POTENSI BIONANOKOMPOSIT DARI PATI BENGKUANG DAN SERAT ECENG GONDOK UNTUK APLIKASI KEMASAN MAKANAN

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ABSTRACT

Isolation of high purity nanocellulose water hyacinth fiber (Eichornia crassipes) has been achieved with chemical and mechanical treatments. Chemical treatments included pulping process in the digester, bleaching, and acid hydrolysis. Meanwhile, mechanical treatment using ultrasonic crusher. SEM image shows that the successful chemical treatments damage lignin and hemicellulose layers. This is supported by FTIR and chemical composition which showing reduced lignin and hemicellulose components. The acid hydrolysis and ultrasonic treatment can reduce the diameter and length of cellulose water hyacinth fiber. Ultrasonic for 1 h has produced cellulose fibers with diameter and length of about 15 nm and 147 nm, respectively. The crystal index of nanocellulose fibers after sonication was 80%. These results were supported by thermal stability. Nanocellulose water hyacinth fiber is a potential use as bionanocomposite reinforcement for food packaging applications with a starch matrix.

Bionanocomposite from yam bean starch (Pachyrhizus spp.) reinforced nanocellulose water hyacinth fiber was made by solution casting method. The addition of nanocellulose fibers in starch matrix was varied 0, 0.1, 0.3, 0.5, and 1 wt% (from dry starch weight basis) in suspension. Ultrasonic treatment for 1 min was given while gelatinized. The highest tensile strength was achieved in 1 wt% nanocellulose fiber in yam bean starch matrix (5.8 MPa). The crystal index also increased by more than 200% with additional nanocellulose just lower than 1 wt%. These results are supported by other data such as thermal stability and moisture absorption.

The addition of ultrasonic vibration was important to make a good dispersion of nanocellulose fibers in starch matrix. The ultrasonic vibration was administered as 0, 15, 30 and 60 min of the bionanocomposite samples. The results show that ultrasonic vibrations can improve the mechanical, thermal, and water barrier properties. This is evidenced by its higher value on mechanical properties compared with untreated bionanocomposite. At 60 min vibration, the value of tensile strength was 11.4 MPa. SEM imaging also displayed a compact structure. These results are supported by crystal index, thermal stability, and moisture absorption. This bionanocomposite's mechanical and thermal properties suggest it could be suitable for food packaging.

The soil burial test for 3, 7 and 15 days was also done to know the biodegradation rate of bionanocomposite. The addition of nanocellulose fiber in matrix to the biodegradation rate has been observed. The slowest biodegradation rate was in the bionanocomposite with the addition of 1% nanocellulose fiber. The weight loss for 15 days in soil was 30-35%. The bionanocomposite in this study are environmentally friendly.

Keywords: *water hyacinth fiber, nanocellulose, yam bean starch, bionanocomposites*