ABSTRACT

Biosorption can be an effective technique for the treatment of heavy metal bearing wastewater resulting from human and industrial activities. To remove the heavy metals there have been many chemical and physical methods are followed to keep the environment free from metal contamination. Many types of researches were reported that attenuated plant biomass has greater biosorption capability than chemical adsorbent. Natural bio adsorbents of the banana bunch, tea waste and maize cob can play a major role in waste water treatment due to being renewable, cheap, easily available and eco-friendly. Comprehensive characterization of bioadsorbents was done to examine its morphology, crystalline structure, and functional groups. Optimization of the adsorption mechanism of various parameters was analyzed such as adsorbent particle size, metal concentration, dosage, time, mixing, agitation speed, and pH. The batch experiments were carried out for the removal of Pb (II). The present study shows that biosorption using banana bunch as 98.0%, Tea waste as 92.03%, and maize cob as 89.65% respectively. The time taken for maximum biosorption of lead was found at 120, 150 and 150 minutes for a banana bunch, tea waste and maize cob respectively. The optimum biomass concentration was obtained at 3, 2.5 and 3.0 mg/ml. The optimum pH level of 5 and other parameters of optimum temperature were confirmed at 28 ºC for the
removal of a lead ion from aqueous solution. Adsorption isotherms of a lead metal ion with three different natural bio adsorbents were analyzed to confirm the Langmuir, Freundlich and Temkin isotherm models. The highest regression coefficient $R^2$ value of 0.9133 in the banana bunch was well fitted than tea waste and maize cob natural bio adsorbents. The kinetic models of first and second order reaction were also tested, based on the mathematical calculation Pseudo-second order was found to be well fitted for the same. The optimized parameters were used for the removal of lead from Tannery, battery, and crackers industry wastewaters. The results with banana bunch adsorbent reveal that 82.9 % lead removal from the tannery industrial wastewater, 86.33% lead removal from crackers and 92.8% of lead removal from battery industries. Therefore, experimental results have proven that banana bunch was found best among the tea waste and maize cob adsorbents.

**Key words:** Bioadsorbent, Lead, reaction kinetics, Isotherm, Wastewater treatment