

Comparative Study of Biosorption Capacity of Cadmium on Banana Peel and Cactus for Different pH and Partical Size

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ABSTRACT: Image inpainting is the process of restoring the lost or damaged regions or modifying the image contents imperceptibly. It refers to the process of filling-in missing data in a designated region of the visual input. In this paper, the technique presented is for detection and removal of text from images. The system detects text using morphological operations, connected component labelling and a set of selection criteria which helps to filter out non text regions. So, the resultant image is the image with only texts. Text Inpainting is done in two steps. The first step detects the text region automatically, without user interaction and in the second step; the text is removed from the image using exemplar based Inpainting algorithm.

KEYWORDS: Banana peel, Cactus, Biosorption, Cadmium, Wastewater etc.

I. INTRODUCTION

CADMIUM, a non-essential and non-beneficial element to plants and animals, is non-biodegradable and travels through the food chain. The kidneys are the critical target organ after ingestion (renal dysfunction, hypertension and anaemia). The major sources of cadmium release into the environment by waste streams are electroplating, smelting, alloy manufacturing, pigments, plastic, batteries, mining and refining processes. This metal is a serious cause of environmental degradation. Therefore, it is necessary to alleviate cadmium ion from industrial effluents. Many methods for treatment have been described include chemical and surface chemistry processes such as precipitation, adsorption, membrane processes, ionic exchange, floatation, and others. However, those techniques have their own inherent limitation such as less efficiency, sensitive operating conditions, and production of secondary sludge requiring further, costly disposal. These disadvantages, together with the need for more economical and effective methods for recovery of metal from wastewater, have resulted in the development of alternative separation technologies. One such alternative is biosorption, where certain types of biomass are able to bind and concentrate metals from even very dilute aqueous solution. A biosorption process offers a number of advantages when compared to the conventional methods currently used. Biosorption, the passive uptake of heavy metals by biomaterials, can be both highly efficient and cost effective. A low cost biosorbent is defined as one which is abundant in nature, or is a by-product or waste material from another industry. Agriculture biosorbent such as orange wastes, olive stones, papaya wood, grape stalk waste, peas, broad bean, and medlar peels, lemon peels, orange peels, grapefruit peels, apple peels, apple kernel, apple core, and grape skins, coconut shell powder, coconut copra meal have been evaluated for their biosorption properties.

II. RELATED WORK

Most of the studies showed that agricultural waste either in natural form or modified form is highly efficient for the removal of cadmium ions. Agricultural by-products usually are composed of lignin and cellulose as major constituents and may also include other polar functional groups of lignin, which includes alcohols, aldehydes, ketones, carboxylic, phenolic, and ether groups. These groups have ability to some extent to bind heavy metal ions by donation

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of an electron pair from these groups to form complexes with the metal ions in solution. Banana peel, agricultural waste, was selected because of its high pectin content and the fact that it is an agricultural byproduct. The by-products resulting from processing represent a major disposal problem for industry and the environment. Therefore, the purpose of this study was to explore the feasibility of using Banana peel for cadmium ion removal from aqueous solutions by conducting batch experiments as a function of solution pH, initial cadmium ions concentration and contact times.

III MATERIALS AND METHODOLOGY

Biosorbents Preparation

Banana peel and cactus was collected as solid waste. The collected material was then washed with deionized water which was prepared by the technique of reverse osmosis several times to remove heavy metals. The washed materials was cut into small pieces (1-2 centimeter; cm) then dried in a hot air oven at 60°C until they reached a constant weight, which was accomplished after 48 hours (hrs). In the final stage these material was dried, ground, and screened with sieves of the cut of size of > 850, 600-850, 425-600, 300-425, 212-300 and 150-212 µm.

Effect of particle size

The effect of particle size, > 850, 600-850, 425-600, 300-425, 212-300 and 150-212 µm, was determined by agitation 0.1 g of banana peel and 100 ml of Cd(NO₃)₂·4H₂O solution at the concentration of 50 mg/l. Agitation contact time was kept for 24 hrs which is sufficient to reach equilibrium with a constant agitation speed of 150 rpm at 25 °C. A pH value of 3 to 6 were maintained throughout the experiment by adding 0.1 N NaOH or HNO₃ before each the experiment same procedure will do for cactus.

Effect of Solution pH

The effect of initial solution pH was determined by agitation 0.1 g of Banana peel and 100 ml of Cd(NO₃)₂·4H₂O solution concentration 50 mg/l using a shaker at different solution pH values ranging from pH 1 to pH 6. Agitation contact time was kept for 24 hrs which was sufficient to reach equilibrium with a constant agitation speed of 150 rpm at 25°C. The pH was adjusted by adding 0.1 N NaOH or 0.1 HNO₃. same procedure will do for cactus.

IV. EXPERIMENTAL RESULTS

Effect of pH

The pH of the aqueous solution was an important controlling parameter in the biosorption process. Most research conducted on heavy metal biosorption indicates that the decrease in metal ion biosorption at acid pH could be due to the increase in competition with protons for active sites. At alkaline pHs, however, other effects could arise that also alter the process, such as the predominant presence of hydrated species of heavy metal, changes in surface charge or the precipitation of the appropriate salt. Effect of pH solution on the biosorption of cadmium ions by using banana peel material and cactus was studied and the results are shown in Fig 1. There was increasing cadmium ion removal with increasing pH from pH 1 to pH 5. The cadmium ion removal increased rapidly. At pH of around 5, cadmium ion removal leveled off at a maximum value. The biosorption of cadmium in a highly acidic solution (pH 1) was observed to be negligible. According to several authors biosorption below pH 2 is negligible due to the competition of hydrogen ions for the active sites. The dependence of cadmium capacity on pH was similar to the cadmium ion sorption on *Hydrilla verticillata* and Cystine-modified biomass. Then the cadmium ion capacity increases as the pH continue increasing. Due to proton (H⁺) vies with cadmium ions in lower pH, the sorbent surface taken up more H⁺, consequently reducing cadmium ions binding on the biosorbent surface. At higher pH, the biosorbent surface takes more negative charges, thus attracting more cadmium ions. However, with further increases in pH the formation of anionic hydroxide complexes decreases the concentration of free cadmium ions.

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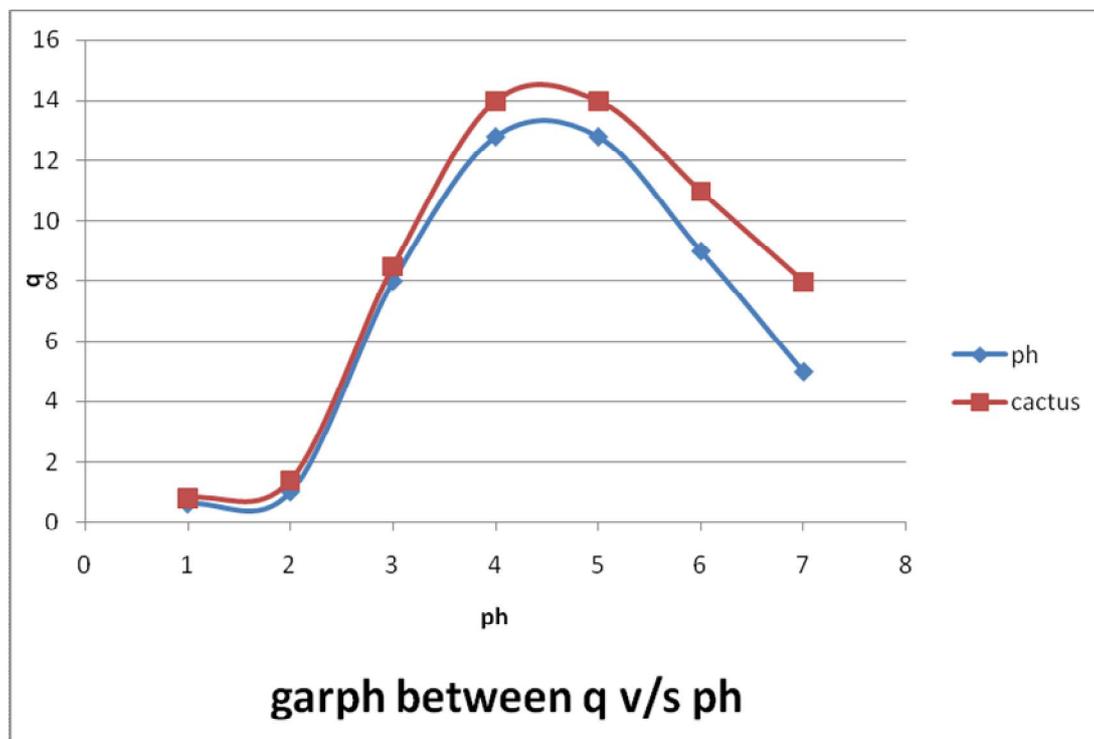


Fig. 1 Effect of pH for Banana peel and cactus biosorption of cadmium ions from aqueous solution. Conditions: 0.1 g; initial $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ concentration 50 mg/l; contact time, 24 hrs; 150 rpm; $25 \pm 2^\circ\text{C}$

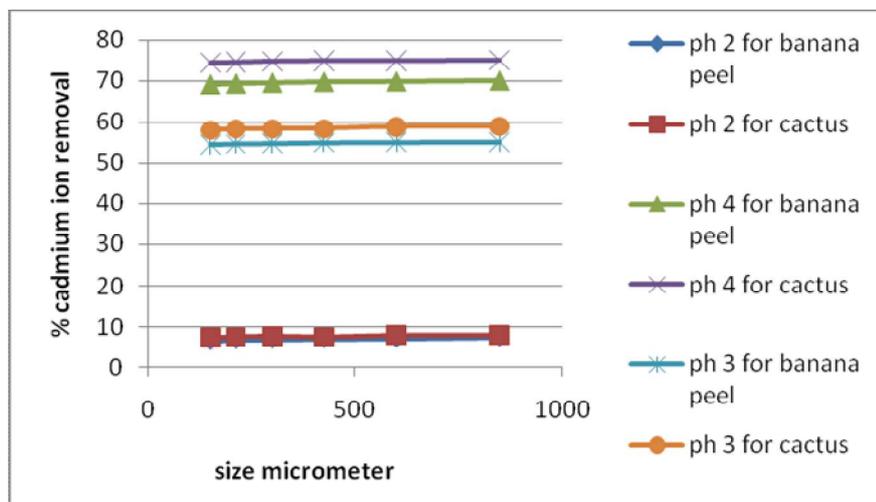
Effect of particle size

The percentage of cadmium ions removal using banana peel at different particle sizes are shown in Fig 2. It was seen that the influence of the particle size was similar at different solution pH ranging from 2 to 6. The particle sizes of banana peel and cactus had no effect on the removal of cadmium ions. The higher biosorption level achieved by smaller particle size of the biosorbents may not be connected to the fact that smaller particle sizes give large surface areas. There was tendency that smaller particle sizes produce shorter time to equilibrate. Although this is contrary to expect for an intraparticle diffusion controlled process, it is necessary to point out that the two sizes of biomass are actually of the same thickness (dimension which determines the diffusion distance). This is due to size grading of ground biomass particle by standard sieves works on the length and width dimensions. The behavior has been reported by others, although Leusch et al. 1995 showed that larger biomass particles of *Sargassum fluitans* and *Ascoplyum nodosum* had higher metal uptake than smaller particles in the case of cadmium, copper, nickel, lead and zinc. Then, the influence of biosorbent size on metal uptake seems to be function of both the type of biomass and the metal ion.

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Effect of particle sizes of banana peel on different pH Conditions: 0.1 g; initial Cadmium nitrate concentration 50 mg/l; contact time, 24 hrs; pH, 2-6; 150 rpm; 25±2°C

V. CONCLUSION

The use of Banana peel and cactus waste could be an environmentally friendly method of cadmium ion adsorption from aqueous solution. Further studies will help to evaluate the economic implications of using this biosorbent. banana peel biosorption of cadmium ions was dependent on solution pH, initial ion concentrations and contact time. In this experiment we can also get the idea biosorption capacity of cactus is greater than the banana peel. Further experiment can be done for metal analysis and isotherm for banana peel and cactus.

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