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ORIGINAL ARTICLE **OPEN ACCESS**

Application of Pomegranate Peel Powder for removal of heavy metal from Indian River waters by Adsorption: a Primary Study

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ABSTRACT

Rapid urbanization, increased industrial effluent and domestic sewage discharge in water bodies, scarcity of fresh water reserves, elevated landfills, leakage in under ground tanks, excess use of Pesticides cause adverse effect on marine life. According to reports published by World Economic Forum 70 % of water is decrepit for human consumption. Heavy metal pollution in aquatic system the main source of water contamination and is one of the leading cause of cancer, neurological disorders and diarrhoeal mortality in children. Biosorption technique finds interest among the researchers due to use of biodegradable adsorbents and is cost effective approach. Hence a need was felt to use biosorptive adsorbants for removal of heavy metals for contaminated water samples. The present study evaluates the application of Pomegranate peels as successful adsorbing medium for the removal of heavy metals from the water samples. Pomegranate peel which are discarded as fruit waste were utilized to prepare ecofriendly bio adsorbent for the adsorption of heavy metals. We herein, have reported the minimization of a load of heavy metals present in the given sample of water after the treatment. Thoroughly washed and decolorized fruit peels were used for the same and it can be postulated that after the filtration of the water samples through the purification setup consisting of pomegranate peel powder layer, the heavy metal impurities were found to be low.

Keywords: *Bio sorption, Ecological issues, heave metal removal*

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INTRODUCTION

Expeditious expansion, Rapid urbanisation and industrialisation growth near the water ressources are the alarming signal for water pollution with incorporated heavy metals. Anthropogenic stresses and biogeochemical transgression of toxic heavy metal pollutants are hazardous to ecosystems. Heavy toxic metals lead to massive death or serious health issues. Thus, there is a need to remove these hazardous heavy metals so that the potable water can be recirculated. (1,2) Conventional methods available suffer from disadvantage of economy concerns, engrossing space, and time. Hence a need was felt to develop eco-friendly material to develop as efficient adsorbing agent and hence we chose pomegranate peel material for the same. Agrowastes are renewable find applications as good adsorbing agents to remove organic and inorganic pollutants from water. Considering the same, we had an idea of using an eco-friendly material to develop as efficient adsorbing agent and hence we chose pomegranate peel material for the same.

MATERIAL AND METHODS

Pomegranate Peel, Three Water Samples of three rivers mainly Nira (Sample A), Mutha (Sample B) and Pavna (Sample C), Cotton cloth, Pebbles, Whattman Filter paper, Potassium Hydrogen Phthalate, Standard lead solution, Dil. Ammonia, Dil. Acetic acid, Hydrogen sulphide solution, Erichrome Black T, Ethylene Diamine tetracetic acid, Ammonium chloride

A. General Methodology adapted

The general methodology adapted for the heavy metal removal from the collected water samples is depicted in Figure 1.

Pomegranate peel was collected and washed several times with distilled water and dried thoroughly in the sunlight for 3 days. The peels were decolorized by soaking them in distilled water for 2 days and

again they were dried to convert into a coarse adsorbent powder. We dried them for more than 48 hours under sunlight. The pomegranate peels were reduced in size into small pieces and half of the peels were converted into powder form. After drying, the powder was sieved. We prepared a multilayered purification set up (Figure 2.) in the container for the filtration.

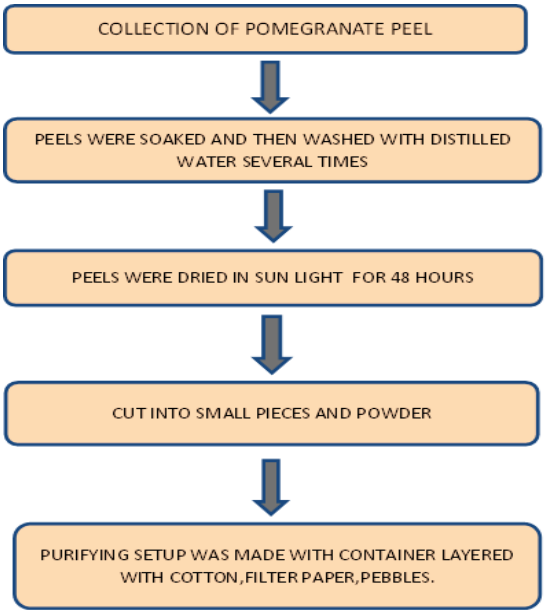


Figure 1: Flow chart of the adapted methodology

Figure 2: Purification setup

B. Analysis of pH before and after the treatment of Pomegranate Peel by pH meter

The analysis of the pH of water samples before and after the treatment was monitored using pH meter. It was calibrated using Potassium Hydrogen Phthalate solution. Post Calibration, the solution is taken in the flask and the electrode is immersed into the sample until a steady reading for pH is reached with neutralization of the solution by titrimetric analysis, simultaneously.

C. Analysis of Turbidity before and after the treatment of Pomegranate Peel by Turbidimetry

The turbidity produced before and after the treatment in the water samples was measured and the standard turbidity should be less than 40 units. The solution was taken in the flask and was poured in the turbidimeter sample holder and the turbidity value was measured using turbidometer.

D. Heavy metal detection before and after the treatment of Pomegranate Peel using Limit test of heavy metals

The detection of the presence of heavy metals in the water samples before and after the treatment was observed by performing a limit test of heavy metals. 2ml of standard lead solution was taken in Nessler's Cylinder and 25ml of distilled water was added. Later, to it dil. Acetic acid or dil. Ammonia was added to

adjust the pH in the range of 3 to 4. The solution was diluted to 35 ml with distilled water and 10ml of freshly prepare Hydrogen sulphide solution was added and solution was made up to the volume of 50 ml with distilled water and kept aside for 5 min. and to compare with the test solution.

E. Test for the Hardness before and after the treatment of Pomegranate Peel

The test for the hardness of the water samples before and after the treatment were performed by titration process. The procedure included few steps of volumetric analysis. 67.5 gm of ammonium chloride was mixed in 200 ml of water. Later, 570 ml of strong ammonia solution was added in the above solution to make up the volume up to 1 liter.25ml of water sample of each river was taken in three different Erlenmeyer's Flasks and 25 ml of distilled water was added in the same. 20 drops of pH 10 Buffer solution was added and Erichrome Black T indicator was added. Sample solutions were titrated separately with Ethylene Diamine Tetraacetic Acid solution. Color was changed from red to bluish-green color and the process was repeatedto get the concordant titer value.

RESULT AND DISCUSSION

A. Result Analysis of pH testing

The pHs of the samples were recorded before and after the filtration from the purification set up. Presence of heavy metals caused the change in the natural pH of the water due to the in situ formation of soluble metal bicarbonates or chloride salts. The decreased pH value depicted in the table 1., suggested that the pomegranate peel may have adsorbed few free heavy metal ions and their water soluble salts. Sample C has shown steady decrease in the pH value indicating the better adsorption of heavy metal ions than that of remaining samples.

Sample	pH value before treatment	pH value after treatment
A (Nira)	7.11	6.15
B (Mutha)	6.83	5.83
C (Pavna)	7.34	**7.00**

Table 1: pH values of the water samples before and after the filtration from the purification setup

B. Result analysis of Turbidity analysis

Heavy metal ions are bound pollutants. They exist in the small particle size which will be suspended in a water to exert a turbid effect [5,6]. Turbidity measurement is an indirect tool to authenticate the presence of pollutants. The results the turbidity analysis has been depicted in Table 2. Turbidity values were measured in unit NTU.

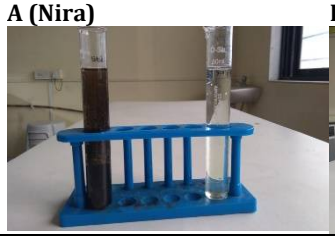
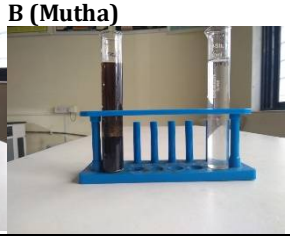
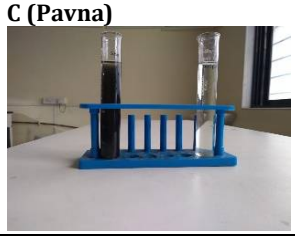
It was observed that all the samples exhibited excellent reports in this test after the filtration performed using a purification setup. The suspended pollutants of heavy metals creating turbidity in the solution were adsorbed successfully by pomegranate peel powder.

Sample	Before Treatment	After Treatment
A (Nira)	028	000
B (Mutha)	006	000
C (Pavna)	001	000

Table 2: Turbidity values of samples

C. Result analysis of Heavy metal identification by limit test

The limit test of heavy metals was performed for the samples twice, before and after the filtration. Due to the presence of micro level concentration of the heavy metals even before the treatment the sample passed the limit test of the heavy metals even before the filtration and even after the filtration. The pictures have been tabulated in Table 3.

	A (Nira)	B (Mutha)	C (Pavna)
Before Treatment			

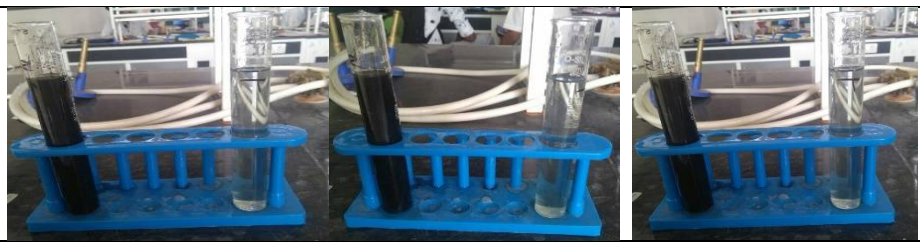
After Treatment	

Table 3: Results of Heavy Metal Limit test of the samples

D. Result analysis of heavy metal testing by Hardness Analysis Experiment

Generally, hard water is characterized by the presence of the mineral and heavy metal ions such as Calcium, magnesium, aluminum and manganese. Volumetric analysis was performed for the determination of presence of heavy metals [7,8]. The amount of ethylene diamine tetra acetic acid solution consumed to neutralize the solution from the burette states the amount of heavy metal ion content present in the sample. It can be observed (Table 4) that all the three samples have consumed significantly less volume of ethylene diamine tetra acetic acid solution after the filtration, proving the adsorbing property of pomegranate peel.

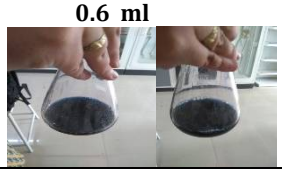
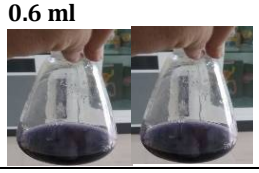
	A (Nira)	**B (Mutha)**	**C (Pavna)**
Before Treatment	7.11ml 	6.83ml 	7.34ml 
After Treatment	**0.6 ml** 	**01 ml** 	**0.6 ml** 

Table 4: Results of Hardness testing experiment

CONCLUSION

Dried, decolorized pomegranate peels were powdered and were explored for their bio sorption property. Exploration of the adsorbing capacity of the pomegranate peel powder was performed by using three different water samples. These samples were filtered through the multilayered purification set up consisting of pomegranate peel powder as one of the layer. Turbidity measurements performed for the samples before and after the filtration prompted the removal of heavy metals as the suspended particles got absorbed by the pomegranate peel powder. As well as, the hardness testing of the samples before and after the filtration exhibited the removal of mineral ions [9,10]. It can be postulated that the pomegranate peels consist of flavonoids which may act as adsorbing agents.

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CONFLICT OF INTEREST

None.

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