STATIC AND DYNAMIC MECHANICAL ANALYSIS OF CHEMICALLY MODIFIED RANDOMLY DISTRIBUTED SHORT BANANA FIBER REINFORCED HIGH-DENSITY POLYETHYLENE/POLY (Є-CAPROLACTONE) COMPOSITES

R.K.Misra[a*], Sandeep Kumar[b]

[a] *Department of Mechanical Engineering, B.I.T Mesra, Ranchi, 835215, India.*
**E-mail: mishrark_kanpur@yahoo.com, Tel.No. +919431382611*
[b] *Scientist, Defence materials and stores research and development establishment, Kanpur, India.*

ABSTRACT

Randomly distributed short banana fiber reinforced HDPE/PCL (high-density polyethylene / poly (Є-caprolactone)) composites have been fabricated to determine the mechanical behavior at static and dynamic loading. To enhance the mechanical properties of matrix, poly caprolactone has been blended with high-density polyethylene. Three samples of banana fibers were treated with sodium hydroxide, sebacoyl chloride, and toluene diisocyanate solutions separately. It has been observed that banana fibers treated with sodium hydroxide give better mechanical properties compared to the other two solutions. The role of fiber/matrix interactions in chemically treated banana fibers reinforced composites was investigated to predict the stiffness and damping properties and their different mechanical behavior is compared with untreated banana fibers. In order to study the static and dynamic response of HDPE, HDPE/PCL blend, treated and untreated banana fiber reinforced composite plate, a multiquadric radial basis function (MQRBF) method was developed. MQRBF is applied for spatial discretization and a Newmark implicit scheme is used for temporal discretization. The discretization of the differential equations generates a larger number of algebraic equations than the unknown coefficients. To

overcome this ill conditioning, the multiple linear regression analysis, which is based on the least square error norm, is employed to obtain the coefficients. Simple supported and clamped boundary conditions are considered. Numerical results are compared with those obtained by other analytical methods.

Notations

a, b	Dimension of the plate
h	Thickness of the plate
R	Aspect ratio (a/b)
ν	Poisson's ratio
ρ	Mass density of the plate
m	Mass of the plate
C_ν^*, C_ν	Viscous damping, dimensionless viscous damping
D	Flexural rigidity
E_R	Young's modulus
G	Shear modulus
q, Q	Transverse load, dimensionless transverse load
t^*, t	Time, dimensionless time
w^*	Displacement in z^* direction
w	Dimensionless displacement in z direction
ω	Natural frequency of vibration
ρ_0	Surface density $(\rho_0 = \rho h)$
λ	Eigen value

Key words: Short banana fiber, Polyethylene, multiquadric radial basis function, multiple linear regression analysis.