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Removal of Lead from aqueous solutions by adsorption on melon peel

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Abstract
Today, heavy metals are the most serious pollutants. Lead pollution impacts all the systems of the human body. Therefore environmental engineers and scientist have investigated the method to treat heavy metal bearing wastewater effectively and economically. The present study for the removal of Pb from aqueous solution by using low cost adsorbent saponified melon peel as a natural adsorbent. The experiment conducted to study the effects of contact time, Effect of pH, adsorbent dose and initial concentration of lead. The percentage removal of lead maximum 72 %.

Keywords: Lead, aqueous solution, Melon peel, Adsorption

Introduction
Nowadays lead contamination in an environment is a very important problem of worldwide concerning due to its highly toxic and non-biodegradable in nature. There are many ways that lead is released into aquatic system such as natural phenomenon, urban, agricultural and industrial activity (1). Various sources of heavy metals in water are battery manufacturing, basic steel, paper pulp, metal plating, leather tanning, agrochemicals petrochemicals and chemical manufacturing, mining and fertilizer industries. Among the heavy metals lead is one of the most toxic elements even at low concentrations (2). Amongst the present day's environmental issues, water scarcity and water pollution rank equal to climate change (3). Increasing level of heavy metals in natural water bodies poses a serious threat to all living species including humans (4) the higher concentration of lead will cause severe damage to the nervous system and affects the function of brain cells (5). Lead can also damage the kidney, liver and reproductive system (6). So their removals from industrial waste waters remain in important challenge (7). According to WHO the maximum permissible limit (MPL) of lead in drinking water is 0.1mg/L (8). The heavy metals are of special concern because they pose a significant danger to human health (9). Therefore environmental engineers and scientist have investigated the method by treat heavy metal bearing wastewater effectively and economically. Enhanced industrialization by the various uses of lead which has caused the release of large quantities of the by-product of this material into Air, Soils and Surface Water (10).The removal of such a heavy metal from contaminated water bodies has been attempted by several scientists employing a wide variety of techniques including chemical precipitation, ion-exchange, electro flotation, membrane filtration, reverse osmosis etc. All these methods are generally expensive (11) due to rapid development and industrialization in many countries. The levels of industrial pollution have been steadily rising. So the pollution problem of industrial wastewater is becoming more and more serious in the world (12). Hence proper treatment of industrial wastewaters that are releasing lead into the aquatic and land system is very important (13). According to the United Nations Organization reports there are 1.1 billion people still do not have access to safe supply of drinking water (14).

Materials and Method
Adsorbate: Pb $(NO_3)_2$ were obtained in analytical reagent and used without further purification synthetic 1000ppm stock solution prepared for lead metal.
Lead solution: 1.6 grams of Pb $(NO_3)_2$ was added in 100ml of distilled water in 1000ml volumetric flask. It was dissolved by shaking and the volume was made up to the mark. Lead solution concentration of this solution was 1000 mg/l (15).

Adsorbent: Melon peel pieces were cut up to 2mm of size and weighed on weighing machine to get 100g wet peel particles. These wet peel particles were than mixed with 10g of calcium hydroxide $Ca(OH)_2$ with 500ml deionized water in a beaker and stirred at room temperature for 24hrs. After 24hrs of stirring the solution was filtered through whatman No.1 filter paper and washed to neutral pH up to 7 with distilled water and filtered again by what man No.1 filter paper. The remaining filtrate was dried in convection oven at 60 ^{0}C for 12hrs. Dried particles than crushed through pestle and mortar and then with grinder as mashed below 300 micrometer. These dried particles are named as saponified melon peel gel (SMP) (16).

Method

Batch adsorption experiments are conducted to study the Lead sorption rates and saponified melon peel gel (SMP). The 100ml effluent of lead solution of known lead concentration (20, 40 50, and 100 ppm) is taken into flask in which different dose of melon peel is added and mixed at mixing condition. The contact time of adsorptive material for lead effluent is kept as 30 min, 60 min, 90 min, 120 min, and 150 min. and then the adsorbent was separated from solution by filtered through whatman No.1 filter paper. The concentration of lead after adsorption was measured using UV spectrophotometer. The experiment conducted to study the effects of contact time, effect of pH, adsorbent dose and initial concentration of lead. The PH of the adsorptive solution was adjusted using NaOH and buffer solution when required. The percentage uptake of lead was calculated according to the following equation.

Percentage uptake (%) = $[(C_0 - C_t)/ C_o] \times 100$

Where C_o is the initial concentration and C_t is the concentration at time t.

Result and Discussions

Effect of contact time: fig 1 shows the variation in the percentage removal of Pb with contact time. Removal efficiency up to 120 min. at maximum 72 percentages for 20 ppm concentration and then gradually decrease at 150 min.

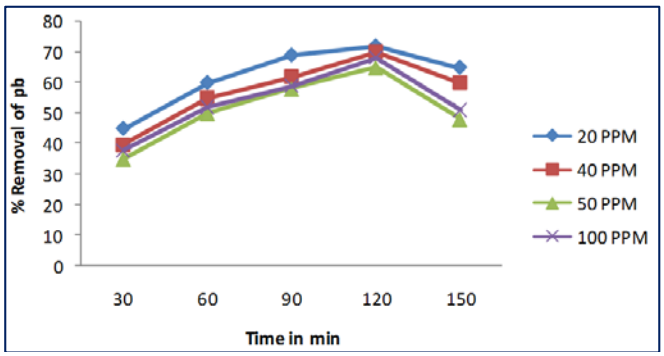

Fig 1: Effect of contact time on percentage removal of lead by melon peel.

Effect of pH

PH variation is one of the most important parameters controlling uptake of heavy metals from aqueous solution. Fig 2 shows the effect of PH on Pb removal efficiencies of melon peel adsorbent. These experiment were conducted at an initial metal ions concentration of 20,40, 50 ppm in 100ml solution, and agitation period are 120 min for all lead ions at varying the PH in each solution. The maximum removal of Pb, at 6 PH and were found to be nearly 72 percentage respectively. The percentage adsorption increases with pH to attain a maximum a 6 pH for Pb and there after it decreases with further increases in pH. The maximum removals of Pb at 6pH were found to be nearly 72 % respectively.

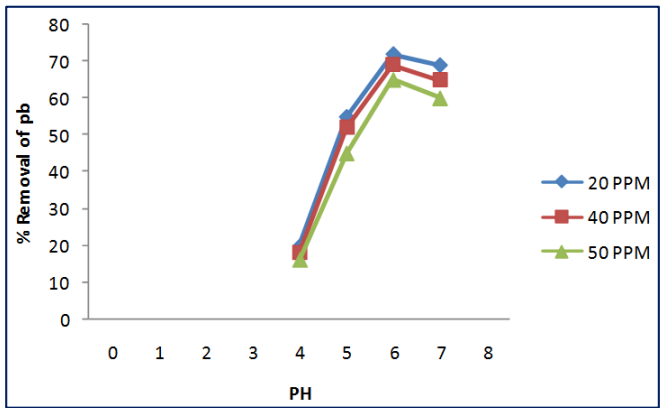

Fig 2: Effect of pH on percentage removal of lead by melon peel.

Effect of adsorbent dose: figure 3 show the result for adsorptive removal of lead with respect to adsorbent dose over the range 0.05 to 0.25 gram/ 100ml, at PH 6 and 120 min contact time. The removal of Pb percentage is increase with adsorbent dose. The maximum removal of Pb 72 percentage respectively at 0.15 gram dose amount of melon peel adsorbent.

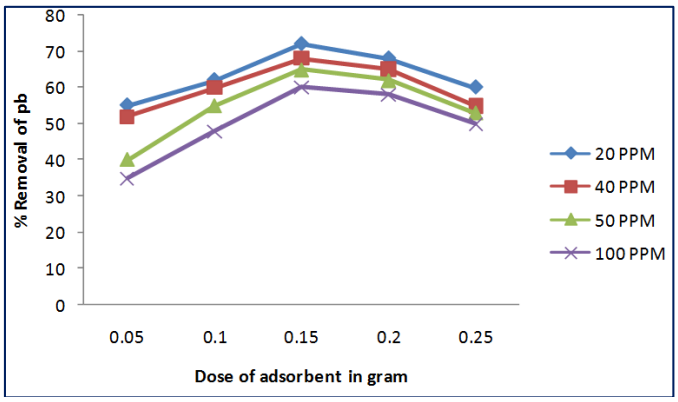

Fig 3: Effect of adsorbent dose on percentage removal of lead ion by melon peel.

Effect of initial concentration: The effect of concentration on percentage removal of Pb by melon peel at adsorbent dose, 6 PH and 120 min contact times. the pH, adsorbent dose and contact time plays an important role in adsorption of Pb from aqueous solution. The result present in figure 4 show that the percentage of removal decreases with increasing initial lead concentration.

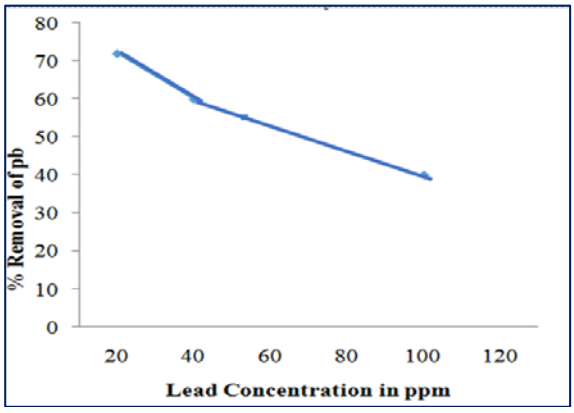

Fig 4: Effect of concentration on percentage removal of lead ions by melon peel.

Conclusion

The adsorption of Pb by melon peel is a function of the adsorbent dosage, contact time, effect of pH, initial concentration of metal ions. the percentage of removal decreases with increasing initial lead concentration the maximum adsorption of Pb is up to 72 percentages for 20 ppm concentration.120 min contact time, 6 pH. Melon peel has been successfully used to adsorbent for the removal of Pb from aqueous solution.

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