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Utilization of microalgal-derived ash as a mineral reinforcement material in biocomposite formulation with polyvinyl alcohol

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Downstream processing of microalgae biomass feedstock such as gasification is an alternative approach which generates fly ash as by a product. The utilization of the ash to make added-value materials could partially offset the total cost of microalgae-based chemicals production. In this work, fly ash converted from lipid-extracted algal (LEA) of the strain *Nannochloropsis* salina was used as fillers for biocomposite fabrication with biodegradable polyvinyl alcohol (PVA). The negative charges ash particles was dispersed and assembled with poly (diallyldimethylammonium chloride) (PDDA) at pH 10, followed by absorption of PVA solution. Composite PVA/ASH and PVA/ASH/PDDA films were synthesized by using solution casting method. Universal testing machine (UTM), thermogravimetry analyzer (TGA), and differential scanning calorimeter (DSC) were used to determine the mechanical and thermal properties the films. The morphological and crystal structures of the composites were investigated by scanning electron microcospy (SEM), X-ray diffractometer (XRD), and Fourier transform infrared spectroscopy (FT-IR), respectively. Results showed that incorporation of the linear polycations significantly enhanced dispersion of ash particles in PVA matrix even at 25% of ash loading, whereas the ash particles tended to aggregate in PVA matrix at higher loading than 5% and severer at 25%. That caused the remarkable decrease in ultimate tensile strength (UTS) of the PVA/ASH composites from 34.5 to 22.8 MPa at 5% to 25% ash content, respectively, which were lower than 37.6 to 32.2 MPa determined for PVA/ASH/PDDA composite films at the same ash proportion. Moreover, these composites significantly increased Young's modulus and thermal resistance compared with the pure PVA.

Biography

Dang-Thuan Tran completed his PhD in 2013 from National Cheng Kung University, Taiwan. Currently, he is working as a Postdoctoral researcher at Advanced Biomass R&D Center, KAIST, Korea. He is currently working on downstream processing of microalgae-based biofuels and bioproducts production. Specifically, he alternatively focuses on conversion of lipid extracted algal biomass to biocomposite materials. He has published more than 15 papers in reputed journals and has been serving as a reviewer of various journals including *Bioresource Technology, Applied Biochemistry and Biotechnology, Biomass & Bioenergy*.

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