Effects of fiber loading, fiber type, its mesh sizes, and coupling agent on the properties of oil palm biomass/polypropylene composites

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ABSTRACT
This study investigates the effects of fiber type, mesh size, fiber loading, and coupling agent on the performance of oil palm biomass (OPB) fiber composites. The dried OPB fibers were ground and screened into 63, 150, 250, 450, and 500 μm meshes for composite production. Fiber composition and fiber morphology were evaluated by scanning electron microscope (SEM) and energy disperse analysis of X-Ray. Ground fiber was compounded into polypropylene (PP) by means of a twin-screw compounder. Maleated polypropylene (MAPP) was used as a coupling agent during compounding. The incorporated fiber contents for OPB composites were 10%, 20%, 30%, and 40% (by weight). The compounded samples were prepared into test specimens by injection molder. The composites were characterized by tensile testing, flexural testing, impact testing, melt flow index, and SEM. The analysis of variance of the effects of fiber types, fiber mesh sizes, and fiber contents and their interactions on the OPB-PP composite properties were studied and found to affect on composite properties significantly. The most significant effect on strength and modulus was found by the addition of coupling agent which was suggested to be due to the thermodynamic segregation of the MAPP toward the interface resulting in covalent bonding to the OH groups on the fiber surface.

KEYWORDS:
oil palm fiber; composites; coupling agent; morphology

REFERENCES

1. Godara, A., Raabe, D., Bergmann, I., Putz, R., Müller, U. 2009) *Composites Science and Technology*, 69 (2), pp. 139-146. Cited 48 times.
   doi: 10.1016/j.compscitech.2008.08.031

2. Sanadi, A.R., Caulfield, D.F., Stark, N.M., Clemons, C.C.
   Thermal and mechanical analysis of lingo cellulosic-polypropylene composites(1999) *The Fifth International Conference on Woodfiber-Plastic Composites*, p. 67. Cited 19 times.
   The Madison Concourse Hotel, Madison, WI, 26-27 May

3. Sanadi, A.R., Caulfield, D.F., Jacobson, R.E.
   (1997) *Paper and Composites from Agro-Based Resources, Chapter 12-Agro Fibre Thermoplastics Composites*, pp. 377-401. Cited 86 times.
   CRC Press, Lewis Publisher

4. Gironès, J., Pimenta, M.T.B., Vilaseca, F., Carvalho, A.J.F., Mutjé, P., Curvelo, A.A.S. (2008) *Carbohydrate Polymers*, 74 (1), pp. 106-113. Cited 43 times. doi: 10.1016/j.carbpol.2008.01.026

5. Pracella, M., Chionna, D., Anguillesi, I., Kulinski, Z., Piorkowska, E. (2006) *Composites Science and Technology*, 66 (13), pp. 2218-2230. Cited 220 times. doi: 10.1016/j.compscitech.2005.12.006