

Area: ANA

Development of a screen-printed electroanalytical sensor based on a polystyrene and organosolv lignin copolymer

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Highlights

Rice husk lignin extraction as agricultural waste valorization; Solid waste polystyrene as polymeric matrix; Obtaining laser-induced graphene (LIG) from sustainable polymer substrates.

Abstract

Solid waste consists of garbage or any remaining solid material, most produced in industrial and agricultural contexts, such as rice husk (RH), a rice processing byproduct rich in biopolymers such as lignin [1]. Other means of solid waste generation include the improper disposal of polymeric materials such as expanded polystyrene (EPS) used in packaging and electronics [2].

Organosolv lignin (LO) was obtained from RH extraction [3]. For film 1, 0.067 g of LO and 1.341 g EPS were mixed with 0.027 g of adipic acid in 100 mL of ethyl acetate solution. Different precursor concentrations were evaluated, with values of 3 and 5 times the initial precursor mass weighted, resulting in films 2 and 3, respectively. The solution underwent ultraviolet (UV) light treatment under agitation for 10 minutes and then cast into petri dishes for drying and film formation. Afterwards, the film was treated with 0.1 mol L⁻¹ sodium tetraborate solution.

LIG screen printing was done by commercial UV printer K4 Pro (TopDirect, Guangdong Province, China), where parameter values such as 60, 65 and 70% for printing speed and 50 and 45% for laser potency were evaluated. It was found that lower precursor concentrations during film 1 formation resulted in a heterogeneous film with surface deformations, rendering the film unsuitable for LIG printing. Film 2, however, had increased thickness and homogeneity, which can be explained by the increase in precursor mass. Film 3 yielded similar results to film 2, with the formation of lignin spots, resulting in increased heterogeneity. Films 2 and 3 were used as LIG substrates. It was observed that higher speeds (70%) paired with lower potency (45%) were the most effective in LIG formation; however, it is necessary to characterize the material to obtain information regarding LIG formation and quality.

[1] SHARMA, S.; KUMAR *et al.* Springer International Publishing, 2020. ISSN: 978-3-030-40663-9

[2] MARTEN, B.; HICKS *et al.* Sustainability (United States), 2018. DOI: 10.1089/sus.2017.0015

[3] ROSA, M *et al.* Biological and Chemical Research, p. 87-98, 2017.

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