The parthenium biosorbents for removals of chlorides and hardness from water

Subhashish Dey

Civil Engineering Department, Gudlavalleru Engineering College, Gudlavalleru, Andhra Pradesh, India

Abstract

Contamination of water toxic metals is an environmental concern and hundreds of millions of people are being affected around the world. Several acute and chronic toxic effects of heavy metals affect different body organs. There are several methods aviliable for removal of sulphates and fluorides present in water among these methods the biosorption is a simple, economical and environment-friendly method for removal of sulphates and fluorides from water. Biosorption is a physiochemical procedure that produces physically in certain biomass those allows it to concentrate passively and bind heavy metals onto its cellular structure. The custard apple leaf biosorbents is one of the best biosorbents for removals of sulphates and fluorides from water. The custard apple fruit which is available for a short season (August to October) is one of the most sought after fruits in India. While the custard apple has countless health benefits like being rich in antioxidants and minerals like calcium and potassium, its leaves are equally nutritious. The performance of custard apple leaf biosorbents synthesized in optimum circumstances for sulphates and fluorides sorption process was related with the changes in intrinsic textural and morphological properties such as measured by XRD, FTIR, BET and SEM-EDX techniques. The regeneration of custard apple leaf biosorbents was also calibrated and observed that the custard apple leaves does not represent any high concentrations of major transform in its performances.

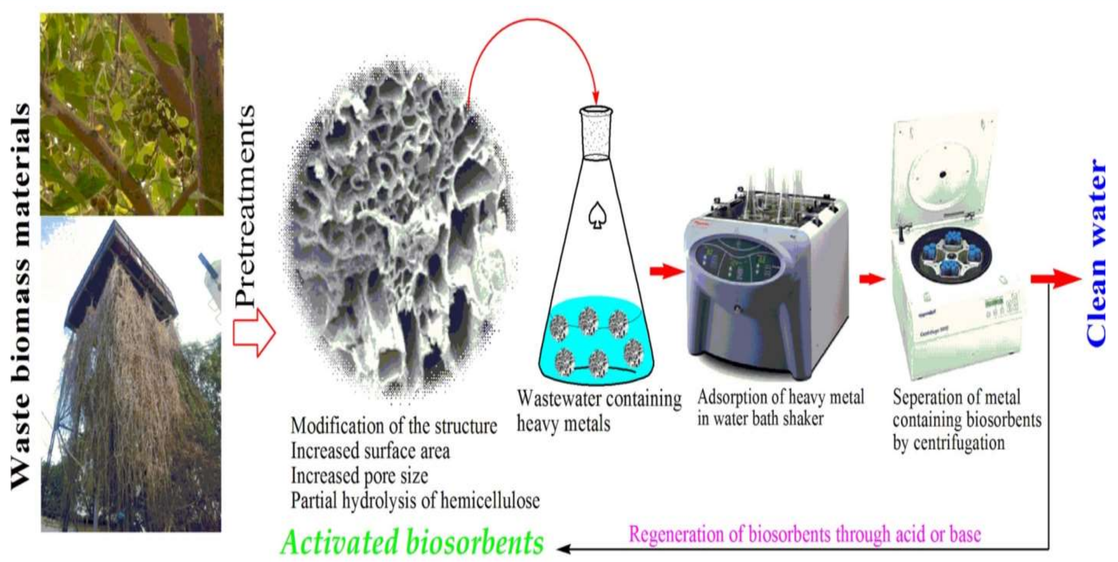
Introduction

Biosorption-based processes offer a number of advantages including low production cost of adsorbents, simple operation, high efficiency, improved selectivity for specific metals of interest, short operation time, no generation of secondary refractory wastes, and easy treatment of spent adsorbents by incineration and so forth. Identification of bio-sorbents for the process of bio-sorption is a major challenge. It is desirable to develop/ obtain bio-sorbents with the capacity to bind/uptake metal ions with greater affinities. A wide variety of materials available in nature can be used as bio-sorbents for the removal of metals from contaminated water resources. The desired characteristics of an ideal bio-sorbent are high affinity for metals (bio-sorption capacity). Low economic values (low cost) availability in large quantities easy desorption of the adsorbed metal ions and possible multiple reuse of the bio-sorbent. Models developed were presented to determine both the number of adsorption sites required to bind each metal ion and rate of adsorption, using a batch reactor mass balance and the Langmuir theory of adsorption to surfaces or continuous dynamic systems . The custard apple fruit which is available for a short season (August to October) is one of the most sought after fruits in India. It is made up of a hard green exterior which is non-edible and the main sweet and fleshy fruit is revealed upon cutting open the exterior. While the custard apple has countless health

Design/Other information

Take1200ml of distilled water and add 1.2g of sodium sulphate mixed thoroughly. Take six conical flasks filled with125ml of sulphate solution with care. Weigh the custard apple leaves biosorbents 1g, 2g, 3g, 4g, 5g and 6g, add to the six conical flasks respectively. Place them in the mechanical shaker for one and half hour with minimum speed. After one and half hour keep aside for settlement for 10min and filter them with a filter paper then take 125ml sample from the filtered solution. Add 5ml of hydroxylamine solution and 10ml of Benzedrine hydrochloride solution in the conical flasks. Place them in the mechanical shaker for 10min. Keep aside for settlement and filter them with a filter paper. Take 100ml of distilled water and clean the filter paper and collect the residue from the filter paper in respective conical flasks. When the solution changes to pink color note down the burette readings to perform calculation and determine the sulphate content. The increase in removal of sulphates percentage with increase in custard apple leaves adsorbent dosage is due to the more availability of exchangeable sites or surface area at higher concentration of the adsorbent. Custard apple is the best bio-sorbent material for removal of sulphates in all the materials we've used. The removal was increased with the contact time variation. In Fig. 2 shown that the biosorbents are more efficient and can be reused multiple times, making them more economically attractive. Batch studies were conducted to evaluate various parameters, including biosorbents amount, temperature, contact duration, pH, rotation speed and initial metal ion concentration. Further this research is to investigate the growth of biosorption processes in terms of modeling biosorbents material regeneration and analyzing the use of immobilized raw biomasses with polluted water. There is often a direct relationship between the intensity of colour in solution and the concentration of coloured component (the sulphates) which it contains. Batch studies were carried out for various parameters, viz., pH, biosorbents dosage, contact time, initial ion concentration, agitation speed and temperature. The development of biosorption processes require further investigation in the direction of modeling of regeneration of biosorbents materials and testing of immobilized raw biomasses with contaminated water. Custard apple leaves biosorbents shows better efficiency and multiple reuses to increase their economic attractiveness. Batch studies were carried out for various parameters, viz., pH, biosorbents dosage, contact time, initial ion concentration, agitation speed and temperature. The development of biosorption processes require further investigation in the direction of modeling of regeneration of biosorbents materials and testing of immobilized raw biomasses with contaminated water. Biosorption was influenced by various process parameters such as pH, temperature and initial metal concentrations of metal ions, biosorbents dosage and speed of agitation. Also, the custard apple leaves biomass can be modified by physical and chemical treatment before use.

Set up



Results

Custard apples leave is one of the most commonly used leaves for remedial purposes. At different dosages to know that the amount required to remove the sulphates from water. The 1gm custard apple leaves biosorbents remove the 25%, 2 gm biosorbents remove 48% sulphates and 3gm biosorbents remove the 72% sulphates. The addition of 4gm biosorbents removal of sulphates is 94% and additional of 5gm biosorbents removal of sulphates is 100%, and again continues additions of custard apple leaves biosorbents it makes constant. Based on all the results, this graph compares the dosages of custard apples biosorbents to show which removes highest sulphates from water. In fluorides removals from water the custard apple leaves biosorbents started showing results at low as 1g of dosage. The initial situation of fluorides elimination percentages was 12% at 1g, 2g the value was 30%, at 3g of dosage it's 50%, 4g it removes 73%, 5g remove 92% and 6g shows the 100% removal was obtained. In custard apple leaves biosorbents showed that the best performance for sulphates and fluorides removals was obtained at 6gm dosages. The eliminations performance was directly related to the concentrations of custard apples leaves dosages was used in the water. The concentrations of custard apples leaves biosorbents dosages is a major factor as the adsorption mostly depends upon the surface regions of biosorbents exists for the interface of contaminants. The amount of custard apples leaves biosorbents dosage plays an important role in the removal of fluorides and sulphates are present in the water. In this, dosage of custard apple leaves biosorbents is calculated to accurate amount at which the sulphates and fluorides in water are removed at the best. The addition of custard apple leaves biosorbents is done from 4.5 gm to 6 gm in fluorides and sulphates contaminated water. Increased custard apple leaves biosorbents dosages enhances sulphates and fluorides biosorption at a given starting ion concentration due to increased surface area, increasing the number of accessible binding sites. The quantity of sulphates and fluorides biosorbed per unit weight of biosorbents was high at lower concentrations of custard apple leaves biosorbents. In contrast, with more custard apples leaves biosorbents concentrations, the amount of sulphates and fluorides ion biosorbed per unit weight falls. This is due to the reduced adsorbent to binding sites ratio, caused by an inadequate solute exists for complete dispersion onto available binding sites and possible binding site interaction. The concentration of biosorbent is key factor as the adsorption mainly depends upon the surface area of adsorbent existing for the contact of pollutant at the interface. This dosage of custard apple leaves biosorbents is calibrated to the exact level that eliminates the most sulphates and fluorides from water . The elimination of sulphates from the water sample was 98% at 4.7g of custard apple leaves dosages and 100% removals obtained at 4.8gm of custard apple leaves biosorbents dosages. According to the Figure 12, increasing the custard apple leaves dosages concentration improved the percent removal of sulphates, but subsequent dosage increases had little effect on the biosorption yield.

Conclusions

The 5.6 g of custard apple leaves biosorbents highly effective for complete removal of sulphates and fluorides present in water. The optimum sorption of sulphates and fluorides over custard apple leaves biosorbents was obtained at basic pH is 9, contact time is 180min, temperature is 40^{o}C and agitation speed is 150rpm. This work has been carried out in a batch type of reactor system. The size range of particles exists in custard apple leaves biosorbents is 3.26 to 8.54µm, crystallite size is vary from 3.02 to 5.24nm, surface area is 34.84-43.68m^2/g, pore volume is 0.316-0.428cm^3/g and average pore size is 38.64-58.74Å. In XPS analysis the binding energy of custard apple leaves biosorbents 964eV and TEM analysis the spent custard apple leaves biosorbents represented a multilayer (3–4) staking of an average length of 16.32 nm.

References

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International Conference on
Composite Materials for Environment Protection & Remediation
(ICCMEPR - 2024) 02-03 July, 2024