STUDY OF SPRINGBACK ANALYSIS IN AIR BENDING PROCESS AFTER DIFFERENT HEAT TREATMENT OF ALUMINIUM 6063 ALLOY

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ABSTRACT

This study deals with the study of spring back effect during air bending of aluminium 6063 alloy during various types of heat treatments. One of the most important challenges for the automotive industry in the upcoming year is to meet the demand of reducing the fuel consumption with a simultaneous increase of the safety property and increase the efficiency of engine. It can be done by reducing the weight of the body by substituting traditional steel or aluminium alloys. Aluminium alloys can be formed into parts by a variety of process similar to those used for steel. Formability of aluminium sheet is under normal processing condition lower than that for typical mild steel. One of the current challenges in the bending operation is the prediction of material behavior after removal of load or pressure on it. Such as spring back control is essential in the production of parts with tight fit up tolerances as result in deviation from desired shape. Spring back is an elastically shape change that occur after forming upon unloading. Spring back commonly occur in forming process .The spring back phenomenon when bending is involved. become a major area of concern, because it is a kind of defect that results in deviation from designed bend angle, which is less than required bend angle, after removal of forming load.

I. INTRODUCTION

Sheet metal forming processes are commonly used in industry. Sheet metal forming processes are usually carried out at room temperature. Forming at elevated temperature could done, because of increase the formability of sheet, reduced spring back and decrease in maximum force. Bending is one most usual forming operation, in air bending a sheet is bent on après brake with help of a die and punch. During bending operation, previous heating of the sheet metal it would be provide some advantage, such as reducing the maximum force, spring back and increase the bend ability. Sheet metal bending is forming process. The elastic recoveries after unloading causes the spring back phenomenon in which radius of curvature slightly increase after bending moment is removed. Spring back is affected by several factors such as elastic modulus, yield stress, sheet thickness and work hardening exponents [31].

1.1 Metal Forming Process

In the forming process, under the application of large amount of mechanical force or by heating the metal and applying small force, the material deforms plastically [3,4].When plastic deformation occurs, the metal appears to flow in the solid state along specific directions, which depends upon the direction of force applied and type of process.

1.2 Air Bending

This process is also called Three Point Bending, because in this process, the work piece comes in contact with the outside edges of the die and with the punch tip. The punch does not come in contact with the bottom of v shaped die. Various bend angles can be obtained with the same tooling as shown in figure:

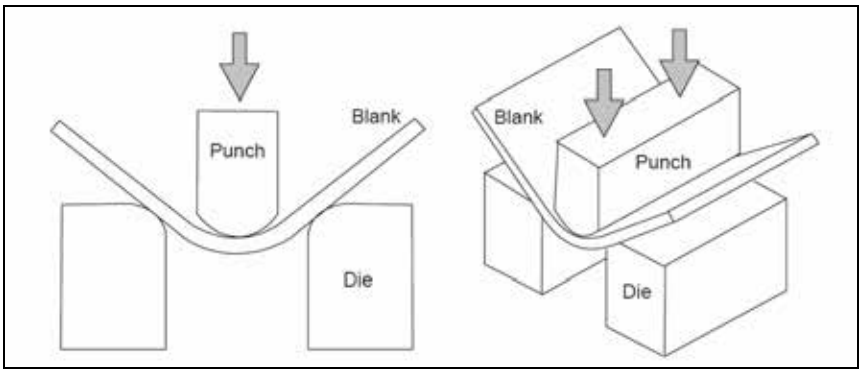

Fig1. : Air Bending Process [7].

II.A BRIEF OF HISTORICAL BACKGROUND EAHE SYSTEMS IN THE WORLD

J-Yanagimoto et al. [22] investigated spring back of high- strength after hot and warm sheet forming. An experimental study has been carried out on high-strength steel(HSS) sheet, using hot compression testing machine and the effect of forming temperature on the amount of spring back was also evaluated. Hot sheet is stamped and quenched between cold die. **Martensitic** transformation from austenite is due to rapid cooling. Tests were performed under precise control of temperature in plastically deformed zone. Temperature was controlled by induction heating. During the experiment temperature of plastically deformation zone was controlled within 10 k and target temperature around 773 k. Two precipitation hardened high strength steels are tested as fellows (a)HSS of 540 MPa strength. (b)HSS-2 of 340 MPa strength.

Material if die Tungsten Carbide

HSS-1 - 540 MPa, 0.80c-0.26 Si-1.09mm

HSS-2 - 340 MPa, 0.0015c- 0.01 Si- 0.3 mm

Heating rate – 50k/s

Punch speed – 1m/s

Punch stroke – 4.5 mm (v bending), 14 mm (hat bending).

It is clear that the amount of spring back decrease markedly when temperature higher than 750K and spring back can be reduced of plastic deformation zone which is far less than the recrystallisation temperature of steel at 750 K in ferrite pearlite phase. Some of experimental and numerical studies were also done in order to analyze the bending operation and spring phenomenon, reported by Hong et al., [23]. Numerical investigation on spring back characteristic of Aluminium sheet metal alloys in warm forming condition was investigated by Moon et al.[24] on Aluminium 1050 sheet and both hot die and cold punch could be improved the forming quality.

Keum and Han (2002) measured the spring back performance which varies bending test at different temperature for Al 1050 and 5032 Alloy. They showed that spring back reduced in warm condition when forging temperature exceeds above 150C. Spring back amount was first studied in isothermal condition where

tool and blank were heated up to the same temperature levels and spring back was effected by Blank Holding Force (BHF), in warm forming condition at three different conditions:

(i) At room temperature

(ii) Isothermal heating (T die and T punch=250 ^{0}C)

(iii) Non-isothermal heating (T die=250^{0}C and T punch=25^{0}C)

It was also found that spring back reduced to increase the Blank Holding Force (BHF) which was explained by simple moment curvature relation. In this paper, investigation on spring back effected by following:-

(i) Elevated temperature

(ii) Effect of BHF

(iii)Friction condition punch speed

(iv)E value

Jenn et al., [25] was conducted the spring back on brass in macro sheet forming and low cast 3 point bending experiment { brass 2600 ½ spring back amount and T/D ratio(thickness /average grain diameter) when thickness is less than 350um. The influence of the size effect on screen of Brass 2600 ½ hard (HO2) was investigated by Tsai et al., [26]. Some experiments, for understanding the spring back were conducted in such manner [27] where some mathematic models was developed by Gau et al., [22]. Brass 2600 ½ Hard (HO2) subjected to various heat treatments on sheet samples of dimensions 10mmx80mm. Heat treatment took place inside the electric furnace and cooled in air. A solution of 25ml NH_4OH, @% ml H_20 and 50ml H_20_2 (3%) used for polishing and catch of brass sample. Area average grain size determined with help of ASTM-E12 standard [28]. All the samples were tested at rate of 10, /min. images were taken to measure the bend angle using an Olympus E300 digital camera. It can be observed that spring base amount increase with decrease t/d ratio which is from 1 to 2.5 and if the brass thickness is less than 350um the convention spring back concept cannot be applied , and spring back in micro sheet forming can be expended as a function t/d ratio instead thickness.

III.METHODOLOGY

The prediction of spring back by means of Trial & Error method consumes a lot of time, thus increases the cost of product, its manufacturing cost, the time of product introduction or launching into the market as well as the development time of the existing product**.**

The Spring back refers to the elastic recovery of non uniformly distributed stresses in a deformed part after removal of bending force [16]. After removal of punch or unloading the sheet, during bending of sheet metal parts, the change in bend part dimension occurs results in deviation in bend angle which is different from designed (required) bend angle. This phenomenon occurs not only in sheet metal parts but also results in rods, wire & bar of any cross section [17].The variations in bending stresses cause spring back after bending. At the bend, the tensile stress occurs is more in the outside surface metal. This tensile stress is zero at neutral axis & decrease towards the centre of sheet thickness & the metal farther from axis, stressed above the yield strength has been plastically or permanently deformed .After the removal of load, the bend tries to return its original shape, but due to plastic deformation zones restriction, it slightly return as the elastic & plastic zones reach an equilibrium & this elastic recovery is called as spring back [18].

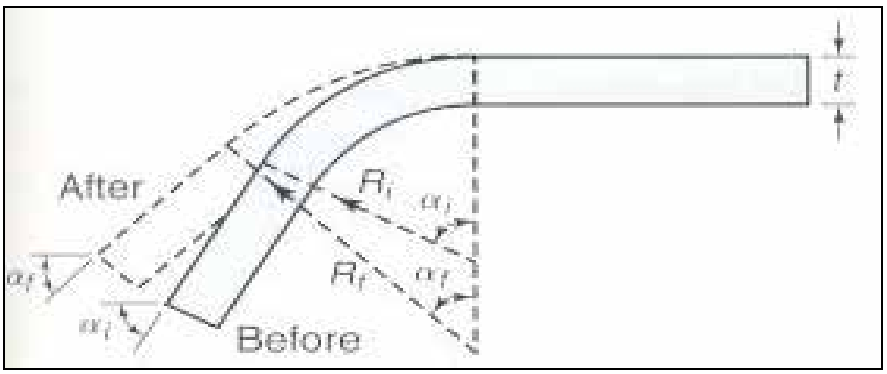

Figure2 : Springback In Bending Process

Experimental Set up

Geometry of Punch & Die

In this work, Die and Punch were assumed as a rigid body and sheet metal was considered as a deformable body. Punch and die are shown in Fig3.

The extruded aluminium alloy sheet with a thickness of 1.5 mm were cut into specimen with a length of 150 mm and a width of 35 mm. Aluminium alloy with chemical composition, shown in table 1 was obtained from NARANGE METALLIURGICAL & SPECTRO SERVICES, new Delhi – 110055.The receive sheet was cut and machined into standard tensile test pieces as shown in Figure 3.2 conformity with ASTM standard. The tensile sheet had gauge length 50 mm with a thickness 1.5 mm.

After 100% of the punch displacement the sheet metal fully bends and the bend angle was measured at loading condition as shown in fig.3.3 (a). The punch is gradually elevated after complete displacement. The sheet gets deflected from its loading shape due to the elastic recovery of sheet metals. The final bend angle was measured from the final bent sheet as shown in fig.3.4 (a).

The Spring back is calculated in terms of change in angle, the difference between loaded bending angle & unloading bending angle.

$$\boldsymbol{\alpha} = \Psi - \Phi \qquad (3.1)$$

where,

α = Springback angle in degree.

Ψ = Loaded bending angle in degree.

Φ = Unloaded bending angle in degree.

$$y = Tan^{-1}\left(\frac{y_1 - y_2}{x_1 - x_2}\right). \qquad (3.2)$$

x_1, x_2, y_1, y_2, are the co-ordinates of two nodal points on the bend sheet (loading).

$$f = Tan^{-1}\left(\frac{y' - y''}{x' - x''}\right) \qquad (3.3)$$

x', x'', y', y'', are the co-ordinates of two nodal points on the bend sheet (unloading). The Fig. 3.3(a) below shows the loaded bend angle, **Ψ** and Fig.3.4 (a) shows unloaded bend angle **Φ**.

Figure3 : Initial Geometry Of Punch, Die And Sheet.

IV. EXPERIMENTAL RESULTS

Scanning electron microscopy (SEM) is a useful technique to study the surface morphology of the materials. The scanning electron microscope (SEM) is the most widely used types of electron microscope. It examines the microscopic structure by scanning the surface of materials, similar to scanning con-focal microscopes, but with much higher resolution and much greater depth of field. An SEM image is formed by a focused electron beam that scans over the surface area of a specimen; it is not formed by the instantaneous illumination of a whole field as for a TEM. Perhaps the most important feature of an SEM is the three-dimensional appearance of its images because of its large depth of field.

A scanning electron microscope consists of an electron gun and a series of electromagnetic lenses. In an SEM, however, the electron beam emitted from an electron gun is condensed to a fine probe for surface scanning. The electron gun for generating an electron beam is the same as in a TEM; either thermionic or field emission type guns are used.

Advanced SEM systems use a field emission gun because of its high beam brightness. Beam brightness plays an even more important role in imaging quality in an SEM than in a TEM. The acceleration voltage for generating

an electron beam is in the range 1–40 KV, which is about one order of magnitude less than that for a TEM. An SEM optical path goes through several electromagnetic lenses, including condenser lenses and one objective lens. The lenses are made of a soft iron core, around which the wire is coiled. Current flows through the wire creating a magnetic field in the air gap of the iron core. When the current in the condenser and objective lens changes, a proportional change occurs in the field strength (B), thus alters the focal length of the lenses. The electromagnetic lenses in an SEM are for electron probe formation, not for image formation directly as in a TEM. The two condenser lenses reduce the crossover diameter of the electron beam; then, the objective lens focuses the electron beam as a probe with a diameter on the nanometre scale. The objective lens should be considered as the third condenser lens in the SEM because it functions more like a condenser than an objective lens. The reason is that the objective lens in SEM demagnifies the cross-section of the electron beam; thus, it functions very differently from the objective lens in a TEM, which magnifies the electron beam. Two types of images may be obtained from SEM, secondary and backscattered. Secondary electrons have low energy typically <50 eV and escape from the first 20 nm of the sample surface. Backscatter electrons escape from the bulk of the sample (500 nm) and have energy >50 eV. Separate detectors are used for detecting secondary and backscattered electrons due to the nature of the radiation

Figure: 4 Deformed Sheet at 100% Displacement

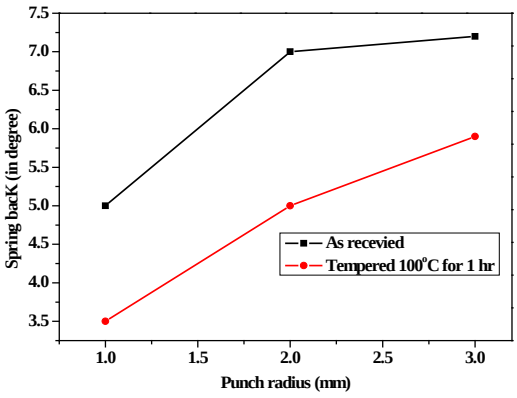

Fig 5: Effect On Spring Back For Different Punch Radius In Air Bending Process Of Sample (A) As Received (B) Tempered At 100˚C For 1 Hour

V. CONCLUSION

In this analysis, we investigated the amount of spring back in aluminium alloys 6063 sheet by changing the punch radius and different heat treatment. Sheet metal air bending of aluminium alloys with respect to the major geometrical parameters associated with the process. The effect of spring back cannot eliminate, but can be minimized by using a suitable die and punch design. This thesis work presents some trends to understand the effect of punch radius and temperature on spring back.The following conclusions has been obtained from results, during the Air Bending Process.

- Ø The spring back increases with increase in punch radius.
- Ø The spring back decreases with increase the temperature.
- Ø Ultimate tensile stress increase with increase tempering temperature.
- Ø Percentage of elongation increase with temperature.

REFERENCE

[1] H.Laurent, J.Coer, P.Y.Manach, M.C.Oliveira mechanical behaviour and springback study of an aluminium alloy in warm forming conditions.

[2] Hong seok kim, Muammer koc, Investigations of springback characteristics of aluminium sheet metal alloys, pg no. 370-389.

[3] P.N.Rao, Manufacturing Technology, Tata McGraw Hill Publishing Company Ltd, New Delhi 2006.

[4] P.C.Sharma, Production Engineering, S.Chand & Company Ltd, New Delhi, 2008.

[5] Henry S.Valberg Applied Metal Forming: Including FEM Analysis, Cambridge University Press.

[6] Prakash M.Dixit, Uday.S.Dixit, Modelling Of Metal Forming & Machining Processes by Finite Element & Soft Computing Methods, Springer Verlag London Limited, 2008.

[7] Olaf diegeL, The Fine Art of Sheet Metal Bending, Complete Design Services, July, 2002.

[8] M.P.Groover, Fundamentals of Modern Manufacturing 3/e, John Wiley & Sons, Iric, 2007.

[9] P.C.Sharma, Production Engineering, S.Chand & Company Ltd, New Delhi, 2008.
Heinz Tschatsch, Metal forming practise-machines tools, springer verlag berlin, heidelberg, 2006.

[10] Henry E thesis, handbook of metal forming processes, marcel dekker inc., New York, 1999, (U.S.A)

[11] Jyhwen Wang, Suhas Verma, Richard Alexander, Jenn-Terng Gua, springback control of sheet metal air bending process, journal of manufacturing processes 10(2008) 21-27.

[12] M.V.Inamdar, P.P.Date, S.V.Sabnis, on the effects of geometric parameters on springback in sheets of five materials subjected to air vee bending, journal of materials processing technology 123 (2002) 459-463.

[13] Gang Liu, Zhongqin Lin, Youxia Bao, J Cao, eliminating springback error in u shaped part forming by variable blank holder force, journal of material engineering & performance volume 11 (1) February (2002).

[14] S.K.Panthi, N.Ramakrishnan, K.K Pathak, J.S.Chouhan, an analysis of springback in sheet metal bending using FEM, journal of materials processing technology 186 (2007) 120-124.

[15] Himanshu V.Gajjar, Anish.H.Gandhi, Harit.K.Raval, finite element analysis of sheet metal air bending using hyper form LS-DYNA, international journal of mechanical, industrial & aerospace engineering (2007).

[16] M.L.Garcia-Romeu, J.Ciurana, I. Ferrer, springback determination of sheet metals in an air bending process based on an experimental work, journal of materials processing technology 191(2007) 174-177.

[17] Orville's Lascol, handbook of fabrication processes, ASM International, 1998, (U.S.A).

[18] S. Kalpakjian, S. Schmid, manufacturing processes for engineering materials, 5th edition, pearson education, 2008.

[19] Muhaeds Jafar and Shakir M. Gatea study the effect of heat treatment an spring back in u bending process.vol.3, issue may 203, pg 49-56.

[20] J-Yanagimoto , k-oyamada, J-Nakagawa Tokyo spring back of high- strength after hot and warm sheet forming is investigated an experimental study has been carried out on high-strength steel(HSS) sheet.

[21] Hong Seok kim, muammer KOC numerical investigation on spring back characteristic of Aluminium sheet metal alloys in warm forming condition. Journal of material processing technology (2008),pp. 370-383.

[22] Y.H.Moon successfully analyses the effect of temperature on the reduced of spring back of aluminium sheet, journal of material processing technology vol.132 (2003) pp 365-368.

[23] Jenn-Terng Gau, Chris Principle Miao, yu spring back of brass in macro sheet formingsheet, journal of material processing technology (2007) pp 07-10.

[24] M.C Tsai, Chen f.k size of effect in micro metal forming of copper and brass.

[25] J.Yanagimoto, K.Oyamada mechanism of spring back-free bending of high –strength steel sheets under warm forming condition investigate spring back in warm sheet forming Annal of the CIRP vol. 56//2007.

[26] M.L.Garcia-Romeo, J.Ciurana, I.Ferrer study spring back determination of sheet metals in an air bending process based on the experimental work, journal of material processing technology (2007) pp 174-177.

[27] Micarietal presented a spring back prediction technique in three dimensional stamping processes.

[28] Gau and Kinzel perform an experimental study for determine the Bauschinger effect on spring back prediction.

[29] J, G Liu and W.L. Chan influence of size effect on the spring back of sheet metal computational materials science (2011) pp. 2604-2614.

[30] F.Stachowicz and T.Pieja warm forming of stainless steel sheet vol.x (2010).

[31] Mohameed Rasheed Bushna, H. Nawal effect of dies shape, sheet thickness and types of alloy on spring back phenomenon vol.30 (2012).

DIVERSITIES OF COMMENSAL & AMMENSAL MATHEMATICAL MODELS WITH LIMITED RESOURCES IN COMMENSAL /AMMENSAL WASHED-OUT STATE

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ABSTRACT

Commensalism and Ammensalism are having much more differences in nature. Both interactions have the inverse nature from one and other. In this paper, the authors aim to discuss the exclusive diversities between the scientific models of Commensalism and Ammensalism in a peculiar case. It is restricted to identify the diversities in Commensal/Ammensal washed out state with limited resources.

Key words: Ammensalism, Commensalism, Stability, Normal State, Enemy, Host.

I.INTRODUCTION

Interactions influence on the living beings which may flourish or decline in the course of time. Indirectly they may cause for environmental balance in nature. Interactions in Ecology are vast and useful concepts to study many real life situations to get more clarity. Many unknown things in various ecological models are investigated through these interactions. Many mathematicians [1,3-13,15] studied basic models in the past few decades. Recently, the importance of ecology has influenced and attracted many scholars [2,14,16] to do research on various interactions. In those interactions, Commensalism and Ammensalism are peculiar interactions with diverse nature.

These interactions of Ammensalism/Commensalism between two species are classified in the table given below:

	Effect on Organism-2	
Effect on Organism-1	Benefit	Harm
	Commensalism(0/+)	Ammensalism(0/-)

II. NOTATIONS ADOPTED

$N_1(t)$ The population of the species S_1 at time t

$N_2(t)$: The population of the species S_1 at time t

a_i :The natural growth rate of S_i, i = 1, 2.

a_{ii} :The rate of decrease of S_i; due to its own insufficient resources ,i=1,2.

$N_{i^*}(t)$:The carrying capacity of N_i, i = 1, 2(a_i / a_{ii})

a : a_{12}/ a_{11} is the coefficient of Commensalism /Ammensalism

S_1 : First Species (Commensal/ Ammensal Species).

S_2 : Second Species (Host /Enemy Species)

The equation for the growth rate of First Species: Ammensal /Commensal species (N_1) under limited resources is given by

$$\frac{dN_1}{dt} = N_1\, a_{11}[N_{1^*} - N_1 \pm a\, N_2] \qquad (1)$$

The equations for the growth rate of Second Species: enemy species/Host (N_2) under limited resources is given by

$$\frac{dN_2}{dt} = a_{22}\, N_2\, [\, N_{2^*} - N_2\,] \qquad (2)$$

Here all constants are positive. The quadratic terms $\left(N_1^2, N_2^2, N_1N_2\right)$ represent the effects of intra and inter – species crowding.

III.EQUILIBRIUM POINTS

The system under this investigation has four equilibrium states:

$i)\ \bar{c}_1 = 0; \bar{c}_2 = 0\,[Fully\ washed\ out\ state].$

$ii)\ \bar{c}_1 = 0; \bar{c}_2 = N_{2^*}\,[Ammensal / Commensal\ only\ is\ washed\ out\ state].$

$iii)\ \bar{c}_1 = N_{1^*}; \bar{c}_2 = 0\,[OnlyAmmensal / Commensal\ survives\ state]$

$iv)\ \bar{c}_1 = N_{1^*} \pm a N_{2^*}; \bar{c}_2 = N_{2^*}\ [Co - existent\ state\ or\ normal\ steady\ state]$

IV.DIVERSITIES OF COMMENSAL /AMMENSAL MODELS IN WHICH COMMENSAL /AMMENSAL (FIRST SPECIES) IS WASHED-OUT

The corresponding Linearised perturbed equations are

$$\frac{dU_1}{dt} = a_1 U_1 \pm N_{2^*} a_{12} U_1, \qquad (3)$$

$$\frac{dU_2}{dt} = -a_2 U_2 \qquad (4)$$

the characteristic equation is $\left(I - \left(a_1 \pm N_{2^*} a_{12}\right)\right)\ \left(\lambda + a_2\right) = 0$ (5)

The roots of this equation are $a_1 \pm N_{2^*} a_{12}$; $-a_2$;

If $\frac{N_{1^*}}{a} < N_{2^*}$

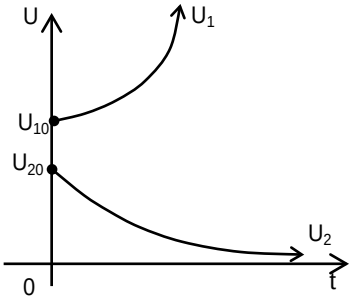
In this case, the steady state in Commensal model is **unstable.** But it is **stable** in case of Ammensal model.

The obtained solutions are $U_1 = U_{10} e^{\left(a_1 \pm N_{2^*} a_{12}\right)t}$; (6)

$$\& \; U_2 = U_{20} e^{- a_2 t} \qquad (7)$$

The solution curves are illustrated in Fig1and Fig 2 and the conclusions are given.

Sub Case 1: $U_{10} > U_{20}$



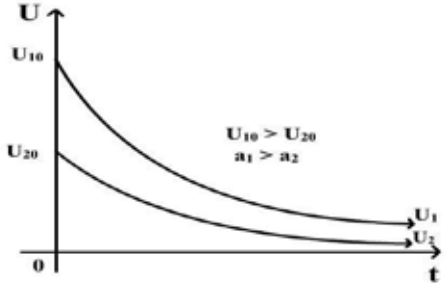
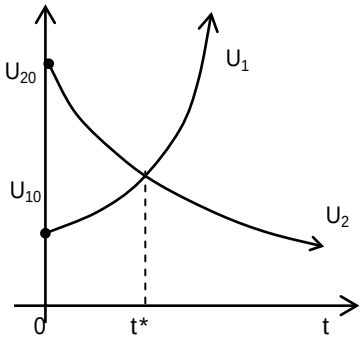


Fig.1(Commensal model) **Fig.2 (Ammesnal model)**

If the initial strength of First species (S_1) is greater than that of the Second species(S_2) i.e. $U_{10} > U_{20,}$ then the Commensal species is observed to be going away from the equilibrium point but the Ammensal species converging asymptotically to the equilibrium point while Second species (S_2) become extinct, as shown in Fig1 and Fig.2

Sub Case 2: $U_{10} < U_{20}$



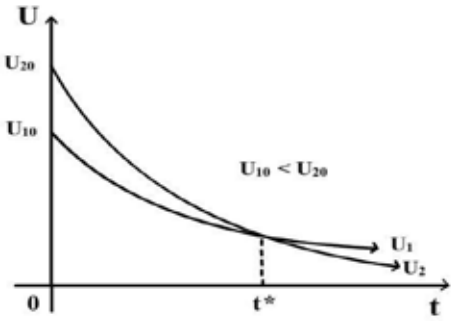


Fig.3(Commensal model) **Fig.4(Ammesnal model)**

If the initial strength of the First Species (S_1) species is greater than the initial strength of the second (S_2) species i.e. $U_{20} > U_{10}$, then the second species (S_2) outnumbers the first (S_1) species initially and the domination continues to exist up to the time $t = t^* = \frac{1}{(a_1 + a_2) \pm N_{2^*} a_{12}} \log\left(\frac{U_{20}}{U_{10}}\right)$. After this time instinct, the First species dominates the Second Species. Further, it is observed that the Commensal species goes away from the equilibrium point in Commensal model, but Ammensal species converges asymptotically to the equilibrium point in Ammensal Model. Hence, Ammensal Model is **stable** and Commensal model is **unstable.**

V. TRAJECTORIES OF PERTURBED SPECIES

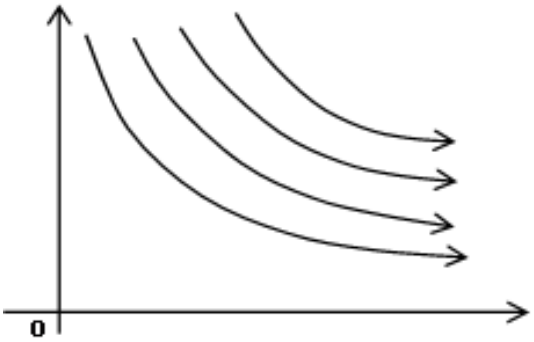


Fig.5(Commensal model)

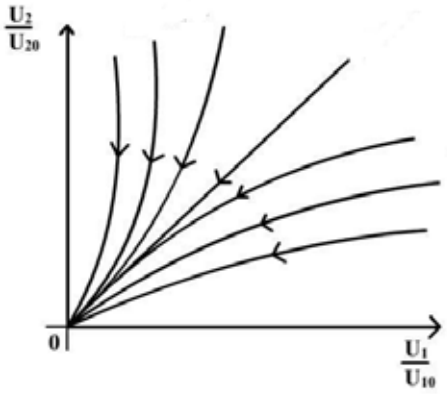


Fig.6(Ammesnal model)

By eliminating‘t’ between the equations (6) and (7), it is obtained

$$\left(\frac{U_1}{U_{10}}\right)^{\frac{1}{a_1 \pm N_2 \cdot a_{12}}} \left(\frac{U_2}{U_{20}}\right)^{\frac{1}{a_2}} = 1$$

The trajectories in Fig.5 are hyperbolic type in Commensal model and Fig.6 exhibits the stability of the steady state in Ammensal Model.

VI. CONCLUSIONS

The diversities in Ammensal and Commensal models in a special case of limited resources are identified. The stable and unstable steady states are traced in Commensal/Ammensal washed out state. The trajectories of perturbed species are also illustrated.

REFERENCES

1) Addicott, J.F. : Mutualistic interactions in populations and community processes.Pages 437-455 In: P.W.Price, W.S. Guad and C.N.Slobodchikoff (eds). A NewEcology: Novel Approaches to interactive systems. John Wiley &sons,NewYork,1984.

2) K.V.L.N.Acharyulu & N.Ch.Pattabhi Ramacharyulu “International Journal of Applied Mathematical Analysis and Applications”, Vol.4, No.2, pp. 149-161, July2009.

3) Cushing, J. M.: Integro – differential equations and Delay Models in Population Dynamics, Lect. Notes in Biomathematics, Vol. 20, Springer-Verlag, Heidelberg, 1977.

4) Kapur, J.N. : Mathematical Modeling, Wiley-Easterm, 1988.

5) Gauss,G.F .: The struggle for existence, Williams and Wilkins,Baltimore,1934

6) George F. Simmons: Differential Equations with applications and historical notes, Tata McGraw-Hill, New Delhi, 1974.

7) Kapur, J.N. : Mathematical Modeling, Wiley-Easterm, 1988.

8) Kapur, J.N.: Mathematical Models in Biology and Medicine Affiliated East- West, 1985 .

9) Lotka, A.j.: Elements of Physical biology, Williams and Wilikins, Baltimore,1925.

10) Gauss,G.F .: The struggle for existence, Williams and Wilkins,Baltimore,1934

11) George F. Simmons: Differential Equations with applications and historical notes, Tata McGraw-Hill, New Delhi, 1974.

12) Kapur, J.N. : Mathematical Modeling, Wiley-Easterm, 1988.

13) Kapur, J.N.: Mathematical Models in Biology and Medicine Affiliated East- West, 1985

14) Lakshminarayan, K and N.Ch.Pattabhi Ramacharyulu : A prey-predator model with cover for the prey and alternative food for the predator and time delay, International Journal of Scientific Computing, Vol.1,,pp.7-14, 2007.

15) Lotka, A.j.: Elements of Physical biology, Williams and Wilikins, Baltimore,1925.

16) Phanikumar N., & Pattabhi Ramacharyulu N.Ch., "Onthe stability of a host – A flourishing commensal species pair with limited resources".International journal of logic based intelligent systems. Vol.3 & Issue1,pp56-68,June-July (2009).

SUGGESTIONS FOR SECURE E-POLLING IMPLEMENTATION WITH DATAMINING TO IDENTIFY VOTING CHARACTERISTICS

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ABSTRACT

This paper describes the security issues in the implementation of electronic polling during elections in India along with suggestions to overcome these issues and also how data of electronic polling can be mined for various other decision making purposes.

Key Words*: *Data-Mining, E-Polling,One Time Password

I.INTRODUCTION

Technology has obtained a prominent place in this 21st Century in every walk of the life of the human being. In the same lines, the government is also emphasizing on usage of technology, especially Information Technology, in automating their workings so as to make it reach easily, in more efficient and convenient way, to citizens of India. Moreover, invocation of IT in government sector has also led to more transparent working of the government. This usage of technology in government sector is known more broadly as E-Governance.

One of such dream of government is to vote electronically using websites. This dream if comes true would definitely increase the polling ratio and finally would lead to the selection of most efficient and suitable candidate. More over this would also reduce the curse of few cases of bogus voting. But developing website for polling is very easy but there is always a problem of security. We, in this research paper, had tried to tackle this security issue and tried to suggest a probable solution to this issue, so that persons with technical know-how could vote using this feature.

Moreover, the data so collected can further be mined, using data-mining techniques, for identifying the characteristics of various users like whether they were urban, rural. Also we can identify whether voting took place using desktop client or mobile client so that in future suitable App can be developed.

II. ISSUES WITH CURRENT SYSTEM

- Current Polling system is carried out using Electronic Voting Machine (EVM) but not online.
- Voters have to reach the polling booth and wait on the booth by remaining standing in the queue.
- Difficult for certain voters many times like aged persons, disable persons, pregnant women etc.
- People, many times, are unable to vote as they are working far away from their respective constituency.
- Unpredicted incidents may occur.

III. SYSTEM SCOPE

- ñ System includes Registration Module for Voters.
- ñ Security Modules during casting vote.
- ñ System is developed for online voting using desktop or laptop only currently.

IV .PROPOSED SUGGESTION FOR PROVIDING SECURE E- POLLING

4.1Registration Module

- ñ User Should be first registered for E-Polling.
- ñ While registration User Should be asked to fill details like: Name, DOB, Current Address, Permanent Address, Type of Photo ID, Photo ID Proof, Scanned Copy of the photo ID proof, Mobile Number, Email id, password, security question with answer etc. Voter's mobile device's IMEI number should also be registered.
- ñ Also while registration, users should be asked to scan their photo using Web Cab as this photo should be re-scanned on the day of voting.
- ñ While registration, user has to give the MAC of the machine from which they are going to vote.
- ñ Once user has filled all these detail, he/she will be sent a code on mobile, to verify mobile, and an email link where this so obtained code has to be fed to verify the email.
- ñ Finally after all above steps, user will be registered for e-voting.
- ñ This registration will be valid for 1year then after user has to refresh the details once again.

4.2 Secure E-Voting Module

- ñ On the day of voting, user will have to log in using pre-created userid and password.
- ñ Then he/she has to select the concerned state, district/constituency to search his name using either election card id or photo id so entered while registration.
- ñ Then after , he/she has to once again upload his photo using webcam and also scanned copy of the photo id.
- ñ Voter has to compulsorily vote using the same computer system whose MAC address is registered at the time of registration process.
- ñ Voter has to keep his mobile number and mobile device on.
- ñ Verification for IMEI number and MAC address should be done automatically by fetching these data from registration database.
- ñ Once photo id, user id, password and webcam photo verification is done, voter will be sent One Time Password (OTP) on his registered mobile phone. This OTP is to be entered while voting submission accurately. This OTP will be valid for 1 minute only.
- ñ Till voter finally casts vote online, the webcam should be kept switched on recording your activities. This should be stored in competent election authorities databases.
- ñ On successful voting submission, voter's computer system, e-polling account and mobile number will be banned by the competent election authorities for any further messages from their side till next 24 hours.
- ñ For unsuccessful transactions, user will have to revert back by email to competent election authorities with FailureID.
- ñ Competent election authorities will revert back using OTP (last time).

- Voters, who have chosen to vote by e-polling, will be allowed to vote electronically only. They can not vote physically by visiting the concerned polling booth.
- For more advanced level of security, competent election authorities may fix the ISPs and mobile communication vendors.

V. DATA-MINING PERSPECTIVE

- We can compare the voting trends as I think percentage of voting will increase due to E-Polling.
- We can identify the users/voters like Male or Female, from Urban or Rural areas, their age groups.
- We can identify the type of users like whether voted using desktop, laptop, mobile devices or any other such devices.

5.1 Implementation Issues

While implementation, there might be issues of usage due to over crowding at servers. I think for solving this issue competent election authorities should make use of Cloud Computing techniques which can easily scale up and scale down with usage.

5.2 Advantages of E-Polling

- Voting percentage would definitely increase.
- Cost of election would decrease and slowly and gradually there may be polling booths where all voters may be voting electronically.
- Fear of misbehavior, damage due to unpredicted natural calamities would be reduced.
- Sale of electronic devices, internet, mobile devices and mobile communication would increase which ultimately would increase country's revenue.
- More secure voting without any bias would be carried out.
- As most of users, slowly and gradually, would begin to use e-polling, cost will be reduced for elections and hence this amount can be used for e-polling infrastructure developments and maintenance.

VI. FUTURE SCOPE

A mobile app can be made for easy usage of this system as most of the users are having smart mobile phones and would like to vote through mobile phones using mobile apps. These mobile apps should be freely available.

VII. CONCLUSION

This would be a great leap in implementation of democracy by the government by implementation of e-polling. E-polling would of great use to people of India more and more democratically powerful. It would reduce cost of holding elections, security during elections and would lead to easy and fast result declaration. Hence this system would definitely prove boon for India.

REFERENCES

[1] Tallinn, "E Voting System:Overview", 2005

[2] Klaus Diehl, Sonja Weddeling , "Online Voting Project –New Developments in the Voting System and Consequently Implemented Improvement in the Representation of Legal Principles", T-Systems Enterprise Services GmbH Onlinevoting

[3] "Electronic Voting Research Project", University of Maryland and Towson University.

[4] G.O. Ofori-Dwumfuo and E. Paatey , "The Design of an Electronic Voting System", Research Journal of Information Technology 3(2): 91-98, 2011 ISSN: 2041-3114.

DESIGN AND IMPLEMENTATION OF EPAR TO SEARCH AND COMMUNICATE WSN NODES

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ABSTRACT

In a big farm there might be more number of animals, so, it is difficult to monitor each one of them. Because of this, animals are being stolen frequently. In such cases monitoring a livestock is a very necessary issue. The proposed system mainly aims to have the animals in a defined boundary stay connected with central hub. Whenever the animals are stolen, it will be intimated to the central hub through missing acknowledgement. This is done by using WSN nodes with EPAR technology. This technology identifies the node's capacity not only based on residual energy, but also on the expected energy required to transfer the packet to the neighbor node. EPAR chooses the transmission path with the maximum packet capacity at the least residual packet capacity for transmission using a mini-max formulation.

Keywords: Central hub, Channels, EPAR, Pan id, Residual battery power

1. INTRODUCTION

For last few years, Wireless networks have become more popular. Infrastructured and infrastructureless networks are two variations of wireless networks. In the former, centric controllers are used to establish and maintain communications among terminals. Examples are the wireless Local Networks (IEEE 802.11) and cellular networks. The latter is commonly known as wireless ad-hoc network. In such a network, the terminals are organized in an ad-hoc manner, where they can establish connections by themselves and uses multi-hop to communicate with each other. This property makes ad-hoc networks to establish a network instantly even in the disaster areas. Example applications include emergency services, recovery of disaster, wireless sensor networks and home networking.

Now a day, the animals in the farm are easily being stolen especially when huge in numbers. The livestock theft has been increased 40 percentage from the last year over countrywide. This is due to inability to manage a large number of livestock at the same time. The project aims to decrease the theft by continually maintaining the livestock within a defined boundary by frequent requests and acknowledgements. The requests to the distance nodes can be sent through multiple hops. In the existing system, DSR method is used where the node is selected dynamically and the nearest node to the present node is selected to make the next hop.

Our nodes are battery driven. Thus, they suffer from less energy power. Also the livestock are mobile; if cattle are stolen the connection between them is broken. Thus, in such a case the two major reasons of a link breakage are.

• Node dying due to energy exhaustion

• Node moving out of the range when they are being stolen.

The EPAR technique is used to select the node with higher power which has capability to make the next hop to another node. Thus the packet can be reached to the destination safer and the power also consumed efficiently.

II. RELATED WORKS

Most of the past works on routing in ad-hoc networks emphasizes on the problem of discovering and maintaining accurate paths to the destination during changing topology and mobility. Strongly connected network uses shortest path algorithm. However, the route chosen may not be the minimum energy solution because of the possible avoidance of the optimal links during the calculation of the backbone connection network. A dynamic routing algorithm which is used for establishing and maintaining connection-oriented sessions uses the idea of proactive to work with the unpredictable changes in the topology.

2.1 Proactive Energy-Aware Routing

This is table-driven routing protocols. In this, each node tries to maintain consistent [1]–[3] updated routing information to all the other nodes in the network. This can be done if there are any changes in the network where each node updates its routing table and the updates are propagated to its nearby nodes. Hence, this is proactive. If a packet is to be transmitted and if the route is already known, then it can be used instantly. In the case for wired networks, either link-state or distance vector algorithms having a series of all the destinations, the next hop, or the series of hops to each destination is used to construct the routing table.

2.2 Reactive Energy-Aware Routing

It is on-demand driven routing. In this, routes can be found whenever the source node desires them. Discovery of routes and its maintenance are two main procedures: In former approach, [4]–[6] the source sends route-request packets to its nearby nodes, which is then forwarded to their neighbors, and so on. Once the destination node received the route-request, reply packet to the request is uni-casted back to the source node through the neighbor from which it got the route-request at first. When an in-between node that has a sufficiently updated route, receives the route-request, it stops forwarding and directly sends a route-reply to the source. Once the route is formed, some route maintenance procedure maintains it in the internal data structure of each node called as route-cache until the destination becomes unreachable along the route. Unlike table-driven routing protocols, not all the updated routes are maintained at every node. The examples of on-demand driven protocols are Ad-Hoc On-Demand Distance Vector (AODV) and Dynamic Source Routing (DSR) [7], [18].

2.3 DSR Protocol

Though the dynamic source routing protocol has many benefits [8], [14]; it does have some drawbacks, that limits its performance under certain conditions. Some of the drawbacks of DSR are as follows: Multicasting is not supported by DSR. All the source and destination route address along with the intermediate route address are present in the data packet header in DSR, thereby the

throughput is decreased. DSR responds with the route reply packets to route request packets that came through various routes. This maximizes the availability of a number of paths for source but also accumulates the routing packet load. Route entry invalidation or route prioritization mechanisms are not present in current specification of DSR.

2.4 Energy Aware Metrics

Most of the of energy efficient routing protocols [11], [12] tries to minimize energy consumption by the use of energy efficient routing metric, used in computation of routing table instead of the minimum-hop metric. By this way, energy efficiency in its packet forwarding can easily be introduced in a routing protocol. These protocols try either to route data using the path that has increased energy bottleneck, or to decrease the end-to-end transmission energy for the packets. The first method for energy efficient routing is called as Minimum Transmission Power Routing (MTPR) which makes use of a simple energy metric which is represented by the total energy utilized to send the information through the route. Through this, MTPR minimizes the transmission power that is utilized per packet, but the lifetime of each node is not directly affected.

III. DESIGN AND IMPLEMENTATION

The amount of energy consumed by all the packets traversing from source node to destination mode should be minimized i.e. the total amount of energy consumed in the packets when travels from one hop to the next hop should be low.

One's packet energy is calculated by the equation (1)

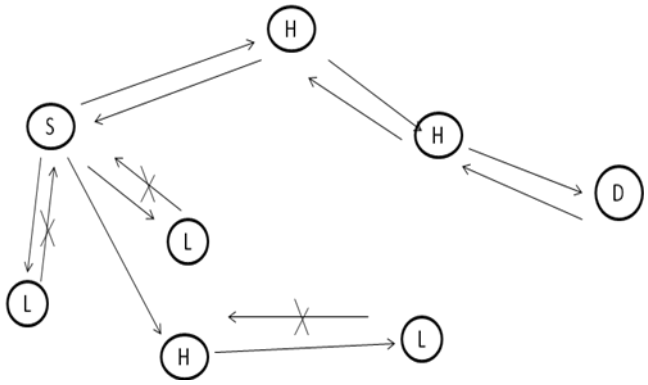
$$E_c = \sum_{i=1}^{k} T(n_i, n_{i+1}) \qquad (1)$$

where, *ni* to *nk* are nodes in the route while *T* denotes the energy consumed in transmitting and receiving a packet over one hop. Then we find minimum value for Ec. The main objective of EPAR is to minimize the variance in the remaining energy of all the nodes and thereby prolong the network lifetime.

3.1 Route Discovery And Maintenance In Proposed Algorithm

EPAR schemes make routing method to optimize performance of power or energy related evaluation metrics. Therefore the power aware routing schemes are transferable from one underlying routing protocol to another; relative merits and drawback remain valid. There are two routing objectives for minimum total transmission energy .When choosing a path, the DSR implementation chooses the path with the minimum number. The path is then selected by choosing the path with the maximum lowest hop energy values 19, 20 AND 40. The second path with energy values 26, 54,29and88. The battery power for the first and second battery is 19 and 26. Since second path is greater the second path is chosen. EPAR algorithm is an on demand source routing protocol that

uses battery lifetime prediction equation. This is with the dynamic topology. This protocol favors the path whose lifetime is maximum.



Consider a route-request to be sent from source to destination. The source will select the high power nodes to make a series of hop. In this case, low power nodes are ignored. By this, the packet will efficiently reach the destination without any loss or delay in the route travelled.

3.2 **Data Packet Format In Epar**

If for any reason a node chooses to change the transmit power for hoop I, then it must set the Pt value in minimum transmission power the link then the link flag is set. The table shows the data packet format for EPAR. This includes the DSR fields of EPAR.

TABLE 1. **Data packet format in modified EPAR.**

IP Header	DSR fixed Header	DSR Source Header	DSR source Route Address [1..N]	EPAR Source Route MTP [1…N]	Link Flag	DATA

IV. NETWORK METRICS FOR PROPOSED PROTOCOL PERFORMANCE

4.1 Dropped Packet

From central hub the packets are been transferred to all other nodes to reach the destination. The packets have the source name, destination name, panid value. Depending on this packet from source it goes on to reach the destination. The dropping of packets denotes the missing node.

4.2 Power Consumption

The central hub has the gathered information of all the animals in the boundary. And each animal has its own tag so that each and every thing is been noted. And the overall power is been stored in the central hub. To an end to end transmission added to it the hub with the higher power will be directed so that the data efficiency will be high without any loss of data.

4.3 Network Lifetime

The network lifetime mainly depends on the battery life time of the node. If the battery power is high in all the mobile nodes the network lifetime is increased. Thus network lifetime is the time at which the first node in the network runs out of energy before transmitting the packets, thereby losing some other functionality too.

4.4 Remaining Battery Power

Remaining battery life depends on an unknown mobile node .The number of nodes in the network versus the average remaining battery power is used to analyze the performance of the protocols in terms of power.

Remaining battery work=Initial energy–consumed energy

V. SIMULATION ANALYSIS

The simulated network of our case consists of 100 nodes that are scattered randomly in 11*11 km. The nodes are moving at different speeds ranging between 0 to 120 m/s. Table 2 shows the simulation parameter setting for the protocol evaluation.

Table 2: SIMULATION PARAMETERS

Number of nodes	100
Area size	11*11
Traffic type	CBR
Transmit power	0.5J
Receive power	0.1J
Routing protocols	DSR,EPAR

Fig. 1 shows the lifetime of the network using EPAR and DSR. Gradual increase is been analyzed in the network lifetime between EPAR and DSR. In each type of node the lifetime of EPAR is greater than that of DSR. This analyses is done to determine the time at which a sensor node or a group of sensor node in a network running out of energy. Also it can be said as the time until the first node dies.

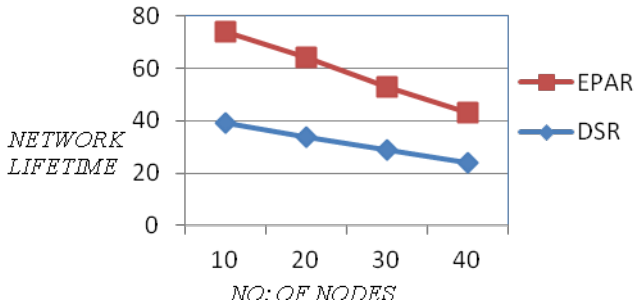


FIGURE 1. Network lifetime versus no: of nodes

Fig .2. show the network latency of EPAR and DSR. The EPAR has the maximum latency of network with the nodes. The time taken for the packet to travel from source to destination is network latency. Thus the networks of EPAR has a longer lifetime than which is running in DSR.

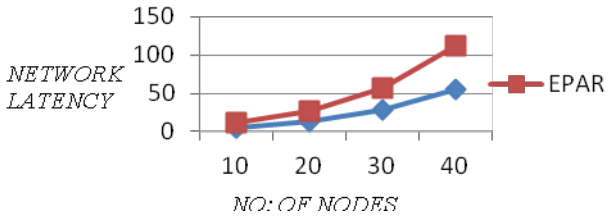


FIGURE 2. Network latency versus no: of nodes

VI. CONCLUSION

This paper deals to prevent the theft of the livestock in the farm. For this, we use a new methodology known as EPAR. This technique has high network lifetime and network latency compared to the traditional method. In this case, only nodes with sufficient energy will respond to the query from the central hub, not by all nodes i.e., data will be carrying forwarded by high power nodes only. If the missing node is the low power node or the query intended for particular node then it would respond for the query made. Hence, it provides high accuracy for searching and communicating the animals through the central hub. The EPAR algorithm that we have used is 65% more efficient than DSR algorithm.

REFERENCES

[1] V. Rishiwal, S. Verma, and S. K. Bajpai, ‘‘*QoS based power aware routing in MANETs*,’’ Int. J. Comput. Theory Eng., *vol. 1, no. 1, pp. 47–54, 2009.*

[2] Huang, ‘‘*On-demand location-aided QoS routing in ad hoc networks*,’’ in Proc. IEEE Int. Conf. Parallel Process., Montreal, QC, Canada, Aug. 2004, *pp. 502–509.*

[3] W.-H. Lio, Y.-C. Tseng, and K.-P. Shih, ‘‘*A TDMA-based bandwidth reservation protocol for QoS outing in a wireless mobile ad hoc network*,’’ in Proc. IEEE Int. Conf. Commun., *vol. 5. 2002, pp. 3186–3190. 196 VOLUME 2, NO. 2, JUNE 2014*Shivashankar et al.: Designing Energy Routing Protocol IEEE TRANSACTIONS ON EMERGING TOPICS IN COMPUTING

[4] J. Punde, N. Pissinou, and K. Makki, ‘‘*On quality of service routing in ad-hoc networks*,’’ in Proc. 28th Annu. IEEE Conf. Local Area Netw., Oct. 2003, *pp. 276–278.*

[5] P-J. Wan, G. Calinescu, X. Li, and O. Frieder, ‘‘*Minimum-energy broadcast routing in static ad hoc wireless networks*,’’ in Proc. IEEE INFOCOM, Apr. 2001, *pp. 1162–1171.*

[6] S.-L. Wu, Y.-C. Tseng, and J.-P. Sheu, ‘‘*Intelligent medium access for mobile ad hoc networks with busy tones and power control*,’’ IEEE J. Sel. Areas Commun., *vol. 18, no. 9, pp. 1647–1657, Sep. 2000.*

[7] S. Muthuramalingam, R. RajaRam, K. Pethaperumal, and V. K. Devi, ''*A dynamic clustering algorithm for MANETs by modifying weighted clustering algorithm with mobility prediction*,'' Int. J. Comput. Elect. Eng., *vol. 2, no. 4, pp. 709–714, 2010.*

[8] S. Gupta, C. K. Nagpal, M. Kaur, and B. Bhushan, ''*Impact of variable transmission range on MANET performance*,'' Int. J. Ad Hoc, Sensor Ubiquitous Comput., *vol. 2, no. 4, pp. 59–66, 2011*.

[9] S. Shankar, B. Sivakumar, G. Varaprasad, and G. Jayanthi, ''*Study of routing protocols for minimizing energy consumption using minimum hop strategy in MANETs*,'' Int. J. Comput. Commun. Netw. Res., *vol. 1. no. 3, pp. 10–21, 2012*.

[10] P. Goyal, V. Parmar, and R. Rishi, ''*MANET: Vulnerabilities, challenges, attacks, application*,'' Int. J. Comput. Eng. Manag., *vol. 11, pp. 32–37, Jan. 2011*.

[11] S. Shakkottai, T. S. Rappaport, and P. C. Karlsson, ''*Cross-layer design for wireless networks*,'' IEEE Commun. Mag., *vol. 41, no. 10, pp. 74–49, Oct. 2003.*

[12] S. Mishra, I. Woungang, and S. C. Misra, ''*Energy efficiency in ad hoc networks*,'' Int. J. Ad Hoc, Sensor Ubiquitous Comput., *vol. 2, no. 1, pp. 139–145, 2011*.

[13] Poongodi and A. M. Natarajan, ''*Optimized replication strategy for intermittently connected mobile networks*,'' Int. J. Business Data Commun. Netw., *vol. 8, no. 1, pp. 1–3, 2012*.

[14] S. Shankar, B. Sivakumar, and G. Varaprasad, ''*Implementing a new algorithm for analysis of protocol efficiency using stability and delay tradeoff in MANET*,'' Int. J. Comput. Technol., *vol. 2. no. 3, pp. 11–17, 2001*.

[15] Kim, J. J. Garcia-Luna-Aceves, K. Obraczka, J.-C. Cano, and P. Manzoni, ''*Routing mechanisms for mobile ad hoc networks based on the energy drain rate*,'' IEEE Trans. Mobile Computing., *vol. 2, no. 2, pp. 161–173, Apr./Jun. 2006.*

[16] M. Izuan and M. Saad ''*Performance analysis of random-based mobility models in MANET routing protocol,''* Eur. J. Sci. Res., *vol. 32, no. 4.*

UNCERTAINTY ANALYSIS FOR SEISMIC HAZARD IN THE COLLAPSE OF DIP SLOPE ON FREEWAY NO. 3

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ABSTRACT

Long-term water immersion can cause the weakening of slope rocks and a substantial decline in the parametersof the rock layer, such as cohesion C and friction angle Ø, thus leading to slope failure. Generally, the traditional analysis of slope failure sets the fixed valuesto the required parameters by means of limit equilibrium, while leaving out the uncertainties related to the parameters. It fails to fully reflect the slope safety factor, resulting in insufficient reliability of the calculated safety factor.

This study examines the collapse of Dapu dip slope on Freeway No. 3 as a case to review the uncertainties in the variation of safety factor before and after water immersion and the weakening of slope rocks. It conducts 4 kinds of probability analysis, ROSEN, MDPE, HARR and GMCS to calculate the corresponding slope safety factors for comparison, takes advantage of Monte Carlo method to establish the reliability of slope slide and probability of slope failure, and finally explores the effect ofρon safety factor, wherein ρ is the correlation coefficient of the rock parameters c and tanØ.

Keywords : Dip Slope, Rock Weakening, Reliability, Monte Carl@

I. INTRODUCTION

Taiwan is located at the junction of the Eurasian plate and the Philippine Sea plate, with faults and joints caused by plate movement that gives rise to crustal extrusion. At the same time, its young age of deposition and vulnerability to erosion and weathering results in poor cementation and soft rocks in some areas. Together with rain in Taiwan, severe weathering makes the stratum even weaker.

The methods of slope stability analysis proposed by the current study consists of limit equilibrium analysis and limit analysis. Limit analysis needs to identify the stress-strain relationship for the slope material, which is too complex to grasp, so the traditional engineering design mainly conducts limit equilibrium analysis for slope stability analysis. Slope stability analysis is often represented by Factor of Safety (FS) in many ways, for example, the intensity ratio of anti-sliding shear stress to sliding shear stress for the sliding surface FS on most infinite slopes, anti-sliding force to sliding force on finite slopes, anti-sliding moment to sliding moment on arc sliding slopes.Slope height ratiocan also be applied, namely the ratio of the critical slope height calculated via a theoretical formula to the actual slope height, as well as the method of strength reduction. If we take into account all these representations, Factor of Safety (FS) can be represented by the ratio of anti-sliding factor to sliding factor on the sliding surface:

$$FS = \frac{R}{D}$$,R= resistance factor, D= sliding factor (1)

As long as FS> 1, the slope is stable; if FS <1, the slope instability will cause sliding or collapse. Almost all the representationsfail to consider the uncertainties of variables or parameters in the analysis model. For example, resistance and sliding factors contain many objective and subjective uncertainties, so sometimes collapse or sliding occurs even though the designed slope FS> 1. The two systems have the same mathematical formula, each variable has the same mean (e.g., $m_A = m_B$), which brings the same design FS (e.g., $FS_A = FS_B$), but variable measurement contains uncertainties, and the variances of variablesare not the same (e.g., $s_A \neq s_B$), resulting in different probabilities of failure in the two systems, (e.g., $P_f(A) \neq P_f(B)$), so damage occurs to some of the traditional slope designs that meet the FS requirements.Fig.1 shows the systems of A and B. The means are the same ($m_A = m_B$), so the safety factors are also the same ($FS_A = FS_B$). However, $s_A < s_B$, so $P_f(A) < P_f(B)$. This is the case in which the two systems have the same safety factor but different probabilities of failure.

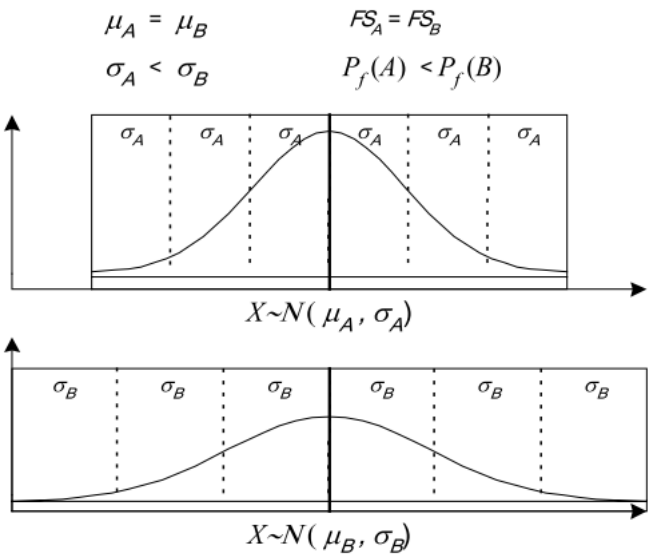

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Fig.1 Systems of A and B

Therefore, the “safe design” based on traditional FS may not be the true reflection of “safety”. The Reliability Analysis Model, which considers the effect of the variance of each variable or parameter, can calculate the probability of failure and Reliability Index (RI) or Safety Index (SI). It is a better way to show the degree of slope safety and reliability and achieve the effect of warning.

This study examines the failure of Dapu dip slope on Freeway No. 3 as a case to establish a slope model according to the field conditions without considering external forces and anchor reinforcement,in an attempt to explorethe variations of slope safety factorand variability of rock slope parameters (γ, c, ∅) before and after immersion and the weakening of slope rocks. It conducts 4 kinds of probability analysis, ROSEN, MDPE, HARR and GMCS, to explore the effect of parameter uncertainty on slope stability,as well asMonte Carlo method to establish the reliability of slope slide and the probability of slope failure, and finally explores the

effect of correlation coefficientof rock parameters c and tanØ, ρ, on safety factor.

II. CASE DESCRIPTION

A severe slope failure occurred at 3.1K of Freeway No. 3 on April 25, 2010 (seeFig.2). The region's strata are composed of the Talio formation of Early Miocene and the Shihti formation of Middle Miocene, both of which strike NE-NNE and tilt southeastward, with the geological cross-section shown in Fig.3, in which slide occurred mainly along the thin interbed and thin laminae of sandshale. The slope failure is about 185m long from the collapse source to the freeway slope, and about 155m wide at the bottom. The collapse source fell by 15.8m from about 161.5m to 145.7m, resulting in a damaged area of 14,000m^2.

Fig.2 Large-scale landslide of dip slope at 3k + 100 of Freeway No. 3

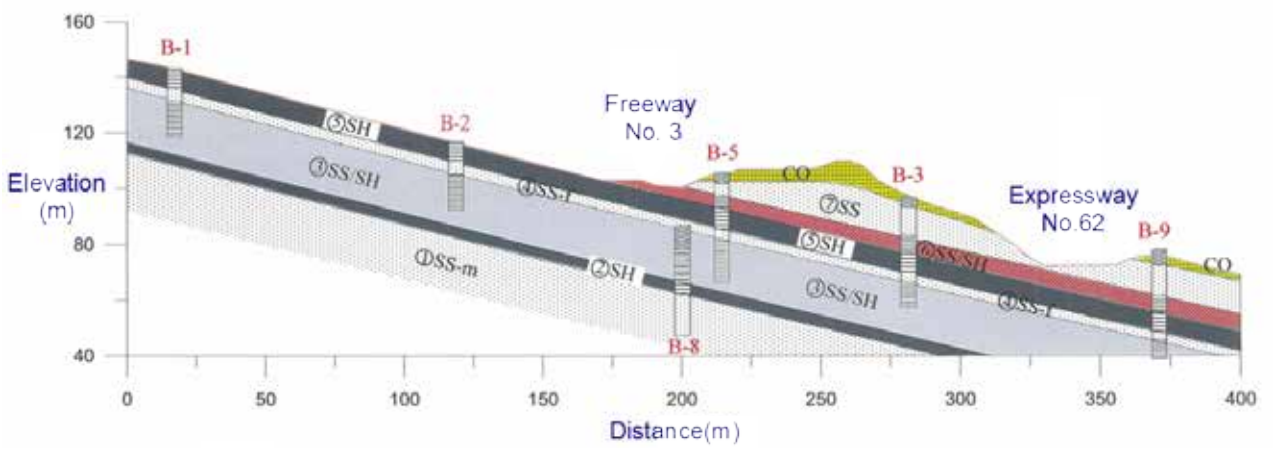

Fig.3 Stratigraphic section perpendicular to the freeway (MOTC, 2011)

After the landslide occurred at 3.1 km of Freeway No. 3 in Qidu on April 25, 2010, the Ministry of Transportation and Communications (MOTC) presented a report on the disaster in the following year, and the landslide findings and the formation parameters are summarized as follows:

1. The disaster is mainly a typical dip slope slide. Judged from the features, the critical slip condition had been reached before the destruction as the groundwater infiltration softened the sliding surface of the dip slope

wedge. At that time, only the rusty anchors maintained their stability and the steel strand of the anchors was overloaded in the disaster, which was the result of the continuous destruction of the independent anchors within a short time.

2. The subsequent endoscopic investigation of the anchor components exposed at the dip slope site show significant anchor corrosion, which not only gradually reduced the tensile strength and safety factor of the anchor, but also caused the slope to collapse with in the shortest time.
3. Destruction course: The disaster is a dip slope slide caused by up to more than a decade of gradual weakening and anchor component corrosion due to long-term groundwater infiltration. The main reasons for destruction are developed slope joints, obvious geological structure of the dip slope, groundwater infiltration and seasonal water level changes that softened the rocks and corroded the anchor strand.
4. The shear strength parameters of the rocks on the site of the dip slope slide of Freeway No. 3 are excerpted in Table 1, where the test numbers RDS (D)-4, RDS (D)-5, RDS (W)-3 and RDS (W)-4 are the formation parameters of the sliding surface for shale and sandshale.

III. ESTABLISHMENT OF SLOPE FAILURE MODEL

The landslide at 3.1 km of Freeway No. 3 is mainly a dip slope failure due to the slide between sandshale strata. Lateral sliding analysis and simulation is carried out in this paper, as shown in Fig.4, and is described as follows:

$$F.S. = \frac{cL + W\cos\theta \tan\varphi}{W\sin\theta} \quad (2)$$

C and φ are the interface parameters of shear strength, W is the weight of the slider ∆ABC, L is the length of the sliding surface, θ is the inclination of the sliding surface, and N is the positive force acting on the sliding surface. Because:

@ $$W = \frac{1}{2}\gamma H(H\cot\theta - H\cot\beta) = \frac{1}{2}\gamma H^2 \frac{\sin(\beta-\theta)}{\sin\beta\sin\theta}$$ @HSI@

$$N = W \quad (4)$$

$$L = \quad (5)$$

Table 1Shear Strength Parameters

No.	Hole No.	Depth (m)	normal stress (kg/cm^2)	peak strength		residual strength		lithologic character	plane of shear
				Cp (kg/cm^2)	Øp (degree)	Cr (kg/cm^2)	Ør (degree)		
RDS(D)-1	B-1	3.00-4.00	2.0/5.0/8.0	2.5	28.0	0.0	25.0	shale	Intact Rock

RDS(D)-2	B-2	4.00-5.00	2.0/4.0/5.0/7.0	2.6	30.1	0.0	28.0	shale	Intact Rock
RDS(D)-3	B-4	2.60-3.60	2.0/5.0/7.0/8.0	1.5	26.7	0.0	22.0	shale	Intact Rock
RDS(D)-4	B-6	16.60-17.00	2.0/5.0/7.0	0.28	22.5	0.0	19.8	Alternations of S.S. & Sh.	bedding plane
RDS(D)-5	B-7	18.00-19.00	2.0/4.0/5.0/6.0	3.2	28.5	0.0	22.7	shale	Intact Rock
RDS(D)-6	B-8	16.00-17.00	2.0/4.0/5.0/7.0	0.7	36.5	0.0	29.0	Alternations of S.S. & Sh.	Intact Rock
RDS(W)-1	B-1	0.00-1.00	2.0/4.0/5.0/7.0	2.1	29.0	0.0	17.2	shale	Intact Rock
RDS(W)-2	B-2	3.40-3.80	2.0/3.0/5.0/7.0	0.5	46.0	0.0	22.0	shale	Intact Rock
RDS(W)-3	B-3	16.60-17.00	2.0/5.0/7.0	0.9	27.7	0.0	23.2	Alternations of S.S. & Sh.	bedding plane
RDS(W)-4	B-5	16.60-17.00	2.0/3.0/5.0/7.0	1.1	26.2	0.0	14.1	shale	Intact Rock
RDS(W)-5	B-9	38.00-39.00	2.0/3.0/5.0/7.0	0.5	34.6	0.0	21.0	Alternations of S.S. & Sh.	Intact Rock
RDS(W)-6	B-10	10.25-11.00	2.0/4.0/5.0/7.0	1.4	37.0	0.0	24.6	Alternations of S.S. & Sh.	Intact Rock
RDS(W)-7	B-6	22.40-22.50	1.0/2.0/4.0	-	-	0.0	21.5	shale	Intact Rock
RDS(W)-8	B-6	17.30-17.40	2.0	-	-	0.0	20.0	Alternations of S.S. & Sh.	bedding plane

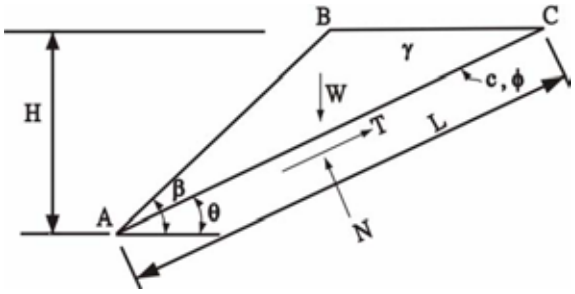

Fig.4 Parallel sliding surfaces of finite slopes

Plug (3), (4), and (5) into (2) to get:

$$F.S. = \frac{\text{Resistance}}{\text{Driving force}} = \frac{2c\sin\beta}{\gamma H\sin(\beta-\theta)\sin\theta} \quad (6)$$

$$\text{Probability of failure } Pf = FS(c, \varphi, \gamma) - \quad (7)$$

This study establishes the parameters for the slope model by simulating the landslide disaster at 3.1 km of Freeway No. 3 in reference to the MOTC report (2011). We take into account the variability of all the formation parameters, γ, c and φ, except for the slope height H = 25m, the sliding surface inclination $\theta = 15^0$ and slope

angle $\beta = 20^0$. The parameters of slope failure model thus established are shown in Table **2**.

Table 2 The parameters of the slope failure model

Parameter	Mean	Standard Deviation (std)	Distribution	Remarks
γ(Kn	22.9	0.11	Normal distribution	
Cp(Kn	2.8-32		Uniform distribution	Before immersion (peak strength)
Cr(Kn/m^2)	0		Constant	After immersion (residual strength)
Øp(degree)	26.1	2.23	Normal distribution	Before immersion (peak strength)
Ør(degree)	19.95	3.62	Normal distribution	After immersion (residual strength)

IV. SENSITIVITY ANALYSIS

This study used EXCEL to calculate the range of rock safety factor both before and after the immersion, and found out that the safety factor was about 3.04 before and 1 after, which was consistent with the MOTC report (2011), thus verifying the feasibility of the lateral-sliding slope failure model employed in this study.

The MOTC report (2011) shows that the rock unit weight g had no significant variation before and after the immersion, but the cohesion c and the friction angle φ substantially reduced after the immersion, resulting in the weakening of the rock, so the variability of the parameters c and φ need to be taken in account. This study therefore explores the uncertainty of these two parameters (cohesion c and friction angle φ), which have higher variabilitythatn other parameters, as well as to what extent their uncertainty influences slope safety factor. In this study, we take into account the variability of the formation parameters c and φ for single-factor and multi-factor sensitivity analysis,respectively,based on field conditions except for the slope height $H = 25m$, the sliding surface inclination $q = 15^{\circ}$,the slope angle $b = 20^{\circ}$,and the unit weight γ = constant. The analysis results arepresented as follows:

4.1 Univariate Sensitivity Analysis

In this study, univariate sensitivity analysis is performed when c and φreduce respectively by 10%, 20% and 30% to facilitate the understanding of how the formation parameters influence FS, with the findings shown in Fig.5. It is found that when cohesion c and φreduce by 30% respectively, the safety factor reduces by 27.63% and 14.47% respectively. The sensitivity of cohesion c is nearly 100% higher than that of friction angle φ, showing that cohesion c has a greater effect on slope safety factor than friction angle φ does.

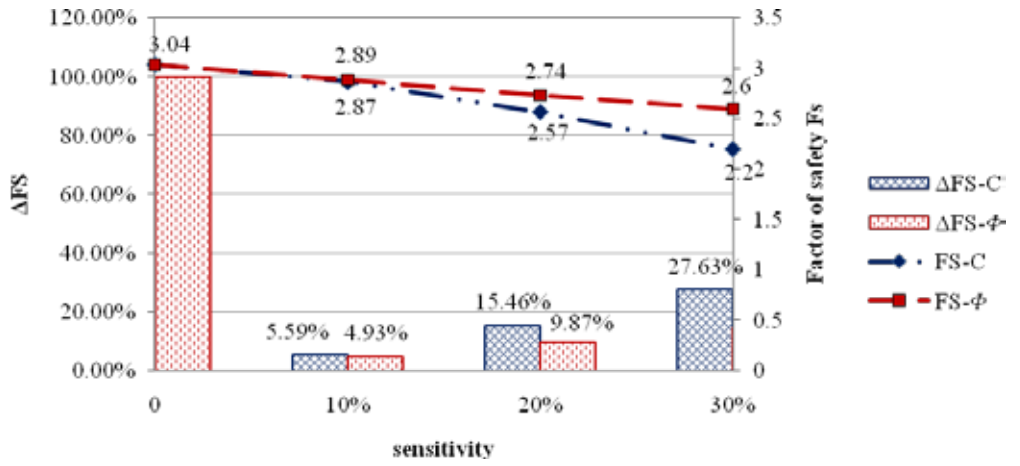

Fig.5 Univariate Sensitivity Analysis

4.2 Multivariate Sensitivity Analysis

The rock weakening due to the immersion will reduce cohesion c and friction angle φ. This study employs multivariate sensitivity analysis to study the changes in slope safety factor after the decrease in the interaction of cohesion c and friction angle φ (as shown in Fig.6). The study has found that when cohesion c and friction angle φ drop down to 6Kpa and 19^0 respectively, the slope safety factor FS <1, which will lead to an unstable state.

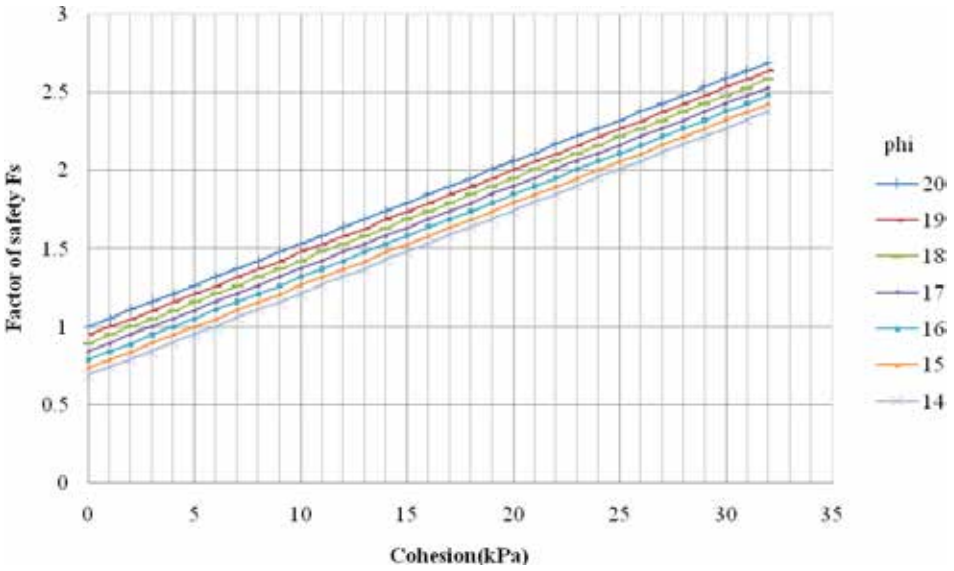

Fig.6 Multivariate Sensitivity Analysis

V. UNCERTAINTY ANALYSIS

In this section, uncertainty analysis is conducted to explore the effect of rock slope parameter (c, φ) variability on stability. Four probability estimation methods, ROSEN, MDPE, HARR and GMCS,are used torespectively calculate the effect of the correlation coefficient for the parameters c and tanφ (ρ = 0 and ρ =-0.5)onthe probability of failure Pf (Pf = FS-1) (in Table 3).The results show thatthe calculated slope safety factor does not changesignificantly with different probability estimation methods regardless of the presence of the correlation

coefficient forc and tanφ. The Pf calculatedusing different methods is greater than 1 (Pf> 1) before the immersion (safe side), and after the immersion, the weakening leads to a substantial decline in the slope safety factor, and the probability of failure approaches 0 (Pf≅0) (imminent destruction), thus indicating that the slope is in the state of critical failure.The GMCS method (1,000 samples, detailed in Fig.7) shows that it is consistent with the traditional safety factor analysis FS≅ 1 (Pf≅0), but the probability of failure is up to 50%, thus indicating an urgent need for taking stabilizing measures.It can also be seen from the correlation coefficient for parameters c and tanφ(ρ =-0.5)that when probability P≈ 90% or 10%, the correlation coefficient is more sensitive and affects the probability of failure Pf by approximately ± 4%.

Table 3 Probability estimation methods to assess probability of failure

method		ρ = 0		ρ = -0.5	
		before the immersion	after the immersion	before the immersion	after the immersion
ROSEN	MEAN	1.2697	0.0018	1.2697	0.0018
	STD. DEV.	0 .4302	0.1968	0.3970	0.1968
MDPE	MEAN	1.2697	0.0018	1.2697	0.0018
	STD. DEV.	0.4302	0.1977	0.5433	0.1969
HARR	MEAN	1.2697	0.0018	1.2697	0.0018
	STD. DEV.	0.4657	0.1977	0.3969	0.1968
GMCS	MEAN	1.2779	0.0060	1.2596	-0.0030
	STD. DEV.	0.4629	0.1964	0. 5263	0.1964

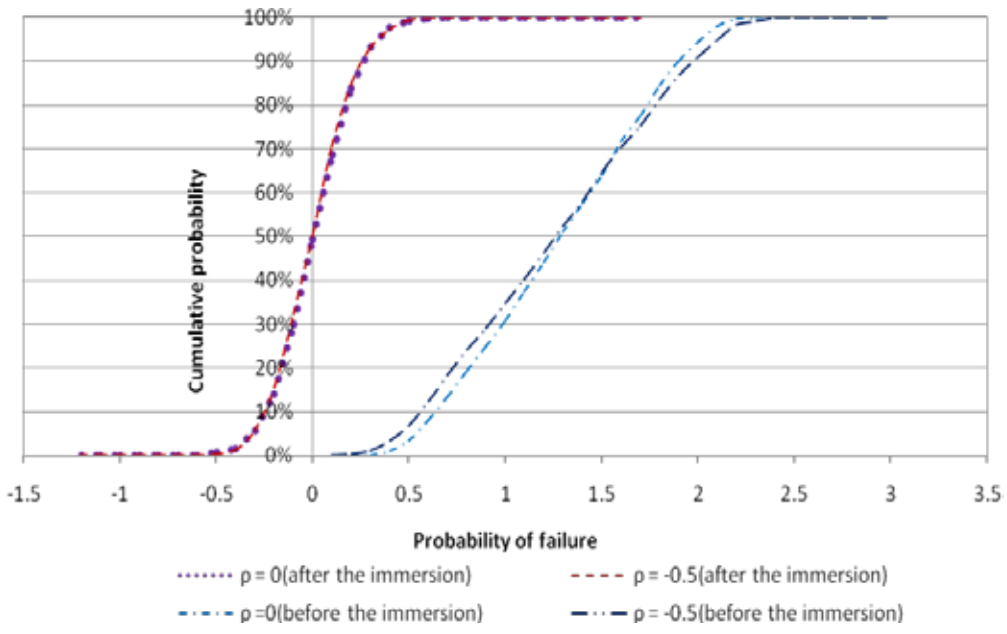

Fig.7 Probability of failure before and after the immersion

VI. CONCLUSIONS AND RECOMMENDATIONS

This study is carried out onthe slope failure at 3K+100 of Freeway No. 3 to establish a slope failure model in reference to field conditions, whichconsiders the uncertainty of rock parameters based on the reliability index method.It uses EXCEL forunivariate and multivariate sensitivity analysis on cohesion C and friction angle φ, and four probability estimation methods, ROSEN, MDPE, HARR and GMCS to assess the variability of rock strength parameters, including the differences inprobability of failure Pf for ρ = 0 and ρ =-0.5, where ρ is the correlation coefficient for c and tanφ. The important conclusions are listed as follows:

1. Before the immersion, the slopewas in a steady state, wherein FS> 2.The weakeningcaused by the immersion reduces cohesion C from 32Kpa to 0Kpa and friction angle φ from to below , and the safe coefficient FS is less than 1, which will give rise to slope instability, so water is the biggest factor affecting slope stability.
2. Before and after the immersion, the rock unit weight changes little, but cohesion c and friction angle φ change a lot. The tests of single factor (c or φ) on the slope safety factor show thatcohesion c is more sensitive to slope stability uncertainties than friction angle φ.
3. The multivariate sensitivity analysis of cohesion c and friction angle φ shows that when cohesion c drops to 6Kpa and friction angle φ to , the slope safety factor FS <1 and the slope is subject to an unstable state.
4. ROSEN, MDPE, HARR and GMCS were all applied forthe estimation and they differ little from one another in calculating the slope safety coefficient before and after the immersion.The GMCS method (1,000 samples) shows that it is consistent with the results of the traditional analysis FS≈1, but the probability of failure is up to 50%, thus indicating an urgent need for taking stabilizing measures.
5. The study also considered the correlation coefficient for c and tan φ (ρ = 0 and ρ =-0.5), and thetested probability isP≈ 90% or 10%.The higher sensitivity of correlation coefficient when ρ =-0.5 affects the probability of failure Pf by approximately ± 4%.

REFERENCES

[1] D. V. Griffiths and G. a. Fenton, *Probabilistic Slope Stability Analysis by Finite Elements, J. Geotech. Geoenvironmental Eng., 2004, vol. 130, no. 5, pp. 507–518.*

[2] X. Z. Wu, *Probabilistic slope stability analysis by a copula-based sampling method, Comput. Geosci., 2013, vol. 17, no. 5, pp. 739–755.*

[3] G. A. Fenton and D. V. *Griffith, Reliability-Based Geotechnical Engineering,GeoFlorida 2010 Adv. Anal. Model.Des. (GSP 199) © 2010 ASCE, pp. 14–52, 2010.*

[4] J.-Y. Ho, and K. T. Lee, *Predicting the Probability of Shallow Landslide Occurrence - Case Study of Da-Tsu-Ken Watershed, J. Chinese Soil Water Conserv.,2010, vol. 41, no. 4, pp. 285–295.*

[5] K. Yang and Y. Lee,*lNFLUENCE OF FAILURE PROBABILlTY DUE TO PARAMETER V ARIANCE CHARACTERISTICS FOR ROCK WEDGE SLOPE, J. Chinese Inst. Civ. Hydraul. Eng., 2012, vol. 24, no. 2, pp. 111–119.*

[6]Wen Zhao Chen, Quan Chen Gao, Jun She Jiang, *Slope instability risk analysis in earth dams considering uncertain factors , Applied Mechanics and Materials, 2011, 117-119, 1475-1478.*

[7]Hung,J. J. *A study on the failure anddisaster prevention of dip slopes, Journal of Civil and Hydraulic Engineering, 2010,94, 5-18.*

[8]Barton, N.,*Review ofa new shear strength criterion of rock joints, Engineering Geology,1973,7, 287-322.*

[9] J. T. Christian, C. C. Ladd, and G. B. Baecher, *Reliability Applied to Slope Stability Analysis, Journal of Geotechnical Engineering, 1994, vol. 120, no. 12. pp. 2180–2207.*

[10] A. I. HuseinMalkawi, W. F. Hassan, and F. A. Abdulla, *Uncertainty and reliability analysis applied to slope stability, Structural Safety, 2000, vol. 22, no. 2, pp. 161–187.*

[11] M. Schwarz, F. Preti, F. Giadrossich, P. Lehmann, and D. Or, *Quantifying the role of vegetation in slope stability: A case study in Tuscany (Italy), Ecol. Eng.,2010, vol. 36, no. 3, pp. 285–291.*

[12]Ministry of Transportation and Communications R.O.C. (2010).*"Translational slide at the Cidu section (3K+100) of Formosan Freeway preliminary examination report,Ministry of Transportation and Communications R.O.C. Report. (in Chinese)*

PERFORMANCE ANALYSIS OF AODV ROUTING PROTOCOL IN MOBILE ADHOC PROTOCOL

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ABSTRACT

Wireless communication is the transfer of information between two or more points that are not connected by an electrical conductor. In order to communicate each other, the nodes cooperatively forward data packets to other nodes in the network by using the routing protocol, they are vulnerable to many severe attacks. we address so many attacks as wormhole attack , Sybil attacks, man-in-middle attacks, sinkhole attacks , jamming attacks and flooding attacks e.t. Routing is a crucial factor of security in MANET and hence the focus of this thesis along with the performance analysis of routing protocols. The comparison analysis will be carrying out about these protocols using Simulator NS 3. In this paper we find the solution approaches which are Result Verification Mechanism for AODV Routing Protocol in MANETs. Mobile Ad hoc Network is based on demand routing protocol to improve the performance and provide secure communication between two devices.

Key words: MANET, AODV, MAODV, Wormhole Attack, Sybil Attack, Simulator NS 3

I INTRODUCTION

A Mobile ad hoc network is a group of wireless mobile computers (or nodes) in which nodes collaborate by forwarding packets for each other to allow them to communicate outside range of direct wireless transmission. Ad hoc networks require no centralized administration or fixed network infrastructure such as base stations or access points, and can be quickly and inexpensively set up as needed. A MANET is an autonomous group of mobile users that communicate over reasonably slow wireless links. The network topology may vary rapidly and unpredictably over time, because the nodes are mobile. The network is decentralized, where all network activity, including discovering the topology and delivering messages must be executed by the nodes themselves [17]. A mobile ad hoc network is collection of self-configuring and adaption of wireless link between communicating devices (mobile devices) to form an arbitrary topology without the use of existing infrastructure. In wireless network technology, simulative analysis is a significant method to understand the performance of routing protocol. In this paper an attempt has been made to compare the performance of two prominent on-demand reactive routing protocols for mobile ad hoc networks: The On-demand protocols, AODV perform better under high mobility simulations than the table-driven protocol. Although AODV perform well with respect to all included performance matrices in the paper if it has no constraints of bandwidth. The performance differentials are analyzed using varying network load, mobility, and network size [8].

1.1 Performance Issues in MANET

Performance in Mobile Ad-Hoc Network (MANET) is the most important concern for the basic functionality of network. To judge the quality of a protocol one needs to test them on the basis of metrics i.e. both qualitative and quantitative. These metrics are used to measure the suitability and performance of the different protocols. The metrics should be chosen carefully and should be independent of any routing protocol. The following is a list of all desirable qualitative properties of MANET as follows:-

- **Security:** - A MANET routing protocol is vulnerable to many forms of attack. They are more prone to security replay transmission, do spoofing threats than other general wired networks because the network structure is not strictly defined. Also a number of nodes keep on getting added as well as deleted from the network making it very easy for a malicious node to enter a network. Then it will be relatively easy for that node to snoop on network traffic, redirect traffic and flood the entire network. Security is very important to stop any kind of disruption of the network. There are three Attacks in security as follows:
- Wormhole Attack Detection in MANET
- Sybil Attack Detection in MANET
- DOS and blackhole Attack Detection in MANET

II. PERFORMANCE EVALUATION MATRICE

Throughput-Throughput is the average rate of successful message delivery over a communication channel. Throughput is usually measured in bits per second (bits/sec), and sometimes in data packets per second or data packets per time slot. High throughput is always desirable in a communication system.

Packet Delivery Ratio: The ratio between the numbers of packets received by the TCP sink at the final destination and the number of packets originated by the “application layer” sources. It is a measure of efficiency of the protocol.

End to End Delay- End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination**.** A data packet may take longer time to reach to the destination due to queuing and different routing paths.

Average Jitter- Jitter is the variation in delay by different data packets that reached the destination and can seriously affect the quality of audio/video and thus an unwanted parameter.

Average Queue Length- It is FIFO Queue Size (bytes) in MAC layers. The length of Queue depends on congestion and route discovery

III COMMON FINDINGS

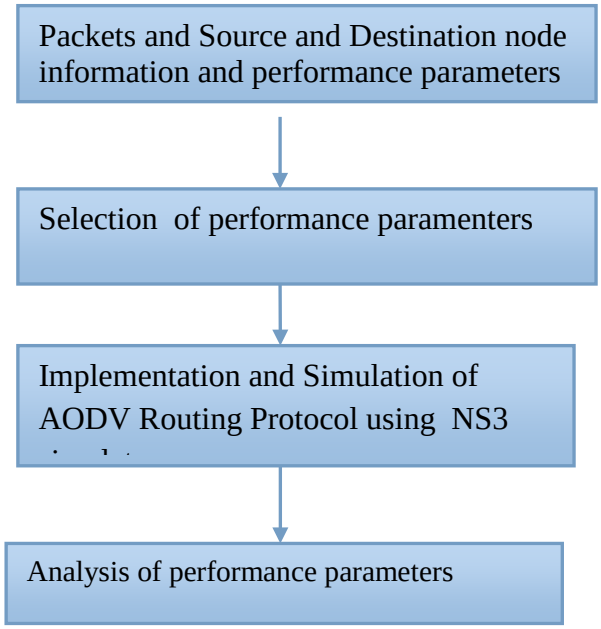
- Ranging method has costs less, no use for high accurate range, but it has extremely precise. It is particularly suitable for the low-cost, lacking resources of wireless sensor network.
- The IDS system is used for wireless *A*dhoc networks which provides with capability of detecting attacks inside and outside of system.
- A cross layer hierarchy design improves Quality of service by high communication of the layers.

- Advantage of the analytical model is presented in this paper which results offer great insights for new worm detection techniques.
- FIS system successfully detects the wormhole present in the MANET using network and physical layer parameters.
- FMS (Feature monitoring system) approach has no need to maintain any hardware requirements like directional antennas, time synchronization, and any unwanted assumptions.
- Wormhole detection technique detects the wormhole, and will serve as improved form of existing AODV protocol.
- Cross layer detection techniques achieves a high accuracy in predicting and defending the network against all Denial of Service attack.
- AODV protocol detects the legitimate path and wormhole path in the network efficiently.
- The sending Route Request (RREQ) processes with RTT method has lowest packet dropped and cannot interrupt the transmission processes thus reduces the traffic loads and increase the performance.
- There are no requirement of any special hardware like directional antennas, time synchronization, and any unwanted assumptions and any complex calculation in the AODV routing protocol.

3.1 Objectives can be outlined as follows

- To Design Network scenario for implementing existing AODV Routing Protocol.
- To make certain modifications in AODV Routing Protocol.
- To decide input/output parameters.
- To carry out Performance Analysis of Existing and modified routing protocol.

Functional Diagram



VI. CONCLUSION

The review of 20 research papers has been carried out in the area of Simulation Based Performance Analysis of Routing Protocols in Mobile ad hoc Network and find out current challenges and scope of work in the area. After the review, one issue was found which should be given proper concern, during the designing and implementation of performance analysis mechanism of routing protocols. The solution approaches under particular issues were studied in depth and were analyzed on the basis of various findings, which helped to understand the strengths and weaknesses of the solution approaches. A routing protocol plays a key role to measure the performance of a MANET. Routing protocols are classified under two categories; proactive protocols and reactive protocols.

As initial objectives, some more specific research papers related to Comparative analysis of routing protocols were reviewed. We analyzed the performance investigation of performance of routers in wireless network on the basis of AODV, DSR, and another protocols and parameters such as throughput, end to end delay and PDR. After that we proposed a Mixed Routing Protocol framework which improves performance.

Further on, we can evaluate the performance of proposed model of simulation enabled on-demand protocols. Beside this, in Future, we will incorporate route break prediction in our proposed different-different routing protocols.

REFERENCES

[1] Larry Korba ,1998," Security System for Wireless Local Area Networks ", In IEEE, National Research Council of Canada, Issue on security of WLAN ,pp1550-1554,1998.

[2] Upkar Varshney, 1998, "Design and Performance Evaluation of Connection Routing Schemes for Wireless ATM Environment", In IEEE, International Conference on Universal Personal Communications (ICUPC), pp. 409-415, 1998.

[3] Upkar Varshney, 1999," Connection Routing Schemes for Wireless ATM", In IEEE, Proceedings of the 32nd Hawaii International Conference on System Sciences, 1999.

[4] Jun-Zhao,2001,"Mobile Ad Hoc Networking :An Essential Technology for Pervasive Computing", In IEEE, IEEE Journal on Selected Areas in Communications, Issue on routing in MANET,pp 316-321,2001.

[5] Harish Sitaraman, Jesse M. Davis,Joseph B. Evans, 2001,"Broadband Wireless Local Loop Evaluation Via an Active TCP Connection Monitoring Methodology", In IEEE, IEEE Communications Magazine, Issue on Monitoring in Wireless network, pp 594-603, 2001.

[6] Prashant Krishnamurthy, Joseph Kabara, Tanapat Anusas-amornkul, 2002, "Security in Wireless Residential Networks", In IEEE, IEEE Transactions on Consumer Electronics, Vol. 48, pp.157-166, 2002.

[7] Ha Cheol Lee, 2003, "The Relation of Cell and Call Connection Level GoS for the Random Traffic in the Wireless ATM Access Transport", In IEEE, Proceedings of ICCT, pp. 886-890, 2003.

[8] Debao Xiao , Chao Chen, Gaolin Chen, 2005, "Intrusion Detection based Security Architecture for Wireless Sensor Networks", In IEEE, Proceedings of ISCIT, 2005.

[9] Shi Zhong, Taghi M. Khoshgoftaar and Shyarn V. Nath , 2005, "A Clustering Approach to Wireless Network Intrusion Detection", In IEEE, Issue on security of wireless networks, Vol.2, No.3, 2005.

[10] Wider D. YU, Vijaylaxmi Jothiram, 2007, "Security in Wireless mobile Technology for Health care System",In IEEE, Issue on security of wireless mobile technology, 2007, pp,308-311, 2005.

[11] Hany Samul, Weihua Zhuang,Bruno Presis, 2008, "Routing over Interconnected Heterogeneous Wireless Network with Intermittent Connections ", In IEEE, IEEE Communication Society, Volume 56, routing in Wireless network, pp 2282-2286, 2008.

[12] Qian Zhang, Ya-Qin Zhang, 2008, " Cross-Layer Design for QoS Support in Multihop Wireless Networks", IEEE, Volume 96, No. 1, Issue on Quality of service in Multihop networks, 2008.

[13] Hassen Redwan and Ki-Hyung Kim, 2008, "Survey of Security Requirements, Attacks and Network Integration in Wireless Mesh Networks", In IEEE, Issue on security on Wireless Mesh Networks,Japan-China Joint Workshop on Frontier of Computer Science and Technology, pp. 3-9, 2008.

[14] Nilesh Ananthanarayanan, 2008,"Vehicle Monitoring System in Wireless Networks", In IEEE,Issue on Monitoring of Wireless Networks,Vol. 26 ,no.5,pp. 141 -146, 2008.

[15] Okoli. Adaobi, Ejiro Igbesoko, Mona Ghassemain,"Evaluation of Security Problems and Instruction Detection System for Routing Attacks in Wireless Self-Oragnised Wireless Network", In IEEE, International Journal of Communications and Information Technology,Volume1,Issue on Security in Wireless Network, pp 16-20, 2012.

[16] Rashween Kaur Saluja, Rajesh Shrivastava, 2012, "A Scenario Based Approach for Gateway Discovery using Manet Routing Protocol", In IEEE, International Conference on Computer Communication and Informatics(ICCI-2012),issue on Routing in Mobile Ad Hoc Network, 2012.

[17] Yan Yu, Yubao Yao," Improved AODV Routing Protocol for Wireless Sensor Network and Implemenation using OPNET", In IEEE, Third International Conference on Intelligent Control and Information Processing july 15-17,2012-Dailan China, Issue on Routing in Wireless Sensor Network, pp 709-713, 2012.

[18] Shi-Zong, Shyarn V. Nath, 2012 "A Clustering Approach based to Wireless network intrusion detection system", Issue on security on wireless networks, IEEE, vol. 35, pp.99-101, 2012.

[19] Woosik Lee,Namgi Kim, 2013, "A study of Transmission Power Control Algorithms in wireless body sensor networks", In IEEE, Soft tech 2013 ,ASTL, Vol. 19,pp. 31-34, 2013.

[20] Lititng Cao, Shriu Zhou ,2013"Intelligent Security system based on Wireless Sensor Networks", In IEEE, First international Conference on Intelligent Networks and Intelligent Sytems,PP,143-146, 2013.

PREPARATION AND CHARACTERIZATION OF SHORT ARECA LEAF FIBER REINFORCED EPOXY AND VINYL ESTER COMPOSITES

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ABSTRACT

In this research work natural fiber reinforced polymer composites were prepared by reinforcing epoxy and vinylester resin with short areca leaf fibers. Different blend composites were prepared by varying weight fractions of areca leaf fibers. Their mechanical and physical properties were studied and compared as per the standard procedure. It has been found that the compressive strength of areca leaf fiber reinforced vinylester composites were more than epoxy composites. It was also observed that the type of compressive failure in epoxy/ leaf and vinylester/ leaf composites at all wt% of fibers was breaking. The erosive wear strength at 90^0 and 75^0 nozzle angles were determined. The water absorption properties were also studied. The ruptured surface of both types of composites which exhibited highest compressive strength was analyzed by SEM micrographs.

Keywords: Areca leaf, Epoxy, Erosive wear, SEM and Vinyl ester.

I INTRODUCTION

During the last few years, natural fibers have received much more attention than ever before from the research community all over the world. Natural fiber reinforced composites prove that it is possible to construct high performance materials with environment friendly resources. Several cellulosic products were preferred as reinforcement mainly to achieve cost savings [1]. The use of wood fibers as a load bearing constituent in composite materials have been gaining increased attention in the field of composites [2, 3]. Recent studies showed that the development of fiber reinforced composite material using plant-based natural fiber such as flax, hemp, bamboo, pineapple, kenaf, sisal, banana, jute, coir etc., as reinforcement due to their availability, cost effectiveness ,world annual production & wide range of properties[4- 9].

The compressive strength is one of the most important and widely measured properties of materials used in various applications The value of compressive stress reached when the material fails

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completely is designated as the compressive strength of that material [10]. Srinivasa and Bharath found that the mechanical properties of areca husk fiber-reinforced epoxy composites depend on the nature of matrix material, the distribution and orientation of the reinforcing fibers, the nature of the fiber-matrix interfaces and of the interphase region [11].

Erosive wear can be described as an extremely short sliding motion and is executed within a short time interval. Erosive wear is caused by the impact of particles of solid against the surface of an object. The impacting particles gradually remove material from the surface through repeated deformations and cutting actions [12]. The rate of erosive wear is dependent upon number of factors. The material characteristics of the particles, such as their shape, hardness, impact velocity and impingement angle are primary factors along with the properties of the surface being eroded. The impingement angle is one of the most important factors and is widely recognized in literature [13].

Moisture diffusion in polymeric composites has shown to be governed by three different mechanisms [14, 15].The first involves the diffusion of water molecules inside the micro gaps between polymer chains. The second involves capillary transport into the gaps & flaws at the interfaces between fiber & the matrix. This is a result of poor wetting & impregnation during the initial manufacturing stage. The third involves transport of micro cracks in the matrix arising from the swelling of fibers (particularly in the case of natural fiber composites). Bharath K.N, Rajesh A.M have studied the moisture absorption property of different weight fraction of randomly distributed areca fiber & maize powder reinforced urea formaldehyde composites [16].The results obtained were shown that moisture absorption decreased with decrease in the fiber to maize powder ratio & moisture absorption was improved with the weight ratio of fibers to maize powder . G.C. Mohan Kumar prepared composites with random distribution of areca husk fibers in Maize stalk fine fiber and Phenol Formaldehyde as a matrix and observed that the amount of moisture in the composite increased with time and later it became constant and he predicted that the water is predominantly absorbed at the fiber and matrix interface [17]. Chkkol et al, carried out water absorption capacity test for the composites made of Urea formaldehyde, Melamine urea formaldehyde and epoxy reinforced with areca husk fibers. Out of these three types of composites least amount of water absorption was found in epoxy reinforced areca husk composites [18]. Amuthakkannan et al, prepared basalt fiber reinforced polymer matrix composites and found that the water absorption behavior of the composites mainly depends on the voids present in the composites, interfacial adhesion between the fiber and matrix, and type of fibers reinforced [19].Ankita Pritam Praharaj et al. Studied the water absorption of randomly oriented paper pulp reinforced Bisphenol-Aglycidyldimethacrylate (BisGMA).They found that the composites with less paper pulp content absorbed less water [20].

In this work polymeric thermosetting materials such as epoxy and vinyl ester were used as matrix materials because they can be processed easily, possess light weight & offer desirable mechanical properties. The reinforcement

materials used was naturally available short areca leaf fibers. The fibrous material was used because of the simple reason that most materials are stronger and stiffer in fibrous form than in any other form.

In coastal Karnataka the areca is the main commercial crop. The areca leaf obtained from the areca tree is used for making leaf cups. No attempt has been made till today to utilize it as an useful material for many other applications. Hence, in this present study, areca leaf fiber reinforced epoxy and vinyl ester composites have been prepared with varying weight percentages. Their physico-mechanical and tribological properties have been studied, owing to scientific interest and technological competence.

II EXPERIMENTAL

2.1Raw materials

The clean areca leaves obtained from the areca tree were dried under sunlight till all of its moisture content was removed. Then they were washed with distilled water and kept in an oven for the drying purpose . The epoxy LY 556 was used as a matrix material with hardener HY 951 and also vinyl ester was used as a matrix material with respective catalyst, accelerator and promoter.

2.2 Specimen preparation

2.2.1Epoxy Composites

Required quantities of fibers and resin were weighed, mixed & stirred properly. Hardener was added to the epoxy-fiber mixture in the proper ratio and stirring was continued till uniform mixture was obtained. The composites were prepared with varying weight percentages of fibers. Developed samples were cured for 24 h at room temperature. Then the samples were cut into required size & shape according to the ASTM standard for different testing purposes and post cured.

2.2.2 Vinyl ester composites

In this, definite quantities of vinyl ester and fibers were mixed. Then the respective catalyst, accelerator and promoter were added in the required amount. The similar procedure used in the preparation of epoxy composite was followed.

2.3 Testing methods

The Compression test was carried out in an Universal Testing Machine (Zwick Roell, Jerman make,Model-Z0200) according to ASTMD695 standard and Wear test was conducted in Air Jet Erosion Test Rig as per ASTM G76 standard at 90^0 & 75^0 nozzle angle.

Density was determined by simple water immersion technique according to ASTM D792 standard.

Water absorption capacity was found out according to the procedure described in the ASTM D570 standard. The percentage increase in weight was calculated as,

$$\% \text{ Water absorption} = \frac{\text{Wet weight} - \text{Reconditioned weight}}{\text{Reconditioned weight}} \times 100$$

Scanning electron microscopic (SEM) studies were conducted to analyse the fracture behaviour of composites.

III RESULTS AND DISCUSSION

3.1 Compressive Strength

All epoxy and vinyl ester composites with varying weight percentages of area leaf fibers were subjected to compression test. The results are shown in Fig.1.The type of failure in epoxy and vinyl ester leaf composites was breaking. Maximum compressive strength of 49.80MPa and 135.83 MPa was found in epoxy and vinyl ester composites at 10wt% and 16wt% respectively which is shown in Fig.1.This clearly indicates that the fiber-matrix interfacial bonding was optimum at 10 wt% and 16wt% of fibers in epoxy and vinyl ester composites respectively. The percentage increment in the compressive strength of vinyl ester composites was found to be 45.46% over that of epoxy composites at 10 wt% of fibers. The vinyl ester composites showed an increment in the strength of 309.13% over epoxy composites at 16 wt% of fibers.

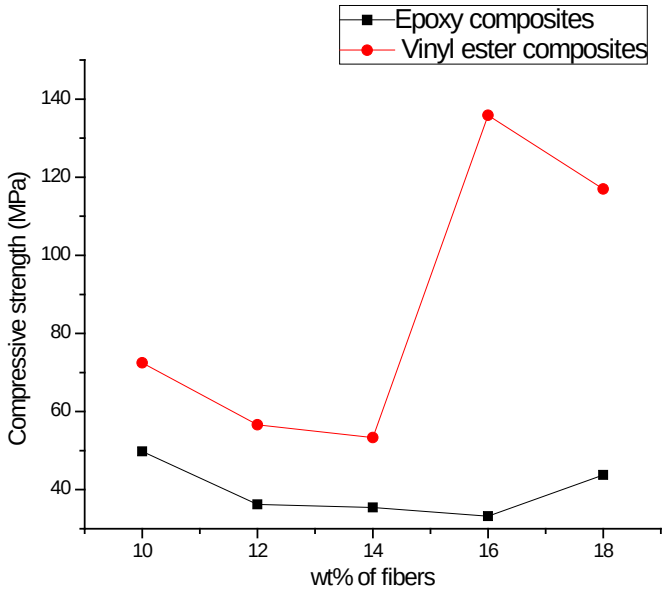

Fig.1.Compressive strength of epoxy and vinyl ester composites

3.2 Wear Test

The erosive wear test results of epoxy and vinyl ester composites at 90^0 and 75^0 nozzle angles are shown in Fig. 2 and Fig. 3 respectively. The rate of erosive wear is dependent upon a number of factors such as type of matrix material, type of fibers used, orientation of fibers, size of fibers and the nozzle angle. The percentage loss in weight at 90^0 nozzle angle was found to be less than at 75^0 nozzle angle in both types of composites which is clearly indicated in the Fig.2and Fig.3.It is clear from the Fig.2 that the minimum percentage weight loss of 0.0068 and 0.0300 was observed at 18wt% and 16wt%of fibers in epoxy composites at 90^0 and 75 º nozzle angle respectively. From Fig.3at 90 º and 75 º nozzle angle the minimum percentage loss in weight of 0.0012 and 0.0365 was observed a 10wt% and12wt% of fibers in vinyl ester composites respectively. A minimum percentage loss in weight of 0.0012 was found in vinyl ester composites at 90 º nozzle angle out of all types of composites.

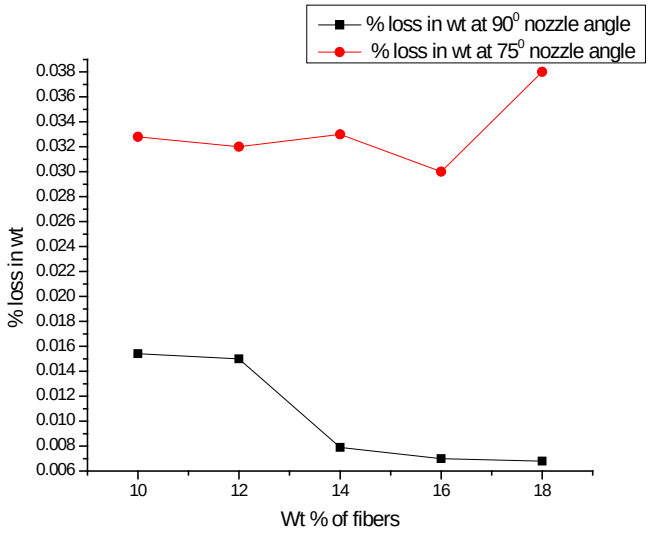

Fig.2. Wear test results of epoxy composites at 90^0 and 75^0 nozzle angle.

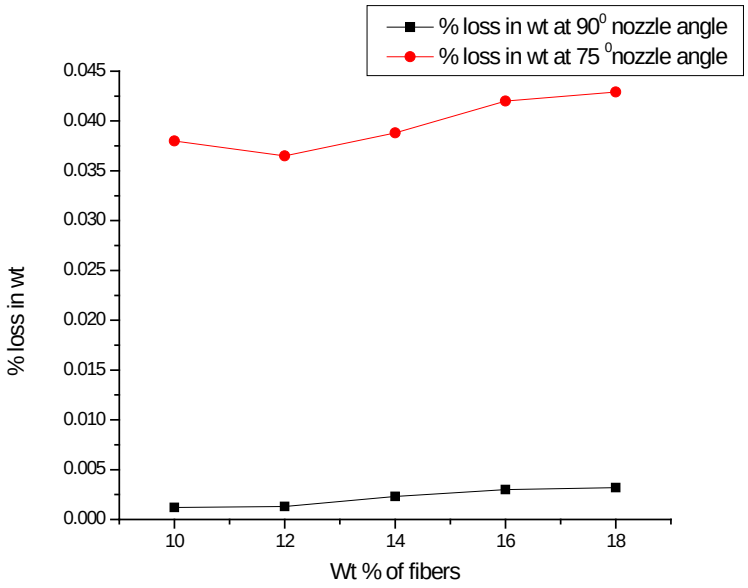

Fig.3. Wear test results of vinyl ester composites at 90^0 and 75^0 nozzle angle

3. 3 Density Test

The density of epoxy and vinyl ester composites with varying weight percentages of fibers is shown in Fig.4**.** The density was found to decrease with increase in fiber content in both types of composites. From the Fig.4, it is clear that a minimum density of 1008.69Kg/m^3 and 898.10Kg/m^3 was found at 18wt% of fibers in epoxy and vinylester composites respectively. The density of vinylester composites was found to be less than epoxy composites at all percentages of fibers. This is because the density of vinylester is less than epoxy**.**

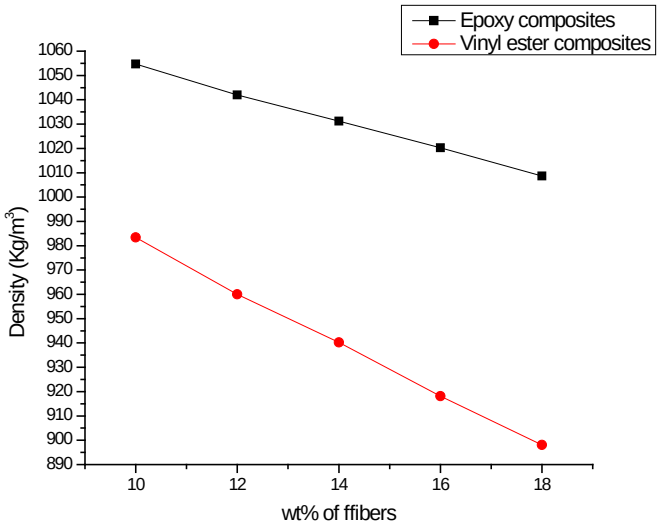

Fig. 4.Density of epoxy and vinyl ester composites

3.4 Water Absorption Test

The water absorption capacity of the composite was measured by the weight gain of the material in regular 24 hrs. of intervals over the period of 15 days. The water absorption test results of the epoxy and vinyl ester composites are shown in Fig.5and Fig. 6 respectively. These results indicate that the water absorption capacity of the composites increases as the weight percentage of fibers increased and later it becomes constant after reaching the saturation level. After analyzing the water absorption capacity of all the composites it is found that the water intake capacity of epoxy composites is less compared with vinyl ester composites. From the Fig.5 and Fig.6, it is clear that a least amount of water absorption of 8.13%& 9.69% was found at 10wt% of both types of composites.

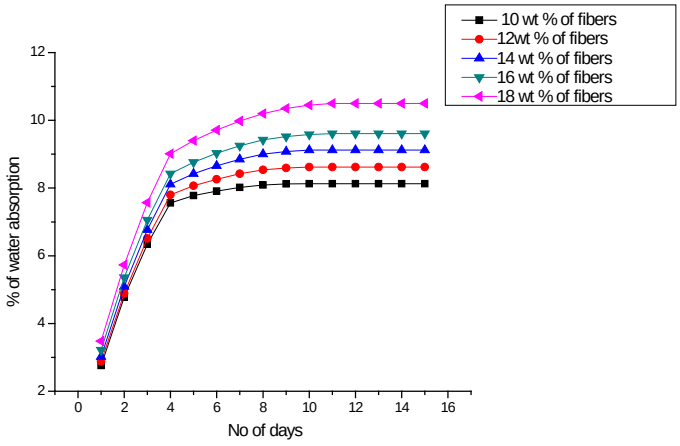

Fig.5.Water absorption test results of epoxy/leaf composites.

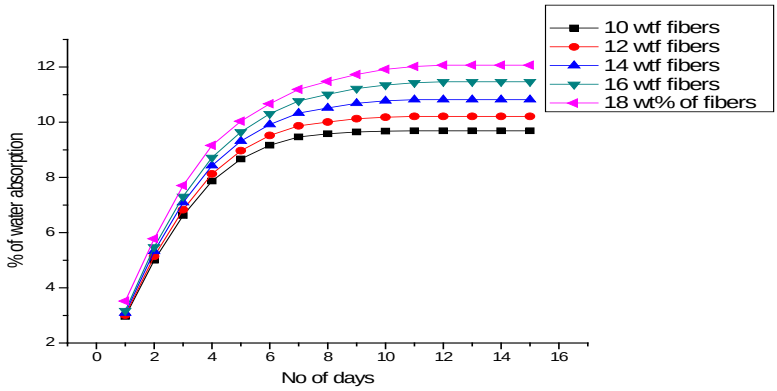

Fig. 6.Water absorption test results of vinyl ester/leaf composites

IV SEM OBSERVATIONS

Morphology of fractured surface of the 10 wt% of epoxy and 16 wt% of vinyl ester composites which exhibited highest compressive strength was examined by scanning Electron Micriscope.The micrographs revealed brittle type of fracture in epoxy and vinyl ester composites due to the formation of cracks which is evident from Fig.7 and Fig.8. The fiber pull out was observed in both types of the composites. This is identified by the holes and cavities in the fractured surface of the epoxy composite which is shown in Fig.9 and cavity in the vinyl ester composite shown in Fig.10.The fiber splitting was observed in epoxy composite which is evident from the Fig. 11.The fibers were found to be broken in vinyl ester composite which is shown in Fig. 12**.** Hence the bonding between fibers and matrix was found to be stronger in vinyl ester composites than the epoxy composites. Due to this reason the compressive strength of vinyl ester composites was higher than the epoxy composites. This also indicates that the nature of failure was not uniform in both types of composites at the fractured surface. It is evident from the SEM images that a combination of matrix cracking, fiber pull out, fiber orientation, breakage and splitting are the predominant failure modes.

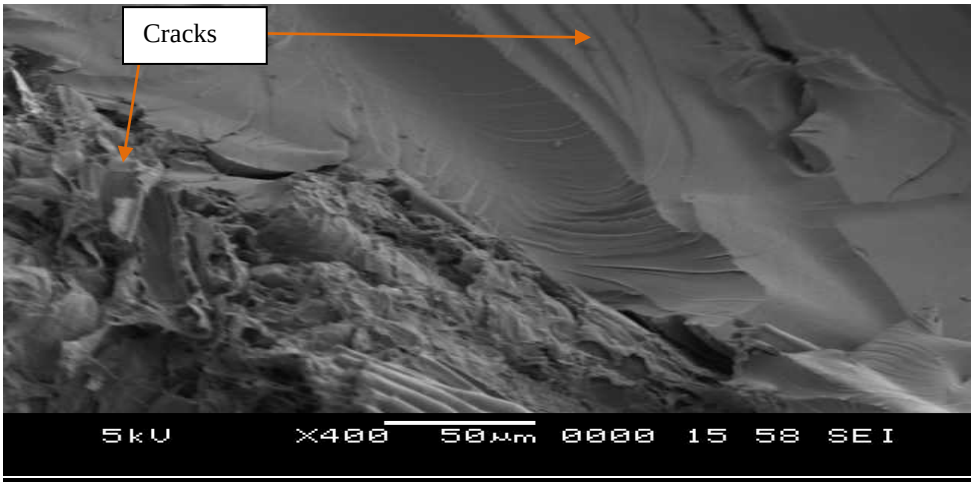

Fig. 7.Cracks formed in the epoxy composite.

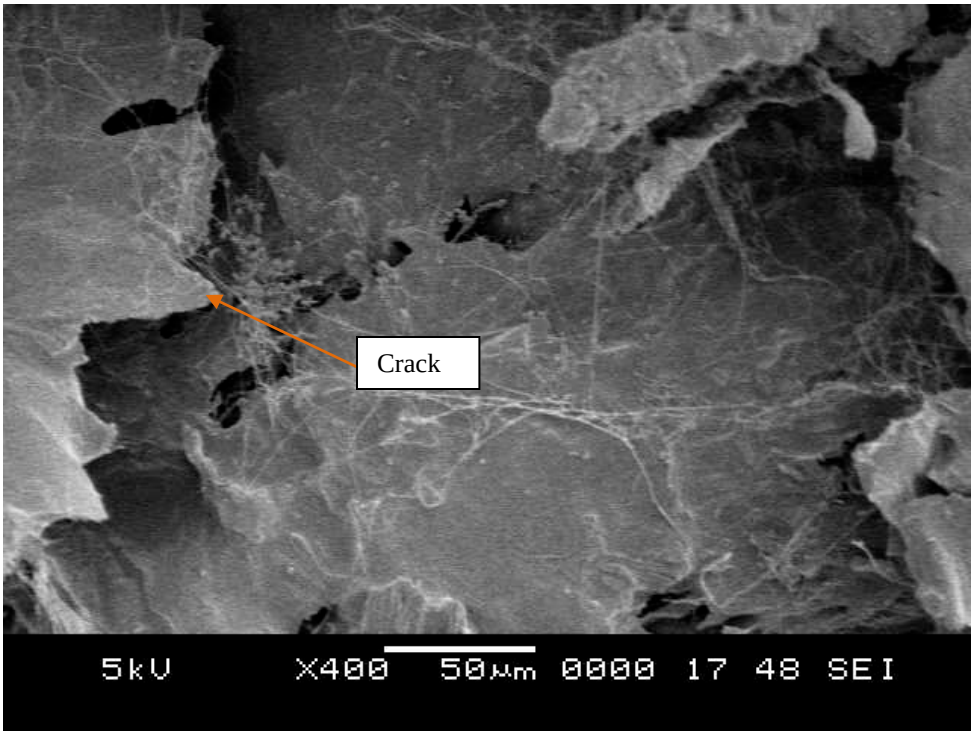

Fig. 8.Crack formed in the vinyl ester composite.

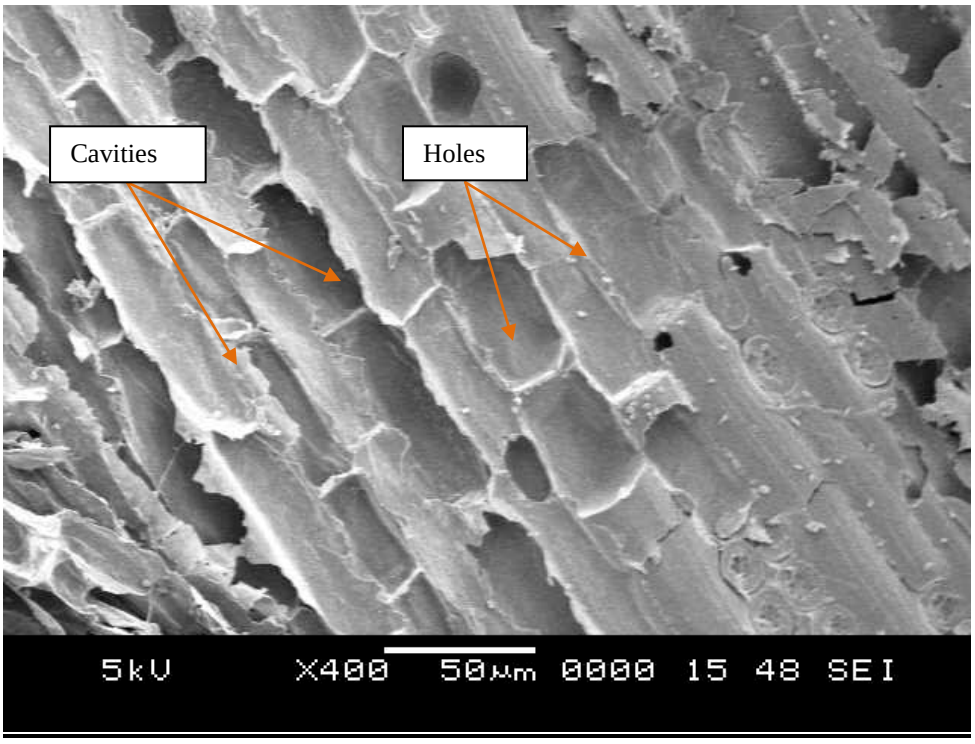

Fig. 9.Cavities and holes formed due to the fiber pull out in the epoxy composite.

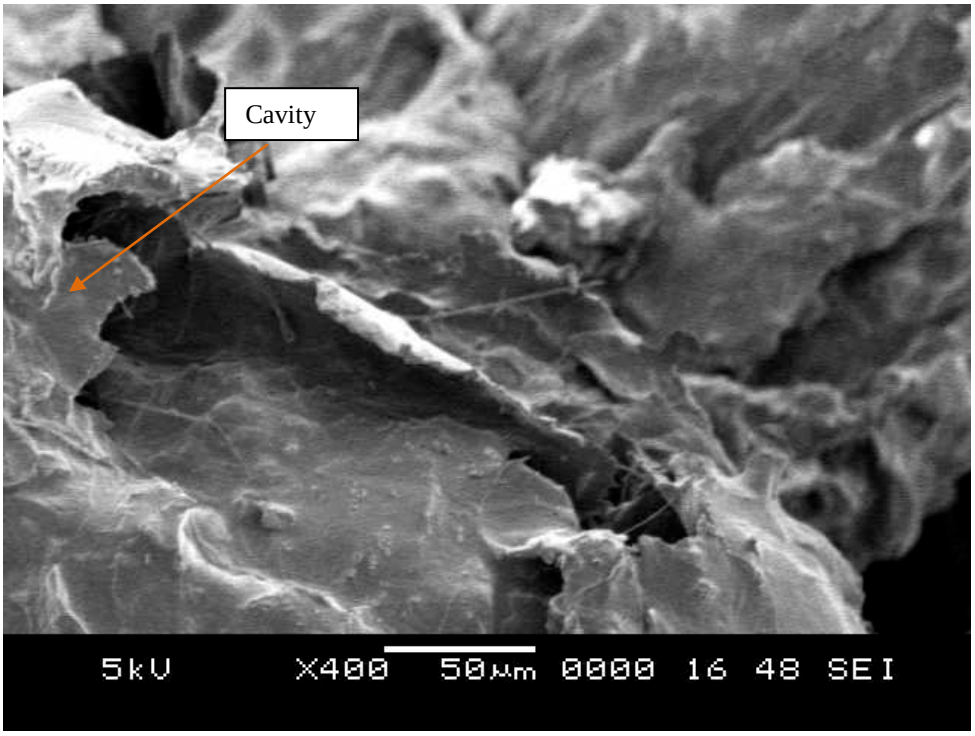

Fig. 10.Cavity formed due to fiber pull out in the vinyl ester composite

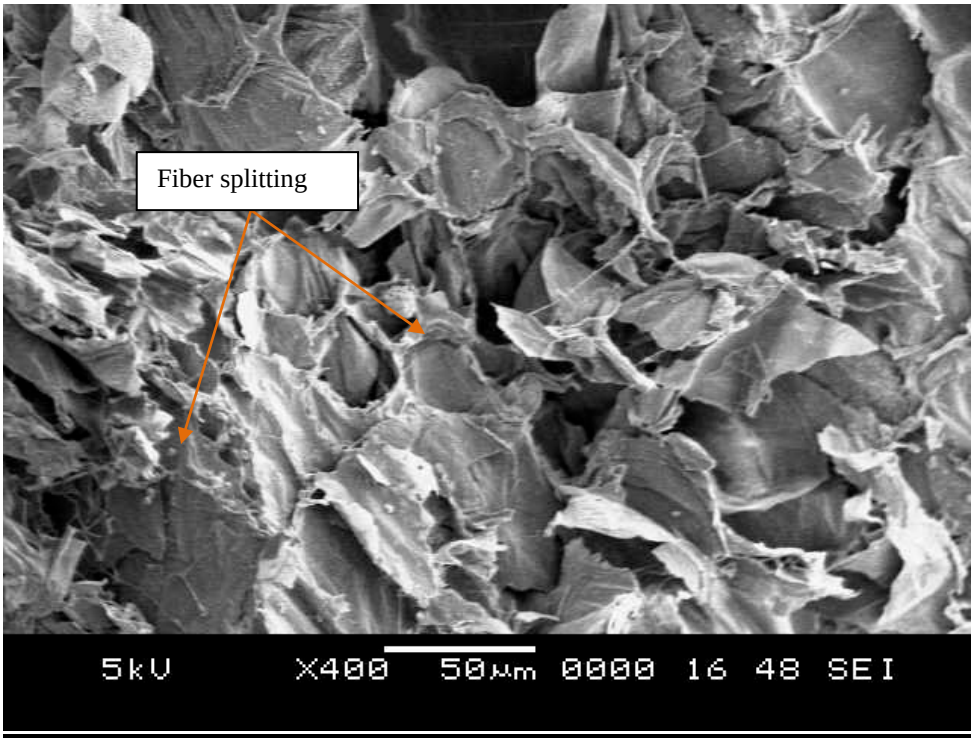

Fig.11.Fiber splitting in the epoxy composite

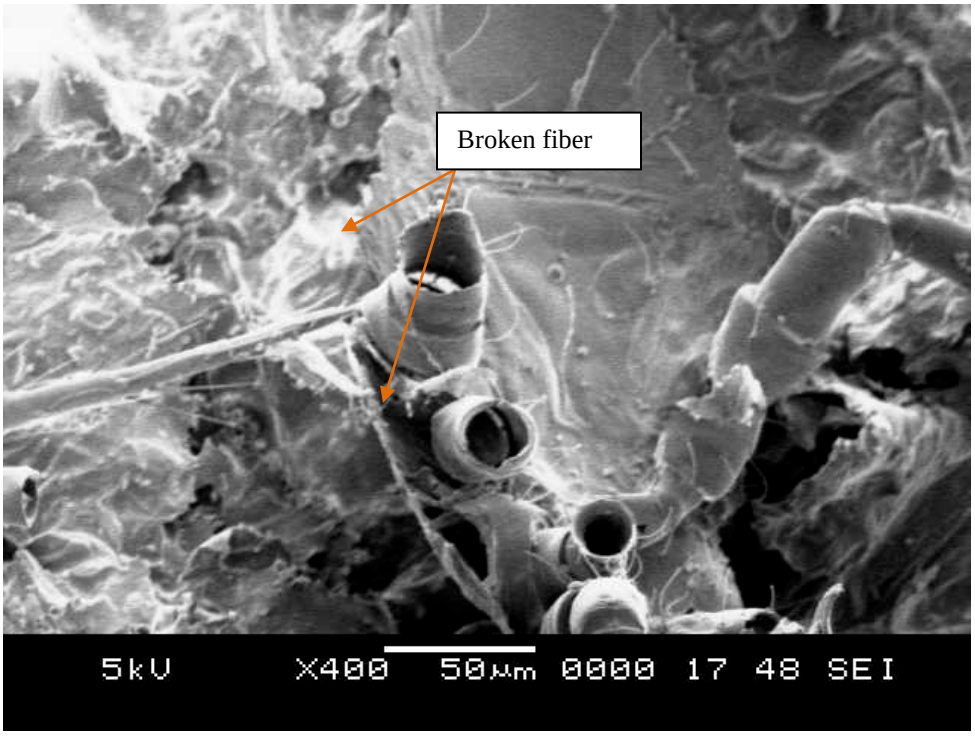

Fig. 12.Broken fiber in vinyl ester composite.

V CONCLUSION

- The results showed that the brittle type of failure occurred in epoxy and vinyl ester composites. The vinyl ester composites exhibited higher compressive strength than the epoxy composites because of the good interfacial bonding.
- The percentage loss of weight in epoxy and vinyl ester composites was found to vary randomly. This is due to the uneven distribution and orientation of fibers. Both types of composites exhibited high wear resistance at 90 º nozzle angle than at 75 º nozzle angle.
- Density of vinyl ester composites was found to be less than epoxy composites.
- The water absorption capacity of all composites was found to increase as the fiber content increased. This is due to the more affinity of fibers to water. The water absorption capacity of epoxy composites was found to be less than the vinyl ester composites at all weight percentages.
- The SEM images indicate that a combination of matrix cracking, fiber pull out, fiber orientation, breakage and splitting are the predominant failure modes.

VI ACKNOWLEDGEMENTS

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REFERENCES

[1] Joseph .K., Thomas, S., Pavithran .C and Brahmkumar, M Tensile properties of short sisal- fiber reinforced polyethylene composites, *J . Apply. Polym . Sci, 1993, 47: 1731-1739.*

[2]Bledzi, A.K and Gassen, Composites reinforced with cellulose based fibers,*1999,Polymer Science, 24 (2): 221-274.*

[3] Eichhorn, S.J., Baillie, C.A., Zafeiropoulos, N., Mwaikambo, L.Y., Ansell, M. P., Dufresne, A., Entwistle, K.M., Herrera- Franco, P.J., Escamilla, G.C, Groom, L.H., Hughes, M., Hill, C., Rials, T.G & Wild. P.M, Review : Current international research into cellulosic fibers and composites, *Journal of Materials Science,2001, 36 (9) :2107-2131.*

[4] Varda Rajulu , A , Ramachandra Reddy ,G.&Narasimha chari k ,Chemical resistance & tensile properties of styrenated polyester-coated bamboo fibers, *Indian J.Fiber. Text.1998, Res, 23:49-51.*

[5] Varada Rajulu , A , Ramachandra Reddy , G .& Narasimha chari,k. ,Chemical resistance & tensile properties of epoxy coated bamboo fibers , *Indian J. Fibre Text . Res, 1996, 21:223-224.*

[6] Takashi Nishino , kochi Hirava , Masaru Kottera, kat suhiko Nakamae & Hiroshi Inagaki ,Kenaf reinforced biodegradable composite, *compos. Sci. & Technol , 2003,63:1281-1286.*

[7] Pathan , L.A.& Sabu Thomas,Polarity parameters & dynamic mechanical behavior of chemically modified banana fiber reinforced polyester composites, *Compos. Sci. & Technol ,2003, 63:1231-1240*

[8] Roy , D ,Sarkar , B.K.,Rana, A.K. & Box, N.R,The Mechanical properties of vinyl ester resin matrix composites reinforced with alkali treated jute fibers , *composites part A, 2001, 32:119-127.*

[9] Jochen Gassan & Bledzki , A.K, Possibilities of improving the mechanical properties of jute/epoxy composites by alkali treatment of fibers , *compos . Sci .& Technol 1999, 59:1303-1309.*

[10]A S Singha and Vijay Kumar Thakur, Mechanical properties of natural fibre reinforced polymer composites, *Bull. Mater. Sci.,2008 Vol. 31, No. 5, pp. 791–799. © Indian Academy of Sciences.*

[11] Srinivasa and Bharath,Department of Mechanical Engineering, GM Institute of Technology, Davangere, Karnataka, India, Impact and hardness properties of areca fiber-epoxy reinforced composites ,*J. Mater. Environ. Sci. 2011,2 (4) , 351-356, ISSN: 2028-2508*

[12]Mamata, K. P, A review on silt erosion in hydro turbines, *Renewable & sustainable energy reviews, 2008, 12(7): 1974.*

[13] Sinmazcelik, T. and I. Taskiran , Erosive wear behaviour of polyphenylenesulphide (PPS) composites, *Materials in engineering ,2007,28(9): 2471-2477.*

[14] Espert A,vilaplana F, Karlsson S. Comparison of water absorption in natural cellulosic fibers from wood & one year crops in polypropylene composites & its influence on their mechanical properties, *Composite Part A, 2002; 35:1267-76.*

[15] Karmaker A.C, Effect of water absorption on dimensional stability & impact energy of jute fiber reinforced polypropylene, *J Mater sci Lett 1997; 16:462.*

[16] Bharath K.N, Rajesh A.M. Moisture absorption characteristics of areca/maize reinforced hybrid polymer composites, *J of Advanced Engg. & application,2010 ,207-211.*

[17]. G. C. Mohan Kumar**,** A study of short areca fiber reinforced PF composites, Proceedings of the World Congress on Engineering 2008 Vol IIWCE 2008, July 2 - 4, 2008, London, U.K.

[18] Chikkol et al, Flexure of areca composites, Bio Resources, *2010, 5(3), 1846-1858*

[19]AmuthakkannanPandian, ManikandanVairavan,WinowlinJappesJebbasThangaiah and Marimuthu Uthayakumar ,Effect of moisture absorption behavior on mechanical properties of basalt fibre reinforced polymer matrix composites, *J. of Composites.Article,2014, ID 587980, 8 pages.*

[20]Ankita Pritam Praharaj,DibakarBehera,Tapan Kumar Bastia, Fabrication and mechanical properties of BisGMA/Amine functionalized paper pulp composites, *International J. of Innovative Research in Science, Engineering and Technology, 2014,Vol.3,Issue 5, 12718-23.*

RAPID EYE MOVEMENT SLEEP BEHAVIOR DISORDER

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ABSTRACT

This article will allow readers to know that sleep is an important phenomenon. Lack of sleep may result into a disease known as Rapid Eye Movement Sleep Behavior Disorder. In a normal person, dreaming is an activity that is observed in mind and his body is at rest. A RBD patient starts acting out his dreams by moving his hands and legs, screaming, talking, walking, hitting his bed partner and sometimes even jumping out of bed. In this article I will also discuss various stages of sleep and RBD symptoms and its causes.

Keywods: Stages Of Sleep, Non-Rapid Eye Movement Sleep, REM Sleep, Rapid Eye Movement Sleep Behavior Disorder, RBD Causes, Symptoms of RBD, Risk Factor, Diagnosis, Treatment

I INTRODUCTION

Sleep is a universal activity that is observed by every species on this earth. Sleep is a natural phenomenon that takes almost one-third of human life. It is an activity that forces every person to leave state of consciousness and navigate between worlds of dreams and deep sleep every night. It is an anabolic state where body repairs and regenerates body tissues, build up the bones and muscles, and strengthen immune system. A sleeping person has eyes closed, lying down, breathes slowly with relaxed muscle and is generally lying still. He is unconscious of the things going around. Sleeping stage is different from comatose and hibernation because a sleepy person can be woken up by loud sound, touches, with bright light etc.

1.1 Stages of Sleep

When a person is awake, he is in stage 0 i.e. his eyes are open, responsive to external stimuli, and can hold intelligible conversation. Technically, the brain wave pattern here is classified by two types of waves. They are-

· **Beta Wave:** These are associated with wakefulness. These waves have highest frequency and lowest amplitude. These are not synchronized in their pattern. This is due to the fact that various cognitive, sensory, and motor activities affect our mental status.

· **Alpha Wave :**When we are resting but still awake, our brain waves starts increasing in amplitude and decreasing in frequency. This makes them a bit synchronous.

According to various sleep studies there are mainly two stages of sleep. They are classified as

· Non rapid eye movement sleep

· Rapid eye movement sleep

1.2 Non Rapid Eye Movement Sleep

NREM sleep is a sleep in which no eye movement is observed. NREM sleep is divided into four categories. They are:

· **Stage I**

It is a stage of light sleep where a person sleep cycle swings between state of wakefulness and sleep. A person's eyes are closed and he can be easily awakened. This stage is characterized by theta waves with are much slower and higher in amplitude than above two waves. This phase may last for 5 to 10 minutes.

· **Stage II**

It is starting stage of actual sleep. This is light sleep. Heart rate slows and the body temperature drops down and the human body is getting ready for deep sleep. It lasts for approximately 20 minutes. The brain begins to produce bursts of rapid, rhythmic brain wave activity known as sleep spindles.

· **Stage III**

Deep, slow brain waves known as delta waves begin to emerge during stage 3 sleep. This stage is sometimes referred to as delta sleep because of the slow brain waves known as delta waves that occur during this time. During this stage, people become less responsive and noises and activity in the environment may fail to generate a response. It also acts as a transitional period between light sleep and a very deep sleep. Bed-wetting and sleepwalking are most likely to occur at the end of this stage of sleep.

· **Stage IV**

This is the deep sleep stage. It's harder to rouse you during this stage, and if someone woke you up, you would feel disoriented for a few minutes. During the deep stages of NREM sleep, the body repairs and regrows tissues, builds bone and muscle, and strengthens the immune system.

1.3 REM Sleep

REM sleep happens 90 minutes after you fall asleep. The first period of REM typically lasts 10 minutes. Each of your later REM stages gets longer, and the final one may last up to an hour. The heart rate and breathing quickens. One can experience intense dreams during REM sleep, since the brain is more active. Babies can spend up to 50% of their sleep in the REM stage, compared to only about 20% for adults.

1.4 Rapid Eye Movement Sleep Behavior Disorder

Dreaming is purely a "mental" activity that is experienced in the mind while the body is at rest. But people who suffer from rem behavior disorder (RBD) starts acting out their dreams. They physically move their limbs or even get up and engage in activities associated with waking.Persons with RBD lack this muscle paralysis, which permits them to act out their dreams in dramatic and violent manner while they are in the REM stage of sleep. Sometimes they starts talking, twitching and jerking during dreaming for years before they fully act out their REM dreams.

II RBD CAUSES

Rapid eye movement behavior disorder (RBD) is seen when there is a loss of normal voluntary muscles during sleep. Thisresults in motor behavior in response to dream content. Adverse reactions to certain drugs or drug withdrawal are also the cause of RBD. It is most common in elderly person. People with neurodegenerative disorders like Parkinson disease, multiple system atrophy and Lewy Body Dementia are also at higher risk to suffer from RBD .

According to different causes, RBD is also categorized as:

2.1 Idiopathic RBD Causes

When a person's sleep structure appears to be normal but he experiences increase in the density of REM sleep. Also an increase in the percentage of slow wave sleep is observed .then he is suffering from idiopathic RBD. This category of RBD is genetic.

2.2 Symptomatic RBD Causes

Symptomatic RBD is common in people suffering from any other neurodegenerative disease. Research shows that About 15% of Parkinson's patients also have RBD, About 70% of multiple system atrophy patients also have RBD, About 85% of Lewy Body Dementia patients also have RBD. Other neurodegenerative associations include Shy-Drager Syndrome, Olivo-Ponto-cerebellar atrophy, multiple sclerosis, vascular Encephalopathy, Tourette's, and Guillain-Barre syndrome. damage of neural circuits that govern REM sleep is also observed.

2.3 Physiological Causes

Following physiological changes are observed in RBD patients as compared to non-RBD patients

- Central nervous system dysfunction
- Abnormal cortical activity
- Low beta waves in the occipital lobe as well as increased theta waves in the frontal and occipital lobes are observed during REM sleep.
- Frontal lobe and pons dysfunctions and lower blood flow in these portions of brain.

  Brainstem

III SYMPTOMS OF RBD

- Kicking
- Shouting
- Jumping
- Grabbing
- Twitching and jerking
- Leaping out of bed
- Hitting and punching
- Performing action
- Self -injury or injury to bed partner

IV RISK FACTOR

Men are more prone to the rapid eye movement disorder than women. This disorder can be seen at any age groubut it is more common after age of 50-60. Persons with rapid eye movement disorder are also at a higher risk of suffering from neurological disorders like

- Parkinson's disease (a brain disease leading to tremors. A person also suffers difficulty while walking and moving)
- Multiple system atrophy (resembles Parkinson's disease but with more damage)
- Narcolepsy (sleep attacks during daytime are experienced)
- Periodic limb movement disorder (feeling of cramping or jerking the limbs is experienced during sleep)
- Sleep apnea (difficulty in breathing during sleep)

V DIAGNOSIS

RBD gets worse over time and is dangerous to self as well as to bed partners. RBD can be diagnosed by performing sleep studies like polysomnography at sleep centers. In polysomnography, a Person is extensively monitored overnight. Readings of sleep, brain activity, muscle activity etc. are taken to distinguish a person suffering from sleep disorder. These studies reveal the muscle paralysis during REM sleep.

Now doctors are also diagnosing this disease by conducting clinical interviews. In these interviews, an individual is asked some questions about his sleeping schedule, sleeping habits, alcohol intakes, medications etc. Doctors even believe in interviewing the bed partners to diagnose the disease in a better way.

VI TREATMENT

RBD can be treated with proper medication. Clonazepam, Melatonin, levodopa, Pramipexole are some of the medicines present till date for treatment of RBD.

VII PRECAUTIONS

Following precautions should be taken with the RBD patient for his as well as bed partner's betterment.

- Secured sleep environment
- Removal of dangerous objects from bedroom like night lamp, flower pot etc.
- Maintaining a normal total sleep schedule
- Avoid sleep deprivation
- Treatment of any other sleep disorder that increases chances of RBD
- Scheduled monitoring of any other neurological symptoms.
- Avoid alcohol, drugs, certain medications etc.

VIII CONCLUSION

Rapid eye movement sleep behavior disorder is one of the serious diseases that people often suffer from. People suffering from RBD may cause harm to themselves as well as their bed partners in very serious way. It needs to be diagnosing at proper age so that it can properly treated. It is also one of a great field of research for both medical as well as engineering student.

REFERENCES

1) Schutte-Rodin, Sharon. "*REM Sleep Behavior Disorder"*, http://www. yoursleep.aasmnet.org, American Academy of Sleep Medicine, 1 October 2011.
2) "*REM Behavior Disorder & Sleep"*, http://www. sleepfoundation.org/sleep-disorders-problems/rem-behavior-disorder
3) "*REM Sleep Behavior Disorder Causes"*,http:// www.webmd.com/sleep-disorders/guide/rem-sleep-behavior-disorderOct 15, 2013
4) "*REM sleep Behavior Disorder: Causes, Diagnosis"* http://www.healthline.com › Reference Library,Aug 15, 2012
5) "*Rapid eye movement behavior disorder*, http://www.en.wikipedia.org/wiki/Rapid_eye_movement_behavior_disorder
6) *"REM Sleep Behavior Disorder - Overview and Facts"*,http://www.sleepeducation.com/sleep-disorders.../rem-sleep-behavior-disorder
7) *"REM sleep behavior disorder", http*://www.mayoclinic.org/diseases-conditions/rem...disorder/.../con-2003665
8) KavitaNamdev, M.Tech Student, Department of Electronics & Communication Engineering , Integral University, Lucknow, Mohd. Maroof Siddiqui, Department of Electronics & Communication Engineering, Integral University, Lucknow, *"Different types of electrical signals produced by human body"*,International Journal of Advance Research In Science And Engineering ,ISSN-2319-8354(E), IJARSE, Vol. No.4, Special Issue (02), February 2015

WATER ABSORPTION AND DIFFUSION PROPERTIES OF ARECA FIBER REINFORCED EPOXY AND VINYL ESTER COMPOSITES

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ABSTRACT

In this study, the areca bast fiber reinforced epoxy and vinyl ester composites were subjected to water immersion test in order to study the water absorption and diffusion properties under the room temperature. Areca fiber epoxy/vinyl ester composites containing 6, 8, 10, 12 and 14 weight percentage of fiber were prepared. The water absorption and diffusion properties of these composites sample were determined using standard weight gain method by immersing the sample in saline water at room temperature. It shows that moisture uptake increases with increase in fiber weight percentage due to increased voids and cellulose content. The diffusion rate also increased with increase of the fiber loading. All specimens showed a high rate of swelling at the beginning of the wetting test, but rate of swelling decreased asymptotically with time. The epoxy matrix shows moisture sensitivity due to interactions between some polar groups of the macromolecules and water molecules. This sensitivity increases with increasing degree of cross linking and also with polarity concentration of the molecular groups. All specimens of vinyl ester composites showed a high rate of water absorption and diffusion compared to specimens of epoxy composites due to their hydrophilicity.

Key Words: Areca Fiber, Diffusion Coefficient, Epoxy, Vinyl Ester, Water Absorption.

I. INTRODUCTION

During recent years, interest in using eco-friendly materials in engineering has been increased due to growing environmental awareness. As a result researchers are leading for renewable recyclable, sustainable, green, decomposable or biodegradable materials to replace some of the traditional engineering that are not environmental friendly [1]. The use of natural fibers as reinforcement in polymer composites for making low

cost engineering materials has guaranteed recent years. It can be substituted for conventional non renewable reinforcing materials such as glass fibers [2]. The use of natural fibers and polyester matrix is highly beneficial because strength and toughness of the resulting composites are greater than those of unreinforced plastics [3].

The bio-fiber world is full of examples where cells or group of cells are designed for strength and stiffness. Cellulose is a natural polymer with high strength and stiffness per unit weight and it is the building materials for long fibrous cells. These cells can be found in the stems, leaves and seeds of plants [4].

Although several natural fibers has been used in composites for many years. Areca fiber is one of the rare materials used for making of composites. In this work areca bast is used for composites. In fact it is cellulose fiber possess several potential advantages such as, 1) their low density which makes it possible to obtain lighter composites 2) their good mechanical properties, 3) their bio-renewable character, 4) their ubiquitous availability at low cost and their modest abrasive character which ensures a greater longevity of a processing tools [4].

Epoxy and vinyl ester are considered as the best polymeric materials for many applications and widely used in industry as matrix materials of fiber reinforced composites due to their superior characteristics such as good mechanical properties and good resistance to chemicals [5]. Epoxy and vinyl ester composites have many advantages such as lower cost, lighter in weight and better performances over hermetic packages [6].

In this work, the water absorption and diffusion coefficients of areca fiber reinforced epoxy and vinyl ester composites have been studied.

The water absorption is caused due to the hydrophilic nature of fiber due to its polarity owing to the free hydroxyl groups of cellulose and lignin. These hydroxyl groups can hold the water molecules by hydrogen bonding. Water absorption into composite materials is addressed by three different mechanisms. The main process consists of diffusion of water molecule inside the micro holes between polymer chains. This involves direct diffusion of water into matrix and to a much lesser extent into fibers. In addition moisture penetration can also occur through the fiber ends, which serves as conduits for water transport. Another mechanism is capillary transport to the gaps and flows at the interfaces between fibers and polymers due to the incomplete wet ability and impregnation and also transport through micro cracks in the matrix formed during the compounding process [7,8].

II. EXPERIMENTAL

2.1 Materials

Raw materials used in experimental work were,

1) Natural fiber (areca bast)
2) Resins (epoxy and vinyl ester)
3) Boron fluoride (promoter)
4) Methyl ethyl ketone peroxide (catalyst)
5) Cobalt Napthanate (accelerator)
6) Aradur HY95 1(hardener)

2.2 Methods

The samples were prepared with 6%, 8%, 10%, 12%, 14% weight mass fractions of fibers. For different mass fraction of fibers a calculated amount of epoxy resin and hardener (10:1) by weight thoroughly mixed and gently

stirred. The load was put on cavity. The whole is left for 24 hours and then removed for curing in the oven. Then composites cut for water absorption testing. Same procedure is taken for vinyl ester matrix based composite in which additional accelerator, catalyst and promoter were mixed and the same procedure was continued as done for epoxy composites [10].

Water absorption testing of composites has been carried out by taking rectangular bars (approximately 3.2 mm thick, 75 mm long and 25 mm width) from composite sheet as per ASTMD570. The samples were dried in oven at 50^0C for 24 hours, and removed, cooled and weighed. Then samples were immersed in sea water at the room temperature. For every 24 hours samples were removed and wiped using cotton and weighed until samples attain saturation [11, 12, 13].

The change in mass of the sample in terms of percentage is calculated by the expression,

M= (Ms-Mi)/Mi×100

Where, **Ms**is the mass of the sample after immersion

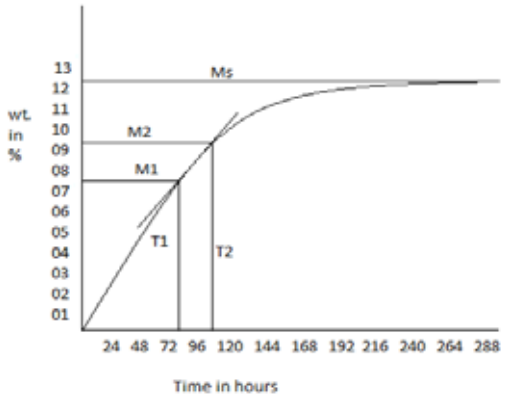
Mi is the initial mass of the sample [14, 15].

The diffusion coefficient (D) was calculated by the formula,

$$D= 3.142 \left(\frac{t}{4Ms}\right)^2 \times \left(\frac{M2-M1}{\sqrt{T2}-\sqrt{T1}}\right)^2$$

$\left(\frac{M2-M1}{\sqrt{T2}-\sqrt{T1}}\right)^2$is the slope.

Where $\mathbf{M_2}$ and $\mathbf{M_1}$are the moisture content at time $\mathbf{t_2}$ and $\mathbf{t_1}$ respectively, **h** is the thickness of the specimen in mm and **Ms** is the maximum moisture uptake. It is graphically represented below in figure, [12,16]



III. RESULT

Generally water absorption in polymer composites is an activated absorption-diffusion process. The water molecule first enters into surface of matrix and then diffuses through the bulk of the polymer composites. It also

enters through nanopores of the composites. The amount of water absorption depends on time, temperature, equilibrium moisture content. When the time increases the proportion of the water absorption decreases [17].

In the figure (1) and (2) water content of composite increased with time and later became saturation. Water is predominantly absorbed at fiber interface and matrix. All specimens showed high rate of absorption and decreases asymptotically with time. Water absorption increases with increase in fiber loading, because asearlier said in the introductory part, fibers containing cellulose which having polar groups are attracted towards water molecules.

Comparisons of epoxy and vinyl ester composite materials are quite interesting. It was observed that water absorption in vinyl ester is more when compared to epoxy composite materials. It is because of ester group present on vinyl ester which is attracted towards water molecules. And graphical representation shows epoxy has resistance power towards water molecules.

Here,

A, F= 6% fiber

B, G= 8 % fiber

C, H= 10 % fiber

D, I= 12 % fiber

E, J= 14 % fiber

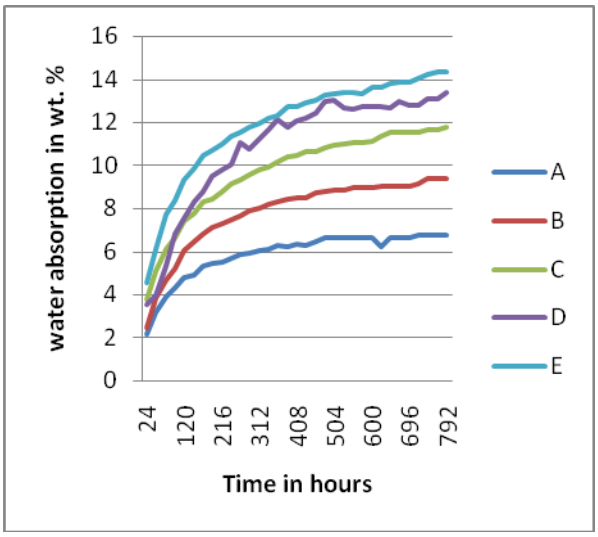


Fig. 1: Water absorption test for epoxy-areca bast composite materials

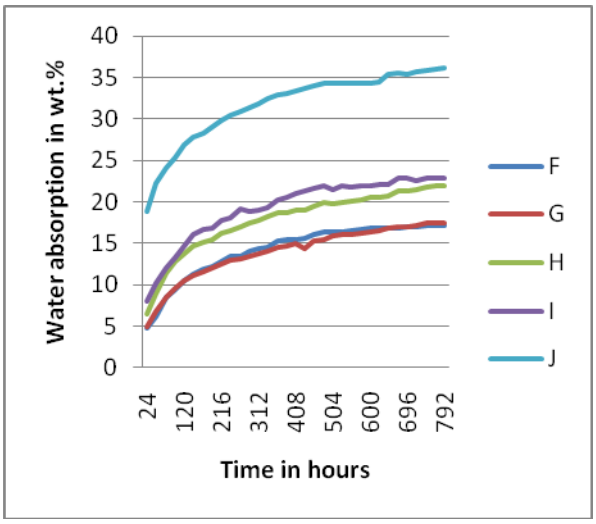


Fig. 2: Water absorption test for vinyl ester-areca bast composite materials

Wt. of fibre in %	D.C of Epoxy CM in m^2/s	D.C of Vinyl Ester CM in m^2/s
6	0.171×10^{-14}	1.062×10^{-14}
8	0.289×10^{-14}	1.120×10^{-14}
10	0.469×10^{-14}	1.142×10^{-14}
12	0.673×10^{-14}	2.570×10^{-14}

14	0.504×10^{-14}	0.147×10^{-14}

3.1 Diffusion coefficients of epoxy and vinyl ester composites

By analyzing above data's, it shows that diffusion coefficient increases with increase in fiber content up to 12% of fiber and at 14%, it suddenly decreases in both epoxy and vinyl ester composite material. It is because of increase in clouding of fiber load which will resist to water molecules to diffuse through the nano-pores. When epoxy and vinyl ester composite materials are compared, it shows that vinyl ester composites having more diffusion rate compared to epoxy composites. More over mechanism of water absorption and diffusion coefficients are similar and they are directly proportional. This context can be observed by the obtained results that, water absorption and diffusion property is more in vinyl ester-areca bast composites compared to epoxy-areca bast composites.

IV. CONCLUSION

The absorption behavior and diffusion coefficient of epoxy and vinyl ester composite materials in sea water at room temperature and comparison of epoxy and vinyl estercomposites materials has been studied. Ultimate result shows that water absorption and diffusion coefficient increases with fiber loading. Water absorption is mainly because of areca fiber. If cellulose composition is more the more water is absorbed. Also these two properties are more in vinyl estercomposite materials compared to epoxy composite material. So it can be concluded that epoxy based composite material is more favorable against water absorption when compared to vinyl ester composite material. In this regard, the study may give platform for the further modifications for the marine applications as well as the materials used in moisture conditions.

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REFERENCE

[1] Reza Masoodi and Krishna M. Pillai, A study on moisture absorption and swelling in bio-based jute-epoxy composites, *Journal of Reinforced Plastics and Composites, 31(5),*2012, 285-294.

[2] H.N. Dhakal, Z.Y. Zhang, M.O.W. Richardson, Effect of water absorption on the mechanical properties of hemp fiber reinforced unsaturated polyester composites, *Composites Science and Technology*, 2006.

[3] Y. Seki, K. Sever, M. Sankanat, I. Sen, A.Aral, Jute/ Polyester composites: The effect of water aging on the interlaminar shear strength(ILSS), 2011.

[4] Sabu Thomas, Laly A. Pothan, Natural Fiber Reinforced Polymer Composites editions des archives contemporaines,NewYork.

[5] Dinh Van Chau, A study on water absorption and its effects on strength of nano-organoclay-epoxy composites, *Journal of AppliedSciences,12(18),*2012,1939-1945

[6] Sabu Thomas, Kuruvilla Joseph, Sant Kumar Malhotra, Koichi Goda, and Meyyarappallil, Sadasivan Sreekala, *Polymer composites* Volume-1,Wiley-VCH

[7] Shirangi M.H., Fan X.J., Michel B. Mechanism of moisture diffusion, hygroscopic swelling and adhesion degradation in epoxy molding compounds,2008

[8] Chi-hung Shen and George S. Springer, Moisture absorption and desorption of composite materials, *Journal of Composite Materials, vol. 10*, 1976.

[9] Girisha.C, Sanjeevamurthy, Gunti Ranga Srinivas, Sisal/Coconut Coir Natural Fibers – Epoxy Composites: Water Absorption and Mechanical Properties, *International Journal of Engineering and Innovative Technology (IJEIT) Volume 2, Issue 3*,2012.

[10] Sridhar Sathyanarayanan1, Investigation Of Moisture Diffusion Process In Fibre Reinforced Composites By Computing Diffusivity Factors Along 3-Perpendicular Directional Axes Of Hot Wet Temperature Resin Matrix, SSRG *International Journal of Mechanical Engineering (SSRG-IJME)–volume2*,2014.

[11] L. Kumosa, B. Benedikt, D. Armentrout and M. Kumosa, Moisture Absorption Properties of Unidirectional Glass/Polymer Composites Used in Composite (Non-Ceramic) Insulators, Composites-Part A, 2004.

[12] Sreejith Muthirakkal, H N R Narasimha Murthy, Munishamaiah Krishna, Kudamara S Rai and Jeena S Karippal, Hygrothermic behavior of Carbon/Vinyl ester, Glass/ Vinyl ester, Carbon/ Epoxy and Glass/ Epoxy composites, *Iranian Polymer Journal, 19(2)*, 89-103, 2010.

[13] Srinivasa C.V., Bharath K.N.,Water absorption behavior of areca fiber reinforced polymer composites, *International Journal of Materials and Biomaterials Applications 2(2)*,12-14, 2012.

[14] Sheelan R. Areef, The study of solution absorption and diffusion coefficient in epoxy composite reinforced with glass fibers, *Engineering and Technology, vol. 26*, 2008

[15] Younus Khalaf Jabber, Study the Effect of Absorption Solution for Same Composite Polymeric Material, *International Journal of Science and Technology, Volume* , 2013

[16] A. Naceri, Moisture diffusion properties of fabric composite (glass fiber/epoxy resin), *vol. 2*, No. 2, 205-210,2009.

[17] Joannie W. Chin, Tinh Nguyen, KhaledAouadi, Sorption and diffusion of water, salt water, and concrete pore solution in composite materials, *Journal of Applied Polymer Science, vol. 71*, 483-492,1998.

ANALYSING OF INDIGOFERA ASPHALATHOIDES COATED FABRIC FOR ITS THERAPEUTIC EFFICIENCY

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ABSTRACT

Medical Textiles are also known as healthcare textiles. Patients with chronic skin diseases may have an increased risk of Cutaneous and other infections. The transdermal drug delivery system enable the drugs to penetrate the surface of skin, skin layers itself and systemic Circulation to treat skin Disease and to heal the wounds. In traditional Indian treatment, oils were used for treating Skin disease. Now a- days "Ayurvastra" cloths treated with various herbs are being developed for treating Skin diseases. The present study focuses on application of Indigofera aspalathoides (Sivanar Vembu) extract on to the fabric for treating skin disease. Indigofera aspalathoides is selected based on its Anti- microbial, Anti- Viral and wound healing properties. These properties are exhibited by its phytoconstituents such as Amino acids, Carbohydrates, Terpenoids, Tannins, Alkaloids, Flavonoids, Saponins, Glycosides and Lipids. The herb is extracted and applied onto the spun bond Polypropylene fabric (disposable nonwoven fabric which is mainly used for surgical gowns) through Pad- Dry- Cure method with and without Permeation Enhancers (olive oil, Papain & DMSO). Permeation Enhancer facilitates the transport of drug molecules across skin by temporarily altering its permeability. Hostapal MRN is used as a wetting agent, in order to improve the wettability of Spun bond polypropylene nonwoven fabric. Finished fabric is then tested for Anti- microbial properties and rate of drug delivery. This paper discusses the performance of the finished non woven in the above said aspects. The study confirms that the finished non woven can also be used for various applications where Anti- microbial and wound healing activity is required. The developed non woven fabric can be used as wraps and also Apparels. The developed finishing technology can also be extended to Woven's and Knits.

Keywords: Anti Bacterial Property, Indigofera Asphalathoides, Medical Textile, Polypropylene, Transdermal Drug Delivery System

I INTRODUCTION

Combination of textile and its application in medical sciences has resulted into a new field called medical textiles. Development of medical textiles is really meant for converting the painful days of patients and surgeons into the comfortable days. The importance of textile materials in the medical field is credited to their excellent physical properties, such as strength, extensibility, flexibility, suppleness, air and moisture permeability and wicking. As the healthcare industry is growing enormously in India, the demand for the Medical Textile is also on the rise. In this paper, textiles used for treating skin problems have been focused [3].

Chronic skin diseases include common inflammatory dermatoses like atopic and seborrheic dermatitis and psoriasis with peak incidences in childhood and young adulthood. Patients with chronic skin diseases may have an increased risk of cutaneous and other infections [2]. As the side effects of the chemical drugs become apparent, natural remedies become the part of the green revolution. Herbalists used herbs for centuries in the treatment of various Skin diseases. Later on, Ayurvastra cloths (Cloths treated by herbal extracts) were used by Ayurveda health clinics in the treatment of a broad range of diseases.

The aim of this work is to develop herbal finished textiles to treat chronic skin disease especially eczema through transdermal drug delivery system.

II ECZEMA AND ITS CAUSES

Skin disease is a common disorder of predominantly the superficial layers of the skin which affects all age groups from the neonate to the elderly stage. Atopic eczema is one of the most common skin diseases which affects up to 20% of children and 1–3% of adults in most countries of the world[8]. Atopic eczema often has a genetic component that leads to the breakdown of the skin barrier. This makes the skin susceptible to trigger factors, including irritants and allergens, which can make the eczema worse[7].

Fig 1- Eczema

III DRUG DELIVERY SYSTEM

Transdermal drug delivery is the application of drug on the skin surface so that it can permeate through the skin and reaches the systemic circulation.

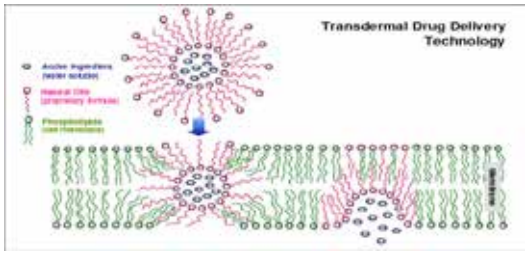

Fig 2-Transdermal drug delivery Technology.

Transdermal patch is applied over the skin and it remains in position for a specific period of time as hours, days or weeks and releases the drug for that period of time. The routes of drug absorption through the skin are intercellular, intracellular and transappendageal. The drug has to pass through various layers of the skin after release from the transdermal patch. The major problem in transdermal drug delivery is the barrier of stratum corneum to the permeation of the drug and can be overcome by permeation enhancing techniques.

IV MATERIALS AND METHODS

4.1. Materials

4.1.1. Herbs used for Eczema Treatments

The Siddha System of Medicine (Traditional Tamil System of medicine), which has been prevalent in the ancient Tamil land, is the foremost of all other medical systems in the world. Its origin goes back to B.C 10,000 to B.C 4,000. Various medicinal plants are being used to treat skin disease in siddha[9]. Among those herbs, *Indigofera aspalathoides* and *Eclipta prostrate* have been selected for the study based on its good Anti bacterial, Anti Viral and Anti fungal activities. Properties of herbs are due to the phyto constituents like Amino acids, Carbohydrates, Terpenoids, Tannins, Alkaloids, Flavonoids, Total phenol, Saponins, Glycosides, and Lipids.

4.1.2. Permeation Enhancer for Transdermal Drug Delivery System (TDDS):

The outer most layer of the skin, the stratum corneum provides a protective barrier that prevents the loss of physiologically essential substances and provides greatest resistance to penetration and it is the rate limiting step of percutaneous absorption. Penetration enhancers are the agents which increase the permeability of skin, maintain the drug level in blood and improve the efficacy of drugs. These are nontoxic, inert substances having no therapeutic value but enhance the absorption of drug through skin by different approaches of penetration enhancement[4].

Dimethyl Sulphoxide, Olive oil and papain has been selected for the present study. DMSO being the chemical can be used as a control. Olive oil has been selected based on its surfactant and moisturising nature. Papain has been selected as it is widely used in medical field for antifungal, antibacterial and anti-inflammatory properties.

4.1.3. Spunbond Polypropylene fabric:

The standard fabric for basic protective apparel; formed by bonding fibers together to form a single layer of breathable, woven-like material. Its main advantages are economy and comfort. These protective garments are available in single-layer spunbonded polypropylene for basic coverage[6]. Spunbond polypropylene nonwoven fabric of 60 GSM is used for our study.

4.1.4. Wetting Agent:

Hostapal MRN, a commercial grade chemical supplied by M/s. Clariant chemicals is used as a wetting agent to improve the absorbency of the PP nonwoven material and facilitate the application of the extract

4.1.5. Test bacterial cultures

The test cultures, Escherichia coli, Staphylococcus aureus, Enterococcus Faecalis and Proteus species used in the study were the significant pathogens isolated from the patients with wound infections (from Kovai Medical Center and Hospital, coimbatore).

4.2. Methods

4.2.1. Extraction of herb:

The extract is prepared using maceration process. In maceration (for fluid extract), whole or coarsely powdered plant-drug is kept in contact with the solvent in a stoppered container for a defined period (7 days) with frequent agitation until soluble matter is dissolved. This method is best suitable for use in case of the thermolabile drugs. 50 grams of herb is added in 500 ml of methanol and extracted using maceration method.

Fig: 3 Extract preparation

Indigofera aspalathoides- Sivanar Veembu showed better Anti microbial activity**.** Thus sivanar vembu has been extracted and used for further studies[1].

4.2.2. Application of herbal extract on nonwoven:

Four different fabric samples are prepared as given in the Table 1. The fabric treated with extract is passed through the squeeze rollers in the padding mangle with 2 bar pressure. It helps to penetrate the extract into the fabric and also remove the excess solution from the fabric surface. After finishing, the fabrics are placed in drying chamber at 80°C for 5 minutes. Due to this process the finished fabric is dried. After drying the fabric, it is placed into curing chamber around at 100° C for 5 minute, which helps in fixing the extract permanently on to the fabric[5].

Sample	Product description
1.NED	Herbal Extract- 30 gpl, DMSO- 60 gpl , Wetting Agent- 5 gpl.
2. NEP	Herbal Extract- 30 gpl, Papain- 2.5 gpl , Wetting Agent- 5 gpl.
3.NEO	Herbal Extract- 30 gpl, Olive oil- 2.5 gpl, Wetting Agent- 5 gpl.
4.NEI	Herbal Extract- 30 gpl, Wetting Agent- 5 gpl.

Table 1: Polypropylene samples prepared through padding mangle

4.2.3. Anti bacterial and antifungal test methods:

4.2.3.1. Antibacterial test method

The antibacterial activity of finished fabric was tested according to EN ISO 20645 against the test bacterial cultures. The finished cotton fabric with the diameter of 6 mm was placed on the surface of Nutrient agar medium which was swabbed with the bacterial cultures. The plates were incubated at 37 ºC for 24 hours to measure the zone of inhibition in millimeters formed around the fabric.

4.2.3.2. Anti fungal test methods:

AATCC 30 – Test method to determine the susceptibility of textile materials to mildew and rot and to evaluate the efficacy of fungicides on textile materials. Each AATCC 30 subpart is treated as a separate antifungal test.

The antibacterial and anti fungal tests were done for the following samples:

a) *Indigofera aspalathoides* and *Eclipta prostrate* herbal extracts to select the best extract

b) *Indigofera aspalathoides* herbal extract was combined with four different types of permeation enhancers. These combinations were tested.

c) The PP nonwoven fabrics coated with the four different combinations of herbal extract and permeation enhancers.

4.2.4. In Vitro Drug release Evaluation - Franz diffusion cell:

In this method transdermal system is placed between receptor and donor compartment of the diffusion cell. The transdermal system faces the receptor compartment in which receptor fluid i.e., buffer is placed. The whole assembly is kept on magnetic stirrer and solution in the receiver compartment is constantly and continuously stirred throughout the experiment using magnetic beads. At predetermined time intervals, the receptor fluid is

removed for analysis and is replaced with an equal volume of fresh receptor fluid. The concentration of drug is determined spectrophotometrically.

Fig 4: Simulated Franz diffusion cell

V RESULTS AND DISCUSSION

5.1. Selecting the best herb for application on the PP fabric

5.1.1. Antibacterial activity of herbal extract by well diffusion method

S.No	Herbs	Con.c	Zone of inhibition (mm)	
			Bacillus	*S.aureus*
1	P1	1X	19	19
		2X	20	23
2	P2	1X	18	19
		2X	20	24

Table 2: Antibacterial activity of herbal extract

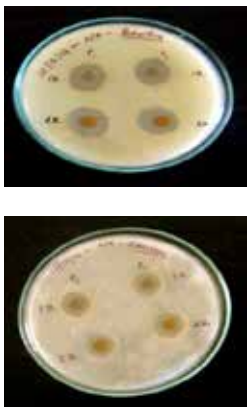

Fig 5: Antibacterial activity of herbal extract

Both the herbs have good Antibacterial activity against the *Bacillus and S. aureus* due to the presence of various phytoconstituents in the herb.

5.1.2. Antifungal activity of herbal extract by well diffusion method:

S.No	Herbs	Conc.	Zone of inhibition (mm)	
			A.niger	*Candida albicans*

1.	P1	1X	17	17
		2 X	16	23
2.	P2	1X	0	0
		2X	0	14

Table 3: Antifungal activity of herbal extract **Fig 6: Antifungal activity of herbal extract**

Sivanar vembu Showed better antifungal activity against *A.niger and Candida albicans* due to the presence of various phytoconstituents in the herb.

(Note: P1-*Indigofera aspalathoides*, P2- *Eclipta prostrate*, 1x-2.5g/50ml, 2x-5g/50ml)

5.2. Antibacterial activity of the herbal extract coated PP fabrics

Samples	Bacillus (mm)	S. aureus (mm)	Enterococcus Faecalis (mm)	Escherichia coli (mm)	Proteus spp. (mm)
1.NED	14	19	18	23	14
2.NEP	19	22	20	22	18
3.NEO	24	28	22	22	22
4.NEI	18	22	20	20	20
5.Ctrl (Amx)	11	13	28	-	19

Table 4: Antibacterial activity of the coated fabrics

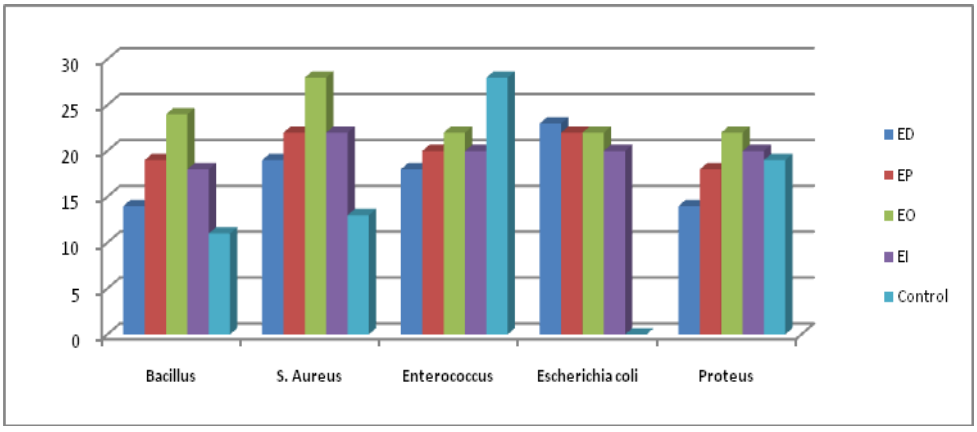

Fig 7: Antibacterial activity of the coated fabrics

Fabric coated with extract and olive oil showed better antibacterial property, which is mainly due to the phytoconstituents present in the herb and due to the better permeation enhancing rate of the olive oil.

5.3. Drug release Studies

5.3.1. Bioactive compounds in *I. aspalthoides*

Amino acids, Carbohydrates, Terpenoids, Tannins- 34.59, Alkaloids, Flavonoids, Total phenol- 47.38, Saponins, Glycosides, and Lipids. UV spec reading was taken to determine the peak value. Maximum absorbance of 0.926 is obtained at 665 nm. This peak shows the presence of various components. Since Phenol is the major constituent and its absorbance range is at 650 nm, phenol content is determined in the study. Catechol equivalent to phenol is used as a standard to determine the concentration of phenol released from the coated fabrics.

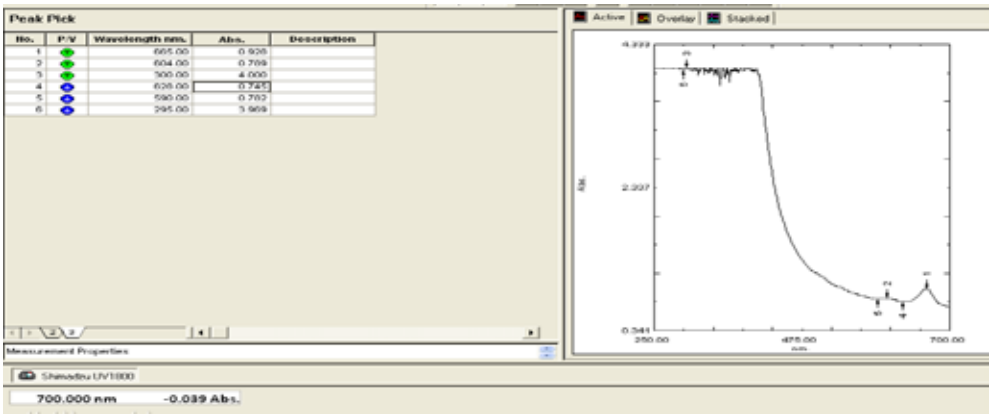

Fig 8: UV Spectophotometer graph to determine the peak value.

5.3.2. Determination of total phenolics:

The extract were taken in a 10ml glass tube(0.2ml) and made up to a volume of 3ml with distilled water. 0.5ml Folin ciocalteau reagent (1:1with water) and 2ml Na_2CO_3(20%) sequentially added in each tube. A blue color was developed in each tube because the phenol undergoes a complex redox reaction with phosphomolibdic acid in folin ciocalteau reagent in alkaline medium which resulted in a blue colored complex, molybdenum blue. The test solution were warmed for 1 minute, cooled and absorbance was measured at 650nm against the reagent used as a blank. A standard calibration plot was generated at 650nm using known concentrations of catechol. The concentrations of phenols in the test samples were calculated from the calibration plot and expressed as mg catechol equivalent of phenol/g of sample.

5.3.3. Calibration plot for phenol determination:

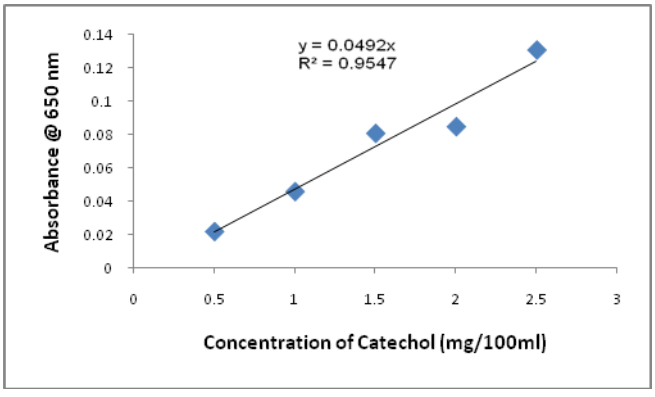

Fig 9: Standard calibration plot catechol equivalent to phenol

5.4.4. Determining the concentration

From the graph, Y= 0.0492 X (X= Concentration, Y= Absorbance).

Therefore, Concentration(X) = Absorbance(Y)/0.0492.

5.4.5. Amount of drug Release

Amount (mg) = Conc. * Dilution factor * Correction factor * Volume of medium

Release rate of Phenolic content from the coated fabric has been determined and tabulated below.

5.4.5.1. Drug release rate- Sample 1 (NED)

Time	Absorb.	Conc. (mg/100ml)	Amount (mg/100ml)
0th hr	0.000	0	0
After 2 hrs	0.001	0.020325203	2.03252
After 4 hrs	0.003	0.06097561	6.09756
After 6 hrs	0.008	0.162601626	16.2602
After 18 hrs	0.014	0.284552846	28.4553
After 20 hrs	0.017	0.345528455	34.5528
After 22 hrs	0.018	0.365853659	36.58537
After 24 hrs	0.019	0.386178862	38.61789
After 26 hrs	0.019	0.386178862	38.61789

Table 5: Drug release rate- Sample 1 (NED)

5.4.5.2. Drug release rate- Sample 2 (NEP)

Time	Absorb.	Conc. (mg/100ml)	Amount (mg/100ml)
0th hr	0.000	0	0
After 2 hrs	0.004	0.081300813	8.130081
After 4 hrs	0.009	0.182926829	18.29268
After 6 hrs	0.010	0.203252033	20.3252
After 18 hrs	0.014	0.284552846	28.45528
After 20 hrs	0.016	0.325203252	32.52033
After 22 hrs	0.017	0.345528455	34.55285
After 24 hrs	0.018	0.365853659	36.58537
After 26 hrs	0.019	0.386178862	38.61789

Table 6: Drug release rate- Sample 2 (NEP)

5.4.5.3. Drug release rate- Sample 3 (NEO)

Time	Absorb.	Conc. (mg/100ml)	Amount (mg/100ml)
0th hr	0.000	0	0
After 2 hrs	0.011	0.223577236	22.35772
After 4 hrs	0.012	0.243902439	24.39024
After 6 hrs	0.013	0.264227642	26.42276

After 18 hrs	0.015	0.304878049	30.4878
After 20 hrs	0.016	0.325203252	32.52033
After 22 hrs	0.017	0.345528455	34.55285
After 24 hrs	0.018	0.365853659	36.58537
After 26 hrs	0.019	0.386178862	38.61789

Table 7: Drug release rate- Sample 3 (NEO)

5.4.5.4. Drug release rate- Sample 4 (NEI)

Time	Absorb.	Conc. (mg/100ml)	Amount (mg/100ml)
0th hr	0.000	0	0
After 2 hrs	0.003	0.06097561	6.097560
After 4 hrs	0.004	0.081300813	8.130081
After 6 hrs	0.006	0.12195122	12.19512
After 18 hrs	0.013	0.264227642	26.42276
After 20 hrs	0.015	0.304878049	30.48780
After 22 hrs	0.016	0.325203252	32.52033
After 24 hrs	0.017	0.345528455	34.55285
After 26 hrs	0.017	0.345528455	34.55285

Table 8: Drug release rate- Sample 4 (NEI)

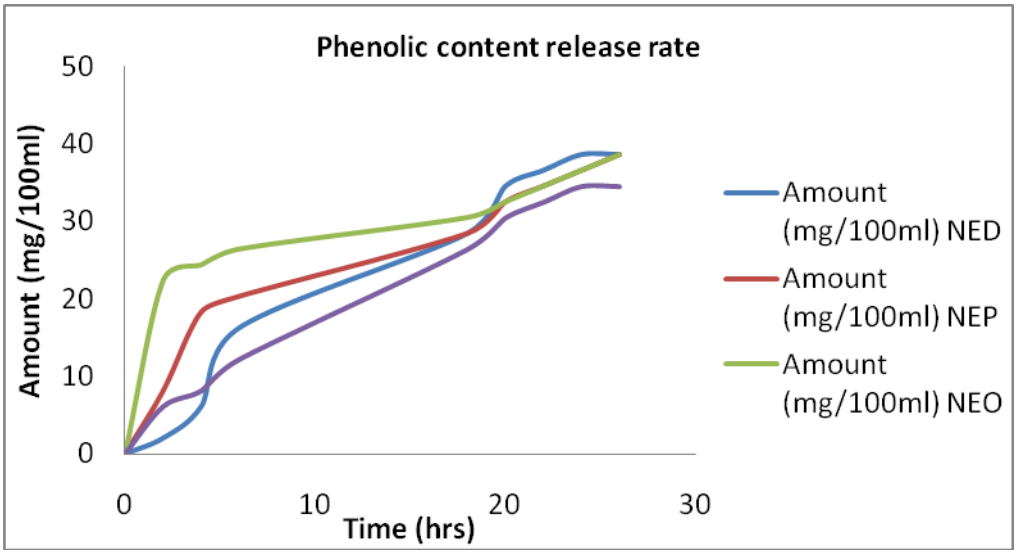

Fig 10: Phenol release rate from the coated fabric

Drug released by the coated fabric of diameter 4cm^2 has been determined. Comparing all the samples, release rate of fabric coated with extract and olive oil is better from the initial hours.

VI CONCLUSION

In this project, Anti-bacterial finish has been applied to the nonwoven polypropylene fabric. Extract of Indigofera aspalathoides has been applied onto the fabric with three different Permeation enhancers .The performance of the finished non woven fabric has been studied and found that fabric treated with extract and olive oil showed better anti microbial properties and efficient drug release rate.

Thus, the sample treated with extract and olive oil has much better properties for preventing Skin disease. The drug release rate is also much effective in this sample. And it is suggested that, this fabric could be used for preventing skin disease and also for other applications were anti microbial finish is required. And also it gives benefit to the people in health and cost wise. In addition, it is environmental friendly.

REFERENCES

1. Amita Pandey, Shalini Tripathi, "Concept of standardization, extraction and pre phytochemical screening strategies for herbal drug", Journal of Pharmacognosy and Phytochemistry 2014; 2 (5): 115-119.
2. Anne Braae Olesen. (2012). Chronic Skin Disease and Risk of Infection. *The Open Infectious Diseases Journal, 6 (Suppl 1: M6)*, pp. 60-64.
3. Dr.Chinta S.K and Veena K.V. (January 2013). Impact of Textiles in Medical Field. *International Journal of Latest Trends in Engineering and Technology, 2 (1).*
4. Dhruba Sankar Goswami, Nidhi Uppal, Sandeep Goyal, Naveen Mehta, Anil Kumar Gupta, "Permeation Enhancer for TDDS from Natural and Synthetic Sources: A Review", *Journal of Biomedical and Pharmaceutical Research 2 (1) 2013, 19-29.*
5. Edwin Sunder. A, Quality assurance in Textile Wet Processing, S.S.M.I.T.T.
6. Hosun Lim. (2010). A Review of Spun bond process. *Journal of Textile and Apparel, Technology and management, 6 (3).*
7. NICE clinical guideline. (December 2007). Atopic eczema in children. *Management of atopic eczema in children from birth up to the age of 12 years, National Insitute for Health and Care Excellence.*
8. Ring. J, A. Alomar *et al*. (2012). Guidelines for treatment of atopic eczema (atopic dermatitis) Part I, *Journal of the European Academy of Dermatology and Venereology, 26,* pp. 1045–1060.
9. Samraj. K, S. Thillaivanan, P. Parthiban. (2014). A review of beneficial effects of medicinal plants on skin and skin diseases. *International Journal Of Pharmaceutical Research and Bio-Science, 3(1),* pp. 93-106.