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Making of Eco-Friendly Water Filter by Using Tulsi and Neem Leaves

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Abstract : It is well known fact that clean water is absolutely essential for healthy living. Adequate supply of fresh and clean drinking water is a basic need for all human beings on the earth, yet it has been observed that millions of people world wise are deprived of this. Clean water use being a prime concern in many communities of developing countries. Contaminated water plays significant role in taking numerous lives in these localities, for which a number of efforts are being made for accessing safe purified drinking water. Fortunately, efficient and cheap water purification systems are being utilized and being tried to be accessed worldwide for easy access to clean water.
In the following project we had tried to develop a "Low Cost Water Purification Technique" using the basic ideas of bottle filter, some locally Herbal available filter material like Tulsi leaves powder, Neem leaves powder, Rice Husk, Sugarcane bagasse, fine graded sand and tries to improve the methodology using the UV Filter, RO Filter, and Activated Carbon Filter mechanism. Main focus was removal of iron from surface water by adsorption technique. Among all the herbal material used, the ash produce from rice husk was proved to give the best result in removal of iron and also available in local area having the cheapest material cost. Locally collected Sugarcane cane bagasse and neem leaves powder mixed with calcium hydroxide (chuna) was prepared which also proved to be effective for removal of iron.

***Index Terms*—Filteration, Tulsi, Neem leaf, Rice Husk, Aluminum Hydroxide.**

I. INTRODUCTION

In the 17th century, an effort was made by Sir Francis Bacon to make seawater unsalted after passing it against the sand filter. But this experiment could not be successful. However, it brought new interests to the field. Pure water is a kind of water out of which we remove all the chemicals through distinct processes. Pure water is needed for all healthful lives, and it contains a huge impact on the life of people every single day, especially in remote and rural areas where safe drinking water access is very difficult. The water on teh surface is actually the only water source that is employed by humans for domestic needs and thus, it is easy for water to get contaminated because of its extremely reckless usage.
When we use unsafe drinking water, it can lead to numerous health issues and infectious diseases. As per WHO, about 1.1 billion people have access to a good supply of drinking water. But about 88 percent of the diarrhea cases in the 4 billion people could be due to water that is unsafe to drink, and 1.8 billion people meet their death every single year because of diarrhea, as said by WHO in 2007. Stats would display that these diseases could be attributed to about 90 percent of the deaths of children that were less than 5 years of age in the developing countries, all because of low immunity in children because of the infections. Reduction of death from diseases that were obtained from water is a huge concern for the health of people in the countries that are developing. Despite the drinking requirements of people getting fulfilled, the water from municipalities that are in use by developing countries is getting improved and the water filtering processes that are pocket-friendly are also being used in the community to get an improved taste of water and do away with any unwanted matter.
Previously, varieties of filters were designed, and these were highly suitable for remote regions of countries, however, the price and the efficacy of filters are not quite satisfactory, and we need more improvement in Hazeltine (in 1997). Clean drinkable water is one of the major problems in India these days. A majority of people across the rural regions are not too capable of using water filters or getting bottled water. To do away with this issue, there have been so many efforts were made so that the cleaning water could turn to be an affordable product. Each house would need to develop a novel system for water purification, and this should target to development of a few low-cost techniques for the purification of water. In this aspect, a lot of assistance has been provided while the media of the filter gets varied from layers of cotton cloth to some of the nanomaterials. Here is a study of some of the methods of water filtration in India.

II. LITERATURE REVIEW

Ajmal (2002) studied adsorption on rice husk: removal and recovery of Cd (II) from waste water. Here phosphate-treated rice husk (PRH) showed that adsorption of Ni (II) and Cd (II) was greater when PRH was used as an adsorbent. Sorption of Cd (II) was dependent on contact time, concentration, temperature, adsorbent doses and pH of the solution. The Langmuir constants and thermodynamic parameters have been calculated at different temperatures. It was found that recovery of Cd (II) from synthetic wastewater by column operation was better than a batch process.

Wong (2002) studied Removal of Cu and Pp by tartaric acid modified rice husk from aqueous solution. They studies on the modification of rice husk by various carboxylic acids. The results showed that tartaric acid modified rice husk (TARH) had the highest binding capacities for Cu and Pp. The carboxyl groups on the surface of the modified rice husk were primarily responsible for the sorption of metal ions. A series of batch experiments using TARH as the sorbent for the removal of Cu and Pp showed that the sorption process was pH dependent, rapid and exothermic. The sorption process conformed to the Langmuir isotherm with maximum sorption capacities of Cu and Pp. The uptake increased with agitation rate. Decrease in sorbent particle size led to an increase in the sorption of metal ions and this could be explained by an increase in surface area and hence binding sites. Metal uptake was reduced in the presence of competitive cations and chelators. The affinity of TARH for Pp is greater than Cu.

Daifulla (2002) studied Utilization of agro-residues (rice husk) in small waste water treatment plans. Rice husk can be made into sorbent materials which are used in environmental remediation. This study characterized and evaluated two types of sorbents made from rice husk. The efficiency of both sorbents in the removal of the complex matrix containing six heavy metals was c100%. These metals are Fe, Mn, Zn, Cu, Cd and Pp., which are found in the drain containing the agriculture and sewage wastewater at El-Menofiya Governorate, Egypt. The two sorbent materials were prepared according to the scheme presented. The two sorbents made from the rice husk have considerable potential for adsorption of metals of environmental concern.

Sharma and Bhattacharyya (2004) studied Absorb Adsorption of Chromium (VI) on Neem Leaf Powder. He was developed a developed a novel adsorbent from mature leaves of the Neem tree for removing metal ions from water. The adsorbent, in the form of fine powder, was found to very effective in removing chromium (v1) from aqueous solution.

Euras, et al. (2006) studied Removal of cadmium from aqueous solution by adsorption on to sugarcane bagasse. In this paper, cadmium removed by sugarcane bagasse from aqueous solution. Process for removal cd, investigated through batch experiments. First experiment of preparation of synthesis waste water and adsorbent and adsorption experiment. The adsorption processes was relatively fast and equilibrium was achieved after some duration. The optimum adsorption of cd occurred at ph. range 5-7. The kinetic process of cd adsorption on to sugarcane bagasse was tested by applying pseudo first order, second order and intraprtide diffusion rate equation. The equilibrium data fitted the Langmuir isotherm model & maximum adsorption capacity determined.

Venkateswarlu et al. (2007) Department of Chemical engineering; Andhra University, Visakhpathanam (India) studied Removal of chromium from an aqueous solution using Neem leaf powder as an adsorbent. He was investigated; Neem leaf powder is used as an adsorbent for the removal of chromium from aqueous solution.

Thomas et al. (2009) Department of Chemical Engineering, University of Benin, Benin City, Nigeria in studied Bio sorption of Heavy Metal Ions from Aqueous Solutions Using a Biomaterial. The aim of this work is to study the removal of toxic heavy metal ions by Neem leaves from synthetic waste water and to offer this bio sorbent as local replacement for existing commercial adsorbent materials.

Ashoka and Inamdar (2010) studied Adsorption removed of methyl red from aqueous solution with treated sugarcane bagasse and activated carbon. Paper reported that methyl red dye removed by sugarcane bagasse, an angro industry waste from the waste water. In this process, sugarcane bagasse treated with formaldehyde and sulphuric acid. The adsorption capacities of both treated bagasse were examined at varying ph. initial dye concentration, adsorbent dosage, contact time and temperature and compare the treated bagasse with commercially available powdered activated carbon. The effect of ph. adsorbent dosage, initial dye conc.., and temperature on removal of dye was examined for different times. It was observed that adsorption efficiency of sulphuric acid treated bagasse was higher than formaldehyde treated bagasse.

Pandhare and Dawande (2010) studied Neem leaves powder as low –cost adsorbent and its characteristics. Adsorption has been used successfully in the removal of impurities from effluents. He was developed the Neem leaves powder activated using chemical treatment as low-cost adsorbent.

III. Materials And Methods

a) Material

Materials used and Preparation of Adsorption Media:

Large number of scientist and environmentalist has investigated the possibility and efficiency of utilization of the herbal as an adsorbent for heavy metal adsorption in polluted water. Following materials were used in removal of iron from water, discussed below.

Plane Sand:

Fine sand and gravel are naturally occurring glacial deposits high in silica content and low in soluble calcium, magnesium and iron compounds are very useful in sedimentation removal. But here the media is used for iron removal from drinking water. Here for the experimentation plane sand passing through 600 Micron IS sieve were used.

Tulsi Leaves Powder:

The scientific name of Tulsi is Ocimum Tenuiflorum, Holy basil or Ocimum Sanctum Linn. Leaves are dropped in drinking water for purification and for medication. In all Hindu temples, water mixed with Tulsi leaves are offered to devotees every day since the herbal plant is an excellent medicinal plant found all over India and is considered sacred. The leaves, seeds and root of this plant have been used in ayurvedic medicine. Chemical composition is highly complex, containing many nutrients and other biological active compounds. It can remove fluoride levels in drinking water. Recently it's used have been found in fighting fluorosis. They are mainly two types of Tulsi. First is Shyam Tulsi having dark colored stems and leaves and second Rama Tulsi have whitish stem and green leaves. Here Tulsi leaves powder was used for removal of iron from water. Tulsi leaf powder was purchased from the local market of Barilley.

Neem Leaves Powder:-

The scientific name of neem is Azadirachta indica. Neem leaf powder was purchased from the local markets of Rourkela. Neem leaves powder was taken for removal of toxic element from water. Here, two methods were adopted. First method was only neem powder used but second method was mixed thoroughly with calcium hydroxide (chuna) 1:10 ratio. Chemical formula of calcium hydroxide is Ca(OH)2. It is springily soluble in water and forms a solution called lime water.

Rice husk:
Rice husk are the hard protecting covering of grains of rice. Around 20% of the paddy weight is Husk. Scientific name for rice is oryza sativa. The chemical composition of Rise husk is similar to that of many common organic fibres and it contains of cellulose 40-50%, lignin 25- 30%, ash 15-20% and moisture 8-15 %(by Hwang and Chandra 1997). After burning, most evaporable components are slowly lost and the silicates are left. Low value agricultural by rice husk can be made purification of water. Rice husk was collected from a local mill in jehanabad, Bihar. The rice husk was sieved in the mesh in the range of 600 micron in order to increase its surface area. This was used as and adsorbent along with sand as a base material.

Aluminum hydroxide coated Rise husk Ash:
Rice husk ash (RHA) is generated by burning rice husk. Cellulose and lignin are removed by burning and leaving behind silica ash. Rice hush ash was produced by controlled temperature and environment of burning process in muffle furnace at a temperature of 500 degree Celsius for 3 hours. The RHA was first soaked with 0.01 N HCl. Dry RHA of 100 gm, 0.6 M of aluminum salt (Aluminum Sulphate salt) solution and 3M sodium hydroxide was added and stirred for one hour and then the filtered rice husk ash was kept in oven for 3 hours at 373 K. This was used as an adsorbent along with sand as a base material.

b) Methodology

- Sampling of Herbal Material.
- Sampling of Drinking Water
- Preparation of Sample for Testing
- Filter Model Preparation.
- Preparation of Absorption Media
- Testing of Layers
- Filtration Test
- Result
- Conclusion

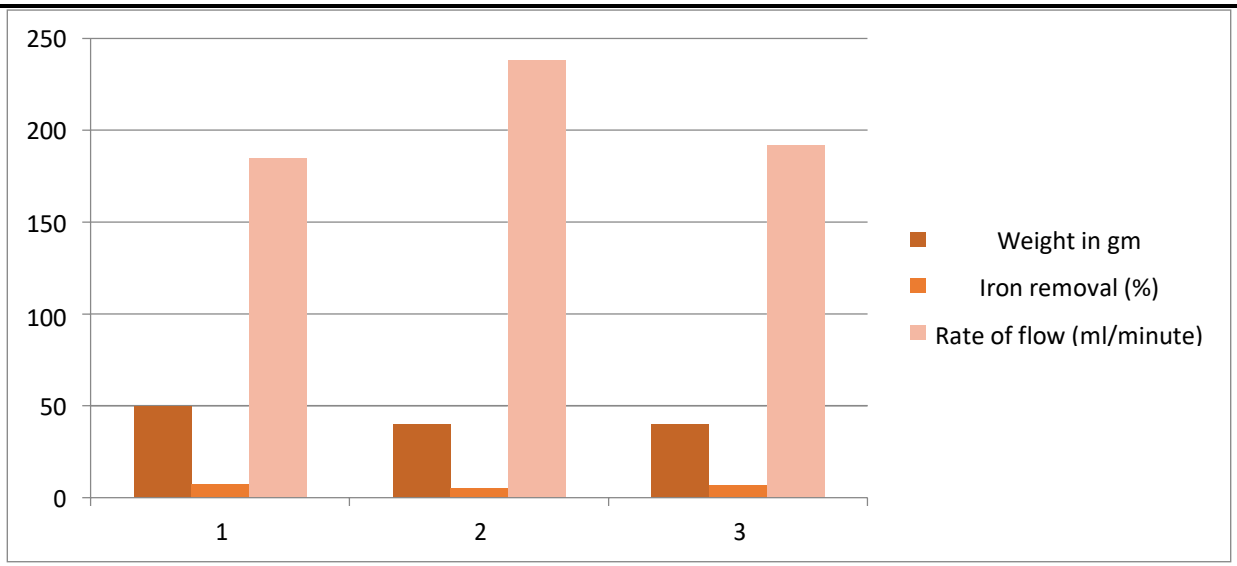
Method of Preparing Standard of Solution:
- The standard of a solution containing of the toxic elements will be made with a mix of toxic elements of water.
- We prepare a filter model that contains sponge, some sand and distinct herbs.
- The standard solution gets passed from the filter mode and what we obtain finally is purified solution
- Next we calculate the amount of toxic elements remaining
- Iron was used as a toxic element.

IV. RESULTS

- Results of filtration in tulsi leaves powder

- Iron removal in Tulsi leaves

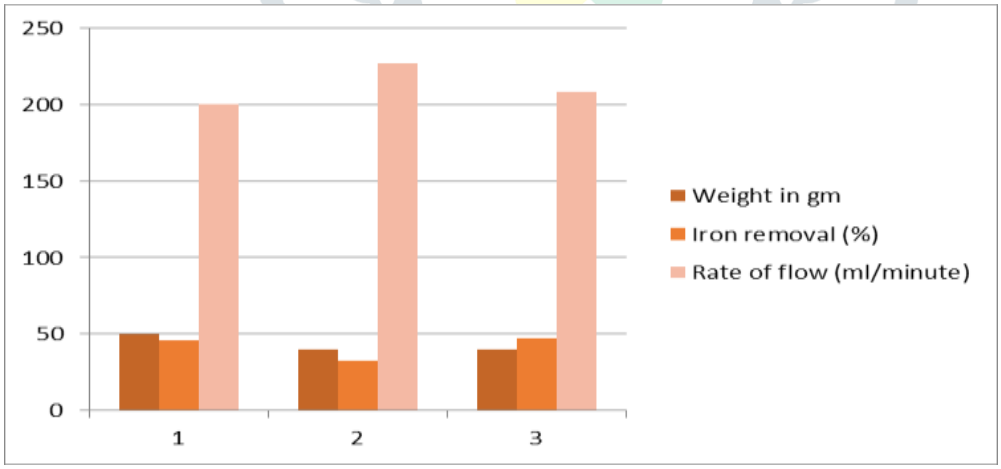
S. No	Thickness of Sand Layer (cm)	Amount of Tulsi Leaf powder (g)	Initial iron content (ppm)	Final iron content (ppm)	Rate of filtration (ml/min)
1.	Top layer=2cm Bottom=3cm	50gram	1.053	0.974	185
2.	Top layer and Bottom=2cm	40gram	1.053	0.998	238
3.	Top layer and bottom=3cm	40gram	1.053	0.983	192



- Results of filtration in Neem leaves powder

S. no	Thickness of sand layer(cm)	Amount of Tulsi Leaf powder	Initial iron content (ppm)	Final iron content (ppm)	Rate of filtration (ml/min)
1.	Top layer=2cm Bottom=3cm	50gram	1.317	0.710	200
2.	Top layer and Bottom=2cm	40gram	1.317	0.890	227
3.	Top layer and bottom=3cm	40gram	1.317	0.698	208

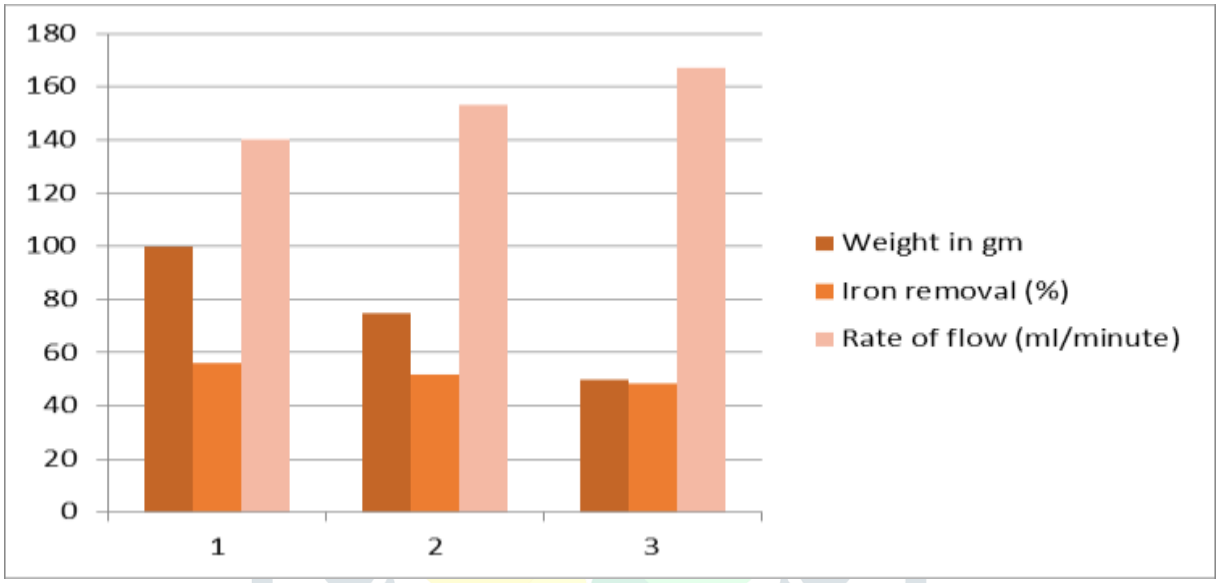
- Iron removal in Neem leaves powder



- Results of filtration in neem leaf powder mixed with lime stone

S. no	Thickness of sand layer(cm)	Amount of Tulsi Leaf powder	Initial iron content (ppm)	Final iron content (ppm)	Rate of filtration (ml/min)
1.	Bottom layer=2cm	100gram	1.317	0.579	140
2.	Bottom layer=2cm	75gram	1.317	0.632	153
3.	Bottom layer=2cm	50gram	1.317	0.676	167

- Iron removal with Lime stone mixed neem powder



V. Conclusion

- Adsorption being the simplest and cheapest technique for iron removal, it has several advantages, like longer filtration runs, shorter ripening time, better filtrate quality. But the only limitation is back wash water requirement is essential for the filter media to run effectively.
- Sand being the cheapest adsorbing surface is very effective in removal of dissolved iron from drinking water and the rate of filtration is also very high. The only demerit is subsequent development of bacterial layer due to rigorous use. Again back washing is needed time to time.
- Tulsi leaves powder is not improve to be a good adsorbent in removal of iron.
- Neem leaf powder mixed with Lime Stone (Ca (OH) 2) proved to be good result in removal of iron compare to untreated neem leaves powder. Because modified neem powder decreased the rate of filtration.
- Aluminum hydroxide coated RHA also proved to be a good adsorbent in removal of iron. Previously Ganvir, et al. in 2011 has been experimented that it forms complexes with fluoride ion for its removal. Here in case of iron, there is no proof of formation of any complex. So the removal may be credited to roughening of RHA surface due to modification by aluminum hydroxide.
- Sugarcane bagasse, the removal is not so significant. This may be due to lager particle size of material being used. Smaller the size of particle larger will be the specific surface and better will be the removal.

References

[1] Nawlakhe G and Bulusu K. (1989): Nalgonda technique a process for removal of excess fluoride from water, Water Qual Bull. 14, 218–220.
[2] Bhattacharjee *et al.* (2013): Disinfection of Drinking Water in Rural Area Using Natural Herbs, International Journal of Engineering Research and Development. 5,07-10
[3] Ekta Singh *et al.* (2012): Diversified potentials of Ocimum sanctum Linn (Tulsi): An exhaustive survey, J. Nat. Prod. Plant Resour., 2(1) , 39-48
[4] Lalit M, *et al.* (2011): Ocimum Sanctum Linn (TULSI) - an overview, International Journal of Pharmaceutical Sciences

Review and Research. 7,52-53
[5] George A. and Chaudhuri M.(1977): Removal of iron from ground water by filtration through coal, J. Am Water Works Assoc. 69, 385-389
[6] Iqbal M. and Edyvean R.(2004): Biosorption of lead, copper and zinc ions on loofa sponge immobilized biomass of Phanerochaete chrysosporium, Minerals Engineering, 17, 217 -223.
[7] Chand S, *et al*. (1996): Removal of hexavalent chromium from wastewater by adsorption, Indian J. Environ. Health, 36, 151-158.
[8] Dakiky M, *et al*. (2002): Selective adsorption of Cr(VI) in industrial waste water using low cost abundantly available adsorbents, Adv. Environ. Res. 6, 533-540.
[9] Pandhare G, *et al.* (2013): "synthesis of low cost adsorbent from neem leaf powder" IJAERS 2(2), 29-31.
[10] Gupta S and babu V B. (2006): "Adsorption of Cr (VI) by a low cost Adsorbent Prepared from Neem Leaves". Proceedings of National Conference on Environmental Conservation (NCEC), 1-3, 175-180.
[11] Rohasliney H. (2012): Rice Husk as Biosorbent: A Review, Health and the Environment Journal. 3, 89-93.
[12] Abbas M and Abbas F. (2013): Utilization of Iraqi Rice Husk in the Removal of Heavy Metals from Wastewater, Research Journal of Environmental and Earth Sciences 5(7), 270-280.
[13] Raju Srinivas K and Naidu. S.V.(2013): A Review on Removal of Heavy Metal Ions from Wastewater by Rice Husk as an Adsorbent, Journal of Chemical, Biological and Physical Sciences 3(2), 602-606.
[14] Ayub. S. *et al.* (2001): Study on the removal of Cr (VI) by sugarcane bagasse from wastewater. Pollution Research Journal, 2, 233-237.
[15] LeMar HJ, *et al,* (1995): "Department of Medicine, Madigan Army Medical Centre, Tacoma, Washington 98431.". Journal of Clinical Endocrinology & Metabolism, 80, 220-223.
[16] Ramachandran, Asha. (2006): "Any Hope for India's Water Woes," India/Kerala News.
[17] Hazeltine B and Bull C. (1999): Appropriate Technology: Tools, Choices, and Implications. New York: Academic Press. 6, 518-52.