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Development of Bio-plastic Material Blending KonjacGlucomanan Flour and Chitosan Using Single Screw Extruder

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ABSTRACT

The aim of the research is study physicochemical properties and the rheology of bio-plastic material. The method for blending polymer is processed using extrusion technology. Composition of material blending between konjacglucomannan(KGM) flour and chitosan are 50:10, 40:20, and 30:30 (% w/v), respectively with 20% glycerol and 0.315% tris-nonylphenylphospite (TNPP) as plasticizer and stabilizer. Physicochemical properties of bio-plastic materials were analysed by DSC, FTIR, SEM, and XRD. The results of the research showed that the bio-plastic material has melting point (T_m) in the range 100-118°C. Bio-plastic products included in the classification of elastomer based on the curve stress-strain relationship which leads to soft and tough character. The value of elongation at break is high, reaching 35%. The bio-plastic product showed that semi-crystalline structure with matrix pattern. Rheology of polymer including non Newton system based on the flow of the material from chitosan blending konjacglucomannan flour in the extrusion process which is showed a slow flow rate due to the high viscosity of the material.

| Bio-plastic | KGM | Chitosan | Blending technique | Single screw extruder |

1. INTRODUCTION

Synthetic plastic is non-biodegradable material waste caused many environmental problems. One of the solutions to minimize the synthetic plastic waste is used thermoplastic starch (TPS) and chitosan (Krist, 2010). TPS and chitosan are renewable, biodegradable, and compostable bio-plastics. They have strong mechanic characteristic and good permeability to the oxygen and water (Agullo, et al., 2003). Recently, polymer blending method was used for new polymer material development. Extrusion technology is suitable and effective for processing polymer material TPS blending from konjacglucomannan (KGM) flour and chitosan. In this paper we report composition blending polymer between KGM and chitosan using single screw extruder technology.

2. EXPERIMENTAL

2.1 Materials, method and instruments

Konjac glucomannan [KGM] 28% from PT. Ambico, chitosan with 88% deacetylation degree from CV. Bio Chitosan Indonesia, etanol, gliserol, 99,99% glacial acetic acid and *tris-nonyl-phenylphospite* [TNPP] from PT. Chandra Asri Petrochemical, Tbk.

The extrusion process was recorded onSingle screw extruder (Yokohama Chemical), Fuctional group was recorded on FT-IR Shimadzu Prestige-21 and Nicolet iS10, thermal analyzed was used Differential Scanning Calorimetry (DSC) Shimadzu DSC-50 with thermal analyzer TA-501 types, mechanical characteristics were recorded by autograph Shimadzu AG-10TE, Densimeter H. The microstructure and morphology of polymer were used the Scanning Electron Microscopy (SEM)-EDX JEOL JSM-6360, JED-2200, and X-Ray Diffraction (XRD) Philips Analytical.

The concentration of material for blending between KGM flour and chitosan are 50:10, 40:20, and 30:30 (% w/v) with 20% glycerol and 0,315% tris-nonylphenylphospite (TNPP) as plasticizer and stabilizer.

3. RESULTS & DISCUSSION

The result of the research showed that the melting point (Tm) of bio-plastic was very sharp at 100 and 60°C (10% concentration of bio-polymer). It indicated that it was not
structure of crystalline, but semi crystalline as shown in
Figure
1.
The bio-plastic product has strong smelt as well as acetic acid, but it was loss after burning and no residue, so namely a thermoplastic polymer. In the 20% concentration Figure 1, the thermograph was flat and like thermosetting polymer due to curing and hard caused crosslinking of polymer and decomposition was occur.