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Development and characterization of poly (vinyl alcohol)/lipid-extracted algal biomass/glycerol biocomposite films

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Biocomposite is an alternative of petroleum-based plastics and bioplastics. Microalgae biomass has been considered as third generation feedstock of biomass-based biofuel production platform. Lipid accumulated in microalgae can be extracted to convert to biodiesel fuel, following by generation of lipid-extracted algae (LEA). Utilization of this byproduct in the economical way will generate added-values for microalgal-based biofuel processing. In this work, LEA produced from lipid extraction of microalgae strain *Nannochloropsis salina* mainly comprises of 20.41% total carbohydrate, 26.89% protein, 9.14% total lipid, and 21.72% ash was used as reinforcement materials in biocomposite formulation with biodegradable and water-soluble polyvinyl alcohol (PVA). "Wet route" was developed to use wet LEA for composite synthesis in presence of glycerol as a plasticizer. Mechanical and thermal properties of the biocomposite PVA/LEA/glycerol films were analyzed with universal testing machine (UTM), and thermogravimetry analyzer (TGA), and differential scanning calorimeter (DSC). Morphology and quantitative analysis was investigated by scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FT-IR). Result indicated that increasing content of LEA reduced ultimate tensile strength (UTS), elongation at break (EB), and Young's modulus (YM) of the composite films, but enhanced thermal stability compared to neat PVA. Moreover, addition of glycerol significantly increased EBs. Overall, LEA and glycerol are compatible with PVA and 40 wt% of PVA could be replaced by LEA and glycerol to produce biocomposites which were named as P6L1G3, P6L2G2, and P6L3G1. These biocomposite could be used as mulching thermoplastic films for using in agriculture or horticulture.

Biography

Hyun-Ro Lee completed his BS in 2014 from Korea Advanced Institute of Science and Technology (KAIST), Korea. Now, he is a Graduate student of the first-year master program of Department of Chemical & Biomolecular Engineering, KAIST. His research is focused on downstream processing of microalgae-based biofuels and bioproducts production, especially conversion of microalgae biomass and lipid-extracted algal (LEA) to biocomposite materials.

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