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Using amazon cupuaçu-husk as filler to produce a POLY(BUTYLENE ADIPATE-CO-TEREPHTHALATE) (PBAT) eco-friendly composite

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Brazil is renowned for its diverse agricultural and forestry crops, which are influenced by its climate and soil conditions. The Amazon region is known for its many agricultural products, with cupuaçu being one of the standout species due to its versatile uses and promise in several industries. Both the pulp (35% of the fruit) and the seed (20% of the fruit) of the cupuaçu are extensively utilized by the food and cosmetics sectors. The husk of cupuaçu (HC), comprising around 45% of the fruit, is typically discarded as waste, frequently improperly in the environment. An unexplored potential application of HC is its utilization as a filler in the production of composites, like poly(butylenoadipate-co-tereftalate) (PBAT), a biodegradable polymer obtained from fossil sources. Therefore, this study intends to explore the potential of employing powder HC as a filler to produce PBAT/HC composites, driven by the goal of finding practical applications for agricultural residue and the demand for biodegradable materials. PBAT composites were produced by incorporating 0, 2.5, 5, 10, and 20% weight of HC. These composites were analyzed for processability, rheology behavior, stress vs strain characteristics (ASTM D638), and morphology using scanning electron microscopy (SEM). There is not a significant difference in torque and energy consumption between the composites with 2.5% and 5% weight in terms of processability. There is a progressive increase in these properties in composites with a HC content higher than 10% by weight, which suggests a high demand for mechanical energy to blend these composites. The complex viscosity (?*), elastic modulus (G'), and viscous modulus (G") all increase as the HC content increased, suggesting a rise in flow resistance as this biofiller is incorporated. A rise in the elastic modulus from 45 to 67 MPa is observed with the addition of HC, whereas there is a decrease in the tensile strength from 22 to 10 MPa and strain at rupture, although the typical ductile behavior remains. The SEM study of the fractured surface of composites revealed the components responsible for the reduction in mechanical characteristics. Finally, this study demonstrates that utilizing HC classified in mesh 47–43 ?m does not enhance all properties of PBAT/HC composites, motivating the need for additional research to enhance the reinforcement. Nevertheless, the results suggest that HC has the potential to be used as an inert biofiller for composites, depending on the specifications needed for the final products.