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Flax Reinforced Thermoset Composites from Polyfurfuryl Alcohol

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Water insoluble poly(furfuryl alcohol) (PFA) is an unexplored thermosetting resin which is synthesized from water-soluble furfuryl alcohol (FA) [1-4]. Commercially available FA has very low viscosity (6.9-7.0 cts at 25℃) and it is obtained from furfural originating from renewable saccharidic biomass. Controlled polymerization of PFA (viscosity of 560 ± 10 cts at 25℃) was carried out under mechanical stirring using p-toulene sulphonic acid (0.3 phr) as a catalyst at 45-50℃ for 30 min. Thermal stability of obtained PFA was very high with T_{max} of 482℃ and 60 % of char yield at 700℃ as compared to FA having two lower T_{max} (195℃ and 443℃) and char yield of 40% at 700℃. Composites with high mechanical properties were prepared by taking different weight fractions (W_f) of the woven flax fibers and PFA by curing at 190℃ for 30 min under contact pressure of 3-5 bar. The composites were prepared at different weight fractions of the matrix ranging from 0.7 to 0.5. With the increase in weight fractions of matrix in composites, tensile strength decreases but water resistance of the composites increases slightly from 7.2% to 6%. Storage modulus (4.8 GPa at 25℃) was the highest for FP-0.6 (having 0.6 W_f of the matrix) than for FP-0.5 (having 0.5 W_f of the matrix) and FP-0.7 (having 0.7 W_f of the matrix). The char yield of the composites increased with the increase in weight fraction of the matrix and for FP-0.7 it was 44 %. Further work is in progress to improve properties of their composites and it is anticipated that PFA based natural fiber reinforced composites may find promising applications in thermal and water resistant composites as they also exhibit good mechanical properties.

References

[1] A. Gandini, Macromolecules 41, 24 (2008) 9491-9504.
[2] M. Choura, N. M. Belgacem and A. Gandini, Macromolecules 29, 11 (1996) 3839-3850.
[3] C. C. M. Ma, M. S. Yn, J. L. Han, C. J. Chang and H. D. Wu, Composites Manufacturing 6, 1 (1995) 45-52.
[4] L. Pranger and R. Tannenbaum, Macromolecules 41, 22 (2008) 8682-8687.