

Synthesis of nanocrystalline cellulose from *Musa Paradisiaca* bunch stalk and peel and its' application in environmental remediation

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The heavy metals in the environment have become a serious threat to human health and the balance of ecosystems. Environmental remediation processes could be used to remove heavy metal ions from the natural environment. Nanocrystalline cellulose (NCC) is a good adsorption material that is well-available, biocompatible, and biodegradable. This study was conducted to synthesize NCC from *Musa Paradisiaca* banana bunch stalk and banana peel, a common agricultural plant waste material, and study their efficiency for heavy metal adsorption. The synthesizing process was successfully carried out with the acid hydrolysis method. From the banana bunch stalk, a 26.1555% yield of NCC was obtained, while from the banana peel, a yield of 29.15 % was obtained. According to FTIR, in the 1000 to 1200 cm^{-1} region there is a very intense peak because of C-O stretching; however, in polysaccharide compounds, an overtone of this stretching occurs in 2000 – 2500 cm^{-1} region, which is clearly visible in banana peel NCC. The XRD analysis was carried out to examine the crystallite size, and the nanocrystalline particles produced were 1.66 nm from the banana bunch stalk and 0.79 nm from the banana peel. These nanomaterials were used to find the adsorption properties of heavy metal ions of Cd^{2+} , Pb^{2+} , Cu^{2+} , and Ni^{2+} . Ni^{2+} showed a high removal percentage of 60% in the range of pH 2 to 6. Pb^{2+} showed higher removal percentages of 45% to 67% in the range of pH 1 to 5. Cd^{2+} and Cu^{2+} showed relatively low removal percentages.

Key words: Nanocrystalline cellulose, Heavy metal adsorption, Environmental remediation

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