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EFFECT OF WOOD FIBER CHARACTERISTICS ON TORQUE PROPERTIES OF WOOD POLYMER COMPOSITES

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We investigated the effects of fiber variability, size and content on the fusion characteristics of wood particle-reinforced high-density polyethylene (HDPE) using a torque rheometer at 180℃ and rotor speed of 50 rotations per minute (RPM). Five types of wood sawdust were investigated in this study: eastern white cedar(Thuja occidentalis L.), with sapwood and heartwood sawdust treated separately; jack pine (Pinus banksiana Lamb.) sawdust divided into wood sawdust and bark shavings; and black spruce sawdust (Picea mariana Mill.). Three different fiber length classes were also used (0.23 mm; 0.35 mm, 0.72 mm). Composite pellets of wood particles at 25%, 35%, and 45% by weight with the HDPE were made using a co-rotating twin-screw extruder. The pellets were placed in the 300cc Haake torque rheometer that was preheated to 180℃, melt mixing occurred in the rhometer during 7 min. Data from the torque rheometer included mixing and melting times, maximum torque and stabilized torque were obtained. Adding wood fibers to the HDPE increased processing time and torque energy. At constant fiber length and proportion, torque properties showed significant variation with fiber origin (species, wood or bark). Variation in fiber length and proportion led also to significant variations in melting properties and torque characteristics. Higher fiber lengths and proportions increased torque energy and time of stabilisation. These results indicate that using wood fibers with different properties will lead to significant variations in processing, such as in extrusion or injection molding parameters. The practical implications on processing and composite properties are discussed.