

Development of Eggshell-Based Orange Peel Activated Carbon Film for Synergetic Adsorption of Cadmium (II) Ion

ABSTRACT

Heavy metal contamination has spread around the world, particularly in emerging countries. This study aimed to assess the effectiveness of starch/eggshell/orange peel-activated carbon-based composite films in removing cadmium (II) ions from water samples. X-ray diffraction and scanning electron microscopy were used to characterize the composite films. The effect of Cd^{2+} was studied using a UV-Vis spectrophotometer and atomic absorption spectroscopy. The morphology of the composite film reveals a highly porous and rough surface with more open channels and a non-uniform honeycomb, indicating that the film has a high potential to adsorb Cd^{2+} . The diffraction peaks for this film were found to be at 13.74° , 17.45° , 18.4° , and 23.6° , indicating a typical crystalline A-type packing arrangement within the starch granules. The results indicate that crystalline structure was unaffected by the addition of eggshell powder and orange peel-activated carbon. In 0.5 mg L^{-1} and 1.0 mg L^{-1} Cd^{2+} ions, the composite film removed 100% and 99.7% of the Cd^{2+} , respectively, while the maximum removal efficiency for methylene blue was 93.75%. Thus, the current study shows that starch/eggshell/orange peel activated carbon film has a high potential for commercial activated carbon as a low-cost adsorbent.