Fungal chitosan thin film from palm oil mill effluent as sustainable piezoelectric biomaterial

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Abstract

Chitosan extracted from fungal biomass could be used as sustainable and biodegradable piezoelectric material. This study aims to fabricate the fungal chitosan thin films using palm oil mill effluent (POME) for piezoelectric applications. POME is a waste from the palm oil industry and used as the sustainable carbon substrate in cultivating the fungi. The cultivation of fungi Aspergillus oryzae using POME was optimized for maximum yield of fungal biomass using Plackett-Burman (PB) design. PB design shows that the highest fungal biomass was produced at 17.5 g/L from the cultivation medium composed of KNO3, CaSO4 ⋅2 H2O, yeast extract and POME. Chitosan is extracted from fungal biomass through extraction and deacetylation of chitin using alkali and organic acid treatment. Different organic acids were investigated in fabricating chitosan thin film using solvent casting technique. Formic acid showed promising results compared to the other acids and further used in fabricating POME-derived fungal chitosan thin films. The physical, chemical, electrical, and structural properties of the fungal chitosan thin film were observed. The mechanical quality factor (Qm) of the POME-derived fungal chitosan thin film using formic acid as the solvent was 11.9, with dissipation factor (tan delta) of 0.083, which demonstrated its potential as piezoelectric biomaterial from sustainable source.

Keywords

Author Keywords: Aspergillus; Chitin; Chitosan; Fungi; Plackett-Burman; Palm oil mill effluent (POME); piezoelectric

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