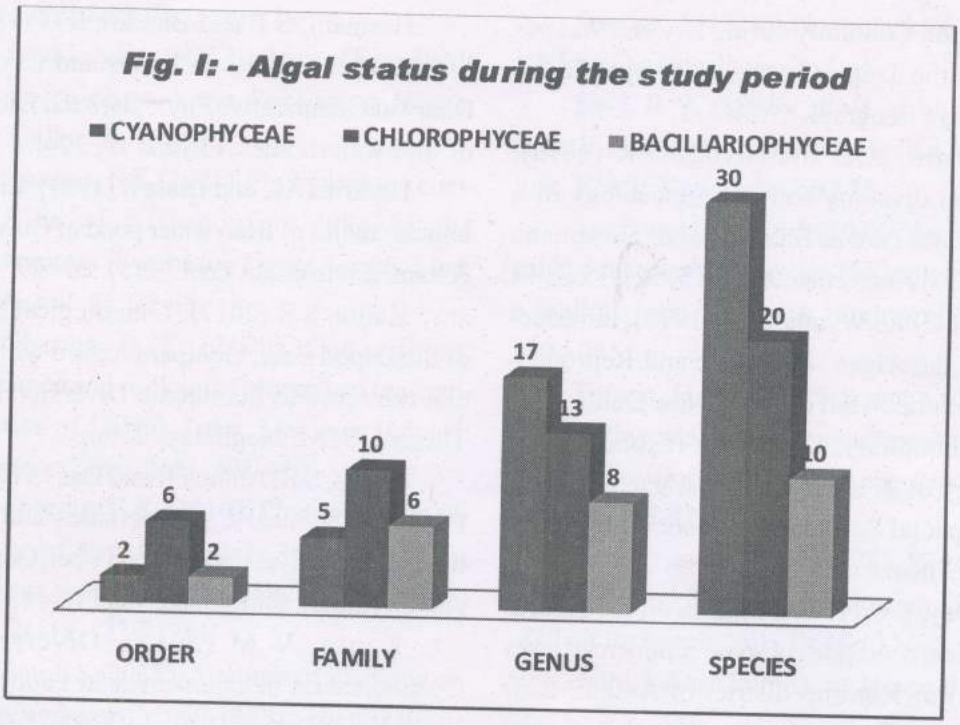
Cyanophyceae - Monsoon > Post-monsoon > Winter> Pre-monsoon

Chlorophyceae - Pre-monsoon > Winter > Monsoon > Post-monsoon

Bacillariophyceae – Monsoon > Post-monsoon > Pre-monsoon > Winter.

The most abundant group among the algal community has been recorded as the Cyanophyceae (30 species) followed by the group Chlorophyceae (20 species). The dominant species of Cyanophyceae has been recorded as *Gleocapsa atrata, G. rupestris, Mycrocystis aeruginosa, Anabaena azollae, A. doliolum, Nostoc muscorum, Oscillatoria tenuis, Lyngbya contorta* during the study period. Singh (2015) also projected Cyanophyceae as the most dominant group in an open pond in Bharatpur, India where *Mycrocystis aeruginosa* observed as most dominant species.

Chlorophyceae was found as the second abundant group well dominated by *Volvox aureus, Spirogyra elliptica* and *Cosmerium* sp. in the study sites during Pre-monsoon and Winter seasons. Dominance of Chlorophyceae in various water bodies has been earlier recorded by many workers in Assam flood plain context (Goswami, 1985, Hazarika & Dutta, 1994). Further the dominance of Chlorophyceae has been described by many workers in recent years (Bhat *et.al.*, 2015; Kalita *et.al.*, 2016).



The group Bacillariophyceae has been represented by 10 number of species dominated by Navicula sp. followed by Gomphonema parvulum during the Monsoon and Post-monsoon seasons. The higher growth of Bacillariophyceae during Monsoon and Post-monsoon might be liked with the rise of water temperature (Laskar and Gupta, 2009) followed by their depletion in winter in the present study, validating the logic fall of temperature.

From the study it is reveals that a large part of the water lodging areas of Sualkuchi village is decreased due to natural as well as anthropogenic activities which may decreases the algal diversity. The presence of higher abundance of Cyanophyceae has been considered as a pollution load as well nutrient rich condition of a water body (Tas and Gonulol, 2007). This investigation also observed higher abundance of Cyanophyceae, yet demand further in depth evaluation.

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S-PRIME MODULES AND MULTIPLICATIVE MODULES IN NEAR-RING MODULES

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Abstract:

We deal with Primeness in Near-ring modules. In this paper, we introduce the concept of s-prime modules and multiplicative modules as A subset S of a near-ring R is called an s-system if s contains a multiplicative system S* such that for every $s \in S$, we have $\langle s \rangle \cap S^* \neq \emptyset$. And study several features of this s-prime modules and multiplicative modules.

Introduction:

The study of s-prime and multiplicative modules is done by Van der- Walt introduced another notion of a s-prime modules and multiplicative modules. Birkenmeier *etalic* extended the Van der Walt definition to near-ring and defined a near-ring R to right s-prime and multiplicative modules and analogously, a near-ring is defined to be left s-prime and multiplicative modules. Further, in ideal A of R an s-prime ideal if R/A is an s-system. Also in ideal A of a near-ring R nilprime if A is 0-prime and $\frac{R}{A}$ has no non zero nil ideals. If in R-ideal P of M satisfied a certain prime condition, then so did that corresponding ideal $\widetilde{P}$ =(P:M) of R. In this section, we generalize these ideas to any R-module M.

Preliminaries:

In this section, we recall some preliminary definitions and results to be used in the sequel.

2.1 Definition: Let P be an R-ideal of an R-module M such that $RM \neq 0$. Let $v = 0,2,3$. Then P is called v-s-prime if

(a) P is v-prime.

(b) $\frac{R}{(P:M)_R}$ contains no nonzero nil ideals (ie. For every $A \lhd R$ such that $A \not\subseteq (P:M)$, there exists an $a \in A \setminus (P:M)$ such that $a^nM \not\subseteq P$ for all $n \in N$)

If we transfer the above definition to the module M itself, then we have that M is v-s-prime if M is v-prime and $\frac{R}{(0:M)_R}$ has no

noniszero nil ideals (ie. for every $A \lhd R$, $A \not\subseteq (0:M)$, there exists an $a \in A \setminus (0:M)$ such that $a^n M \neq 0$ for all $n \in N$.

Furthermore, it is well known that the nil radical of near-ring R is defined as: $N(R) = \sum\{A \lhd R : A \text{ is a nil ideal of } R\}$.

2.2 Definition: Let $v = 0,2,3$ and $RM \neq 0$. Then $P \lhd_R M$ is called v-s-prime if P is v-prime and $N_{\frac{R}{(P:M)_R}} = 0$.

It is clear that every v-s-prime R-ideal (R-module) is *v*-prime for $v = 0,2,3$. Furthermore, we proved the following result for an R-ideal P of M.

(a) P is 3-prime $\Rightarrow$ P is 2-prime $\Rightarrow$ P is 0-prime. (Note here that we Provided examples to show that these three types of primes are nonequivalent in general. We can use the same examples to conclude the nonequivalence of the three types of s-primes).

(b) If R has identity, then P is 2-prime $\Leftrightarrow$ P is 3-prime.

(c) For $v = 2,3$, if P is *v*-prime, then $\widetilde{P} = (P:M) \lhd R$ is *v*-prime.

(d) If P is 0-prime and M is a monogenic (or tame) R-module, then $\widetilde{P} \lhd R$ is 0-prime.

By applying the above results and Definition, we conclude the following string of result with respect to a *v-s*-prime R-ideal P of an R-module M (or with respect to M itself).

2.3 Proposition: P (or M) is 3-s-prime $\Rightarrow$ P (or M) is 2-s-prime $\Rightarrow$ P (or M) is 0-s-prime. Furthermore, if R has identity, then P(or M) 2-s-prime $\Leftrightarrow$ P (or M) is 3-s-prime.

2.4 Proposition: Let M be a monogenic (or tame) R-module. Then

(a) $P \lhd_R M$ is 0-s-prime implies $\widetilde{P} \lhd R$ is also 0-s-prime.

(b) M is a 0-s-prime R-module implies (0:M) is a 0-s-prime ideal of R.

2.5 Proposition: Let $v = 2,3$ and let P be a *v-s*-prime ideal of R such that $P \neq R$. Then there ecists a *v-s*-prime R-module M with $P = (0:M)$.

Proof: Since P is *v*-prime, from Proposition 2.2.35, we know that $\frac{R}{P}$ is a nonzero R-module, $\frac{R}{P}$ is *v*-prime and $P = (o:\frac{R}{P})_R$. So let $M = \frac{R}{P}$. Since M is v-prime. Since P is a v-s-prime ideal, it follows from the definition of an s-prime ideal that $\frac{R}{P}$ has no nonzero nil ideals.

But $P = (o:\frac{R}{P})_R$. Hence $\frac{\frac{R}{P}}{(o:\frac{R}{P})_R} = \frac{R}{(0:M)_R}$ has no nonzero nil ideals.

So M is a v-s-prime R-module.

2.6 Corollary: If $P \lhd R$ with $P \neq R$, then there exists a 2-s-prime (3-s-prime) R-module M with $P = (0:M)_R$ if and only if P is a 2-s-prime (3-s-prime) ideal.

3.1 Proposition: Let M be a 2-s-prime (3-s-prime) R-module and let P be an R-ideal of M. Then P is a 2-s-prime (3-s-prime) R-module.

Proof: From Proposition, P is a 2-prime (3-prime) R-module. Hence we need only show that $\frac{R}{(O:P)_R}$ contains no nonzero nil ideals.

3.2 Definition: Let M be an R-module. Then

(a) $C \subseteq M$ is called a multiplication set if $\widetilde{C}M = C$.

(b) $m \in M$ is called a multiplication element if the singleton set $\{m\}$ is a multiplication set.

Note that (b) above translates to $\{\widetilde{m}\}M = m$. For future applications we will simply write $\{\widetilde{m}\}$ as $\widetilde{m}$.

3.3 Definition: Let M be an R-module. Then

(a) M is called a 0-multiplication module if every R-ideal of M is multiplication set.

(b) M is called a 2-multiplication module if every R-submodule of M is multiplication set.

(c) M is called a c-multiplication module if every $m \in M$ is a multiplication element. The three types of multiplication modules defined above are, in general, nonequivalent. We demonstrate the existence of v-multiplication ($v = 0,2,c$) modules .

Since M is 2-s-prime (3-s-prime), $\frac{R}{(OM)_R}$ contains no nonzero nil ideals. But $(0:M)_R \subseteq (0:P)_R$ implies that $\frac{R}{(0:P)_R} \subseteq \frac{R}{(0:M)_R}$. So, $\frac{R}{(0:P)_R}$ also contains no nonzero nil ideals. Before we prove the next proposition, we state the following lemma.

3.4 Lemma: If R is an $\mathcal{A}$-near-ring and $I \lhd R$, then $N(I) = I \cap N(R)$.

3.5 Definition: Let M be an R-module. Then

(a) $C \subseteq M$ is called a multiplication set if $\widetilde{C}M = C$.

(b) $m \subseteq M$ is called a multiplication element if the singleton set $\{m\}$ is a multiplication set.

Note that (b) above translates to $\{\widetilde{m}\}M = m$. For future applications we will simply write $\{\widetilde{m}\}$ as $\widetilde{m}$.

3.6 Definition: Let M be an R-module. Then

(a) M is called a 0-multiplication module if every R-ideal of M is multiplication set.

(b) M is called a 2-multiplication module if every R-submodule of M is multiplication set.

(c) M is called a c-multiplication module if every $m \in M$ is a multiplication element. The three types of multiplication modules defined above are, in general, nonequivalent. We demonstrate the existence of v-multiplication ($v = 0,2,c$) modules.

4.1 Proposition: Let M be an R-module. Then M is a c-multiplication module $\Rightarrow$ M is a 2-multiplication module $\Rightarrow$ M is a 0-multiplication module.

Proof: Suppose that M is a c-multiplication module. Let A be an R-submodule of M. Since M is a c-multiplication module, for each $a \in A$, we have $\tilde{\alpha}\, M = a$. Hence $\tilde{A}M = A$, thus proving that M is a 2-multiplication module.

Now suppose that M is a 2-multiplication module. Let $A \lhd_R M$. Since R is zerosymmetric, A is an R-submodule of M. Since M is a 2-multiplication module, we have $\tilde{A}M = A$ and the proof is complete.

4.2 Proposition: Let P be an R-ideal

of a 2-multipication R-module M such that $\widetilde{P}$ is a 2-prime ideal of R. Then P is a 2-prime R-ideal of M.

4.3 Proposition: Let P be an R-ideal of a c-multiplication R-module M such that $\widetilde{P}$ is a 3-prime (resp. c-prime) ideal of R. Then P is a 3-prime (resp. c-prime) R-ideal of M.

Proof: Suppose that $\widetilde{P}$ is a 3-prime ideal of R. Let $a \in R$ and $m \in M$ such that $aRm \subseteq P$. Since M is a c-multiplication module, $aR\widetilde{m}M = aRm \subseteq P$ which implies that $aR\widetilde{m} \subseteq \widetilde{P}$. Since $\widetilde{P}$ is a 3-prime ideal of R, $a \in \widetilde{P}$ or $\widetilde{m} \subseteq \widetilde{P}$ If $a \in \widetilde{P}$ then $aM \subseteq P$ and the proof is complete. If $\widetilde{m} \subseteq \widetilde{P}$, then $\widetilde{m} \subseteq (P:M)$ which implies that $\widetilde{m}\, M \subseteq P$. So $m = \widetilde{m}\, M \in P$ and once again we are done.

Now suppose that $\widetilde{P}$ is a c-prime ideal of R. Let $a \in R$ and $m \in M$ such that $am \in P$. Then $a\widetilde{m}\, M = am \in P$ and the rest of the proof follows as for the 3-prime case.

4.4 Proposition: Let P be an R-ideal of M. Then

(a) If M is a 0-multiplication R-module and $\widetilde{P} \lhd R$ is 0-s-prime, then $P \lhd_R M$ is 0-s-prime.

(b) If M is a 2-multiplication R-module and $\widetilde{P} \lhd R$ is 2-s-prime, then $P \lhd_R M$ is 2-s-prime.

(c) If M is a c-multiplication R-module and $\widetilde{P} \lhd R$ is 3-s-prime, then $P \lhd_R M$ is 3-s-prime.

4.5 Proposition: Let P be an R-ideal of a c-multiplication R-module M such that $\widetilde{P}$ is a strongly prime ideal of R. Then P is a strongly prime R-ideal of M.

Proof: Let $m \in M \setminus P$. Then if $t \in \widetilde{m}$, we get $tM = \{m\} \notin P$ and hence $t \notin (P:M) = \tilde{P}$. Since $\widetilde{P} \lhd R$ is strongly prime, there exists a finite subset F of R such that $a \notin R$ and $aFt \subseteq \widetilde{P}$ implies that $a \in \widetilde{P}$.

Therefore, if $r \in R$ such that $m \subseteq rFP$, we get

$rFtM \subseteq P \Rightarrow rFt \subseteq \widetilde{P} \Rightarrow r \in \widetilde{P}$

Hence $rM \subseteq P$ implies that P is strongly prime R-ideal of M.

4.6 Corollary: Suppose that M is a v-multiplication faithful R-module where $v = 0,2,c$. Then M is v-prime if and only if R is v-prime.

Furthermore, if M is a c-multiplication faithful R-module, then

(a) M is 3-prime if and only if R is 3-prime.

(b) M is strongly prime if and only if R is strongly prime.

Finally, we conclude this section with the following definition of prime modules.

4.7 Definition: Let M be an R-module. Then

(a) M is called a 0-fully faithful R-module R-module if all nonzero proper R-ideals of M are faithful R-modules.

(b) M is called a 2-fully faithful R-module if all nonzero proper R-submodules of M are faithful R-modules.

5 Conclusion: The result in this paper gives only the concepts of S-Prime Modules and Multiplicative Modules of a ring. Many more information regarding its properties and

applications can be expected.

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