Heavy Metal Ions Adsorption and Biofilm Production by Nanocellulose Synthesized From Sugarcane Bagasse

Law, Ho Suet Hilary (School: St. Paul's Convent School)
Chan, Si Ching (School: St. Paul's Convent School)
So, Yuen Ching (School: St. Paul's Convent School)

Our project aims to upcycle waste sugarcane bagasse which will be used to synthesize nanocellulose, investigating the effectiveness of nanocellulose, bagasse powder and unrefined sugarcane bagasse as adsorbents to remove three heavy metal ions (mercury(Ⅱ), lead(Ⅱ) and copper(Ⅱ)). We examined their adsorption capacity for heavy metal ions, and the effectiveness of copper(Ⅱ) ions recovery and the regeneration of the adsorbents. Results show that nanocellulose is most effective in lead(Ⅱ) and copper(Ⅱ) ions adsorption while bagasse powder is most effective in mercury(Ⅱ) ions adsorption, and hence we believe that these biodegradable bagasse waste and nanocellulose would be great alternatives to treat polluted water resources. On the other hand, by mixing PVA, glycerol and citric acid of different proportions with nanocellulose, we aim to produce biofilms and compare their tensile strength and water absorption ability. Results show that the biofilm blend 4 of the combination (nanocellulose :PVA : glycerol : citric acid = 10 : 2 : 1 : 0) has the highest tensile strength whereas Blend 9 of the combination (nanocellulose : PVA : glycerol : citric acid = 10 : 6 : 1 : 0) has the lowest water absorption ability. Lastly, blend 9 is selected as the best combination for making packaging materials because it has the best overall performance in the tests conducted on tensile strength, water absorption ability and flexibility of the films. The nanocellulose biofilm can be a replacement for cling film, showing new possibilities in the development of sustainable materials.