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Physical and Mechanical Properties of Biodegradable Pot Derived from Oil Palm Empty Fruit Bunch and Sodium Alginate

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Abstract

Efforts to overcome the problem of agroplastic waste (in the form of pots, polybags, and other planting containers) continue to be studied. This research investigated the use of oil palm empty fruit bunch (OPEFB) and sodium alginate in the production process of biodegradable pots. This study also investigated the comprehensive features of biodegradable pots which included physical, mechanical, structural (chemical), and morphological properties. Physical and mechanical characterization showed that the moisture content, specific gravity, water absorption, ultimate tensile strength (UTS), and elongation at break of the examined biodegradable pots increased with increasing sodium alginate content. Biopot-3 with 15% sodium alginate exhibited the highest UTS at 1.29 MPa and elongation at break at 6.77%. FTIR spectra in the 400-4000 cm^{-1} region showed that all examined biodegradable pots exhibited identical spectra which most of the peaks showed the characteristics of cellulose, hemicellulose, and alginate. While, XRD patterns showed that the biodegradable pot material has an amorphous structure with 2θ angles being 21.69°, 22.01°, and 22.03°, respectively. Surface morphology analysis by SEM revealed that Biopot-1 containing 5% sodium alginate (the lowest sodium alginate content) exhibited many porous cavities, indicating that the matrix could not completely fill the space between the fibers. It contrasts with Biopot-2 and Biopot-3 (10% and 15% sodium alginate, respectively), which have a morphology with a denser surface. In general, the produced biodegradable pots exhibited adequate functional properties as ecologically friendly planting containers, but further research is required to investigate their field applicability.

Keywords:
agroplastic; biocomposite; biopot; cellulose; thermopressing