SYNTHESIS AND APPLICATION OF THIN FILMS OF GRAPHENE NANOCOMPOSITE CHITOSAN COPPER PLATINUM FOR ENVIRONMENTAL APPLICATION

Edith Flora Joel[1*], Galina Lujanienė[1], Sandra Stanionytė[1], Martynas Skapas[1], Loreta Leviskaitė[2]

[1] SRI Center for Physical Sciences and Technology, Lithuania

[2] SRI Nature Research Centre, Vilnius, Lithuania

edith.joel@ftmc.lt

The non-toxicity of Chitosan when mixed with other metal composites can have a wide application of environmental application owing to its high biodegradability. On the other hand, graphene oxide is known for its mechanical strength as well as excellent chemical and physical properties. Although graphene oxide has high potential for applications in the environment sector, due to some limitations associated with its characteristics, Graphene Oxide-chitosan nanocomposites have found wide application in solving environmental issues [1]. Metal nanoparticles like platinum and copper and their oxides are known for their enhanced anticorrosive and adsorption properties [2]. Chitosan-graphene oxide-platinum-copper nanocomposites and its oxides immobilized on a thin chitosan film have been synthesized for the first time. Firstly, Graphene Oxide nanoparticles are obtained by a modified Hummers method. Chitosan oxide composite thin films were prepared by mixing an aqueous solution of 3% chitosan and 1.5 g of graphene oxide in the presence of diluted 1 % acetic acid [3].

The Copper (Cu), Copper oxide (CuO), Cuprous Oxide (Cu_2O) and Copper (I) perOxide(Cu_2O_2) were synthesised in the laboratory conditions by the reduction of copper sulphate pentahydrate. Later the platinum and copper / copper oxide nanoparticles were added to the synthesized graphene-oxide chitosan aqueous solution and ultrasonication was done so that the oxygen-containing functional groups attract the platinum by electrostatic interaction [4]. The structural properties and swelling test, were performed to analyse the physical characteristics of the thin films. Finally, copper nanoparticles were also added along with the homogenous solution of Graphene Oxide-chitosan-platinum and sonication is completed and left overnight. The copper nanoparticles and the graphene oxide/chitosan nanoparticles were characterised by EDAX, XRD. After this, the films GO-CS-Pt-Cu, GO-CS-Pt-CuO, GO-CS-Pt-Cu_2O, GO-CS-Pt-Cu_2O_2 were fabricated by the gel casting method aided by the self-healing ability of the chitosan framework. In conclusion, our studies form the basis for the prospective use of these nanocomposites as potential agents for antibacterial, cleaning, anticorrosion, and other environmental applications.

REFERENCE:

1. Menazea, Abdelrahman A., et al. "Chitosan/graphene oxide composite as an effective removal of Ni, Cu, As, Cd and Pb from wastewater." *Computational and Theoretical Chemistry* 1189 (2020): 112980.

2. .Nzaba, Sarre MK, Bhekie B. Mamba, and Alex T. Kuvarega. "Platinum Group Metal-Based Nanocatalysts for Environmental Decontamination." *Nanocatalysts* (2019).

3. Han, Donglin, et al. "Preparation of chitosan/graphene oxide composite film with enhanced mechanical strength in the wet state." Carbohydrate Polymers 83.2 (2011): 653-658.

4. Lu, Yang, et al. "Facile synthesis of graphene-like copper oxide nanofilms with enhanced electrochemical and photocatalytic properties in energy and environmental applications." *ACS applied materials & interfaces* 7.18 (2015): 9682-9690.