A profuse agricultural biomass waste oil palm frond powder (OPFP) has been used as a stable extractor for the removal of chromium ions and characterized by using Fourier Transform Infrared (FTIR), Thermogravimetric analysis (TGA), X-ray diffraction (XRD), and Scanning electron microscopy (SEM) analyses. Batch adsorption experiments were employed to study the main parameters under various conditions (e.g., contact time, solution pH, initial metal ion concentration, temperature, etc.). The most favorable pH for the optimum sorption of chromium ion was found to be 4. Langmuir and Freundlich isotherms were tested to describe the adsorption mechanism. The monolayer adsorption capacity of OPFP for Cr(III) was found to be 119.04, 75.18, and 90.09 mg g\(^{-1}\) at 30, 40, and 50\(^{\circ}\)C, respectively. Thermodynamic parameters were also computed and their results exposed the spontaneous and endothermic nature of sorption. FTIR confirmed that the interactions between metal ions and OPFP were responsible for adsorption. TGA indicated that no weight loss of mass was observed up to 300\(^{\circ}\)C. XRD and SEM image showed amorphous morphology of untreated and metal-treated adsorbent. It was also found that after adsorption, the morphology of metal-treated OPFP had been completely changed which proved the phenomenon of adsorption. The low-cost thermally stable OPFP adsorbent has been successfully used for the removal of chromium ions from aqueous solutions.

**Keywords:** Oil palm frond; Characterization; Adsorption; Isotherm; Thermodynamic