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EFFECTIVE REMOVAL OF CADMIUM IN WATER USING POWDERED ORANGE PEEL

S. Ravichandran
Associate Professor in Chemistry, Lovely Professional University, Phagwara-144 411(Punjab).
E-mail: ravichandran.23324@lpu.co.in

Abstract

Cadmium is the heavy metal, entering into environment from various industries that cause harmful effects on living beings. The main aim of this work involves the use of orange peel powder as effective adsorbent to remove Cd metal from water. In recent years, bio degradable things are widely used for the removal of heavy metals from water because they are non-hazardous, abundant in nature and available at low cost. In the present study, the potential of orange peel powder as an adsorbent for the removal of heavy metal such as Cadmium from water was investigated. It was observed that the percentage removal decreases with increase in concentration of Cd (II). Hence the present study reveals that the low cost adsorbent of orange peel powder may be used for removing the Cadmium heavy metal effectively from water.
Keywords : Cadmium, water, orange peel powder.

Introduction

Water is essential to all forms of life and makes up 50-96 % of the weight of all plants and animals. It is also a vital resource for agriculture, manufacturing and other human activities. Industrial waste water are mostly loaded with heavy metals that are not biodegradable and leads to accumulate in to aquatic organism. Our life is very precious and water is one of the most important natural resource for the existence of our life. Water is essential to all forms of life. Groundwater is a vital natural resource for the reliable and economic provision of potable water supply in both the urban and rural environment. Water contamination is a global problem that can result in illness and death. Cadmium is one of the potentially toxic heavy metals when adsorbed into the body. The release of industrial effluents containing heavy metals to the water causes several adverse health effects. Heavy metals are dangerous environment pollutants due to their toxicity and strong tendency to concentrate in environmental pollution and in food chains. Consumption of contaminated drinking water is particularly problematic in many developing countries where inadequate purification processes, coupled with rapidly increasing population growth and industrialization pose serious health risks. One of the most common and deadly contaminants found in water are Cadmium, Chromium and Lead. Agricultural waste is one of the major sources of low cost adsorbents besides industrial by product and natural material. The presence of heavy metals in drinking water sources and in edible agricultural crops can be harmful to human. They damage nerves, liver and bones also block functional groups of vital enzymes. Heavy metals are found in water and soil. The major sources of heavy metals in water and soil are waste water streams from many industrial processes. Heavy metal ion contamination of aqueous stream is becoming a serious threat to aquatic system, because of their high toxicity even at very low concentrations. Heavy metals ions released by number of industrial processes are the major pollutants in marine, ground water, industrial and even in treated waste water. Although great efforts made to protect environment but still majority of industries of the world are constantly releasing toxic metals into the environment. Cadmium has been considered as one of the toxic pollutants and because of its carcinogenic characteristics, it has been become a serious health problem. Umar (2015), Manish *et al.* (2015), Guo *et al.* (2011), Annadurai *et al.* (2016), Ekpete *et al.* (2010), Priyanka Kumari (2017), Khalfaoui *et al.* (2012), Yi-Ling Lai *et al.* (2010), Tripathi *et al.* (2015), Gonen *et al.* (2012), Kumar *et al.* (2012), Chandan Adhikari *et al.* (2020), Gawanda *et al.* (2016), Sharma *et al.* (2017), Thakur *et al.* (2015), Ashish Kumar *et al.* (2015), Jaswinder Singh *et al.* (2016), Mehta *et al.* (2016), Vijay Mishra *et al.* (2018), Monica *et al.* (2018), Mankar *et al.* (2009,2018), Aparna Joshi *et al.* (2018), Praveen Kumar Sharma *et al.* (2018), Amit *et al.* (2018), Harish *et al.* (2018), Harpreet Kaur *et al.* (2018), Dipika *et al.* (2018), Parveen Sharma *et al.* (2018) and Bureau of Indian Standards (BIS, 2012) reported that the suitability of groundwater for drinking and other uses may be assessed by comparing heavy metal concentrations of the study area with the guidelines recommended by Bureau of Indian Standards (BIS, 2012). Heavy metals are those elements which have high density and their traces even cause toxicity. Heavy metals are naturally found on Earth's crust. When they are found in large concentration in the body then they can bio accumulate which can be harmful to the body. Tripathi *et al.* (2015), Gonen *et al.* (2012) and Kumar *et al.* (2012) described that human body do need heavy metals but in relatively small amount, their higher concentration will have adverse effect. The maximum concentration was recorded at Jalandhar (0.069mg/l). Cadmium comes to our body from different vegetables and foodstuff that will affect our health. In this present work, orange peel powder is used for the removal of cadmium (II) from water.

Materials and Method for analysis

The orange peel was collected in the local market. The collected orange peel was taken as an adsorbent for this experimental work. Then the orange peel was dried in the air oven. The dried orange peel were grinded to fine orange peel powder and used as adsorbent for overall studies. All reagents used were of analytical grade (Merck) without further purification.

Table 1: Effect of concentration and percentage removal of Cd (II)

Conc.(mg/L)	10	20	30	40	50	60	100
Cd (II) removal %	96	84	76	68	46	34	20

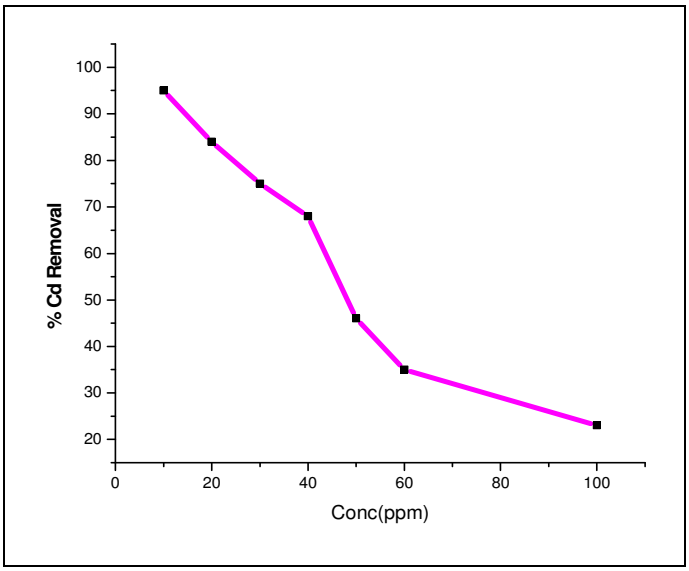

Fig. 1: Effect of Cadmium by orange peel at different concentrations.

The adsorption % removal efficiency was calculated using the following equations respectively.

$$q_e = \frac{(Co - Ce) \times V}{m}$$

$$\text{Removal efficiency}(\%) = \frac{(Co - Ce) \times 100}{M}$$

Results and Discussion

To a 100 mL of Cd(II) solution, 0.5 g adsorbent added contacted for 1 h. Then analyzed by UV spectrometer. The results are shown in figure 1. As the percentage removal decreases with increasing in concentration of Cd(II).

Conclusion

Orange peel is a cheap and good adsorbent for Cd(II) removal. It was observed that the percentage removal decreases with increase in concentration of Cd (II). At low concentrations, metal ions are very easily adsorbed on vacant sites. As the metal ion concentration decreases, the percent removal increases. Our results suggest that Orange peel assisted adsorption process has a high capability to remove the heavy metal from water.

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