WATER PURIFICATION USING BIOADSORBENTS

Reetha G P[1], Jayalakshmi DG[1], Shaik Riyaz Ur Roshan[1], Mohammed Ishaq Sharieff[1], Bindu S[1], Prathibha B[1]

BNM Institute of Technology

Abstract: *India is facing a water crisis and it is necessary to solve this problem by considering approaches such as Reduce, Reuse, and Recycle formula. Any method of water treatment aims to remove contamination from that water. Nowadays, increased pharmaceutical companies release Pharmaceutically active compounds (PACs) into the water bodies, resulting in contaminants in water. The reports have confirmed that the water bodies contaminated with PACs in natural and wastewater may lead to issues indicating the emergency of the situation. From their studies, they report that the productivity of sawdust adsorbents removes impurities from water. The current methods of removing metal ions, like mercury, cadmium, lead, and membrane filtration, are extremely high costs when large capacities areas are fixed. Bio-Adsorption and bioaccumulation are environmentally supportable methods. These methods provide advantages compared to other methods and report a solution to build a filter packed with biomass by taking advantage of its permeable structure to the surface absorption properties.*

INTRODUCTION

In many countries, people suffer due to scarcity of drinking water, specially cleaned and filtered water. Nowadays increased pollution in cities contaminates the water bodies that are not safe for drinking purposes without proper treatment. In nature, the groundwater is naturally filtered as it passes through the soil and plays a major role in water handling. The artificial filter is like a strainer, that filters small particles and suspended materials present in the water sample. The water from taps and industries can be collected and treated with filters made from agricultural wastes which can be processed as galvanized carbon adsorbents. Heavy metals in water could be dangerous and their levels of toxic substances could lead to severe health problems such as kidney disease. Water also contains metals such as chromium, zinc (Zn), arsenic (As), copper (Cu), nickel (Ni), cobalt (Co), cadmium (Cd), mercury (Hg).), etc which could be equally dangerous when consumed in excess. The use of natural biomass is highly efficient and could be used as raw material for making filters. The use of biomass from agricultural and manufacturing left-over in making filters is inexpensive and ecologically sound.

LITERATURE SURVEY

Researchers have explored all possibilities to tackle contaminated water. T. Janani et al[1]., have reported that grey water has been treated and its efficiency of usage after filtration was increased. They have used raw corncobs to filter the contaminated water and make it suitable for groundwater recharge, gardening, flushing, and other indoor purposes. They have also mentioned that by increasing the period of filtration the same greywater is filtered to an extent that could be suitable for drinking or another household. In this work, they have used grey water from the bathroom, kitchen, and laundry to filter the candle made from sand, geotextile cloth, and corncobs. In the first layer corncobs were placed in a closed container and placed layer by layer and spread uniformly, In the second layer, gravel coat and one kilogram of silt are spread over the geotextile material and compressed well. In the third layer, powdered corncobs are spread after washing and dried thoroughly. In the fourth layer, one kilogram of activated carbon, and in the fifth layer large corn cobs were smashed and broken into pieces dried and placed above the geotextile cloth. Figure 1 shows all the layers arranged inside the casing used for filtering grey water from kitchen waste.

Figure 1. Images of the filter with biomass materials used to filter grey water from kitchen waste.

R Farma1et al [2]., have reported filtration of sea water in their work that corn cobs-based carbon is activated by using the method called microwave-assisted chemical activation and carbonization. Their study said that potassium hydroxides (KOH) remain cast-off as an activation agent, which by nearly 5% potassium hydroxides in the heaviness of self-adhesive carbon scrap of corn cob are saturated in 150 ml purified aquatic. Then the samples were exposed using a microwave oven with control of 360, 450, and 720 watts for 15 minutes. After purifying the seawater using activated carbons they measured metallic adsorptions, pH, temperature, and color of seawater. After examination of the microstructure, the heavy metal adsorption was 85,20%, 89,80%, and 70,41% for Ni, Pb, and Zn respectively. The purity of water can also be observed in Figure 2

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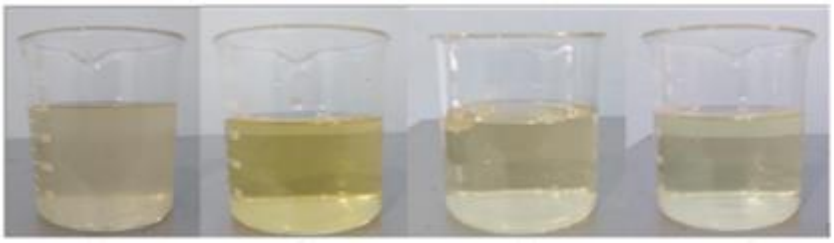

Figure 2. stages of water sample after several filtrations using Corncob-based galvanized carbon filter made using a microwave oven for treating seawater.

Ajay Bhaskar Reddy et al [3],. have reported on water filtration done on samples selected from tap water, Lake Water, and groundwater. Lake water analysis was done and found that the filtered water was fit for domestic use and drinking. The biomaterials used for filtration in this work were sugarcane bagasse, Rice Husk, well-sorted sand, charcoal, pebbles, and cotton. This low-cost filter was suitable to purify aquatic water.

Sand

Rice Husk

Activated Charcoal

Pebbles

Fibre Cloth

Filter

Figure 3. showing materials used for filtering aquatic water samples.

In the first layer, fine sand with high content of silica was mixed with calcium and Mg which was beneficial in the elimination of deposits. The second layer-rice husk, in the third layer activated carbon, was used to remove hazardous substances. In the fourth layer, pebbles were used to remove pathogens and other particles. In the last layer, a fiber cloth was used to remove bacteria and other pathogens.

Ayokunle et al [4]., have reported on measuring physio chemical parameters of river water by using sawdust adsorbents. This method does not filter bacteriological parameters and requires coagulations and/or chlorination for making it portable. They have reported on the turbidity level of the river water. The procedure used in this work is they have filled 15 liters of water in a bucket and added gravel and sand after sieving and thoroughly washing and to that, and they have added sawdust to remove organic and inorganic matters after washing and drying it. As shown in figure 4

The Larger-Sized Gravel

The Smaller-Sized Gravel

River Sand Being Sun-Dried

Sawdust Being Sun-Dried

Figure 4: Material used for filtering

All the materials are arranged in the form of layers and have made the sawdust filter. The setup was allowed to remain for 5 minutes before it could be discharged. The water filtered in this way was very clear and could be used for purposes other than drinking.

Khudair et al.[5], have used corn cobs and bentonite (red mud) for wastewater filtration systems and have compared the two filtration methods with filter 1 using bentonite and filter 2 using corn cobs. Filter 1 was designed with three layers of bentonite, sand, and gravel. Filter 2 had three layers of corn cobs, sand, and gravel. By using these two filters they have checked 4 parameters in the contaminated water sample such as pH, (Biochemicals oxygen demand) BOD, TSS (Total Suspended solids), and COD (chemical oxygen demand). The wastewater was collected and tested for four parameters before filtering.

The method of filtration used in filter 1 and filter 2 is shown in figure 5. The only difference between the two filters is by using either bentonite or corncobs.

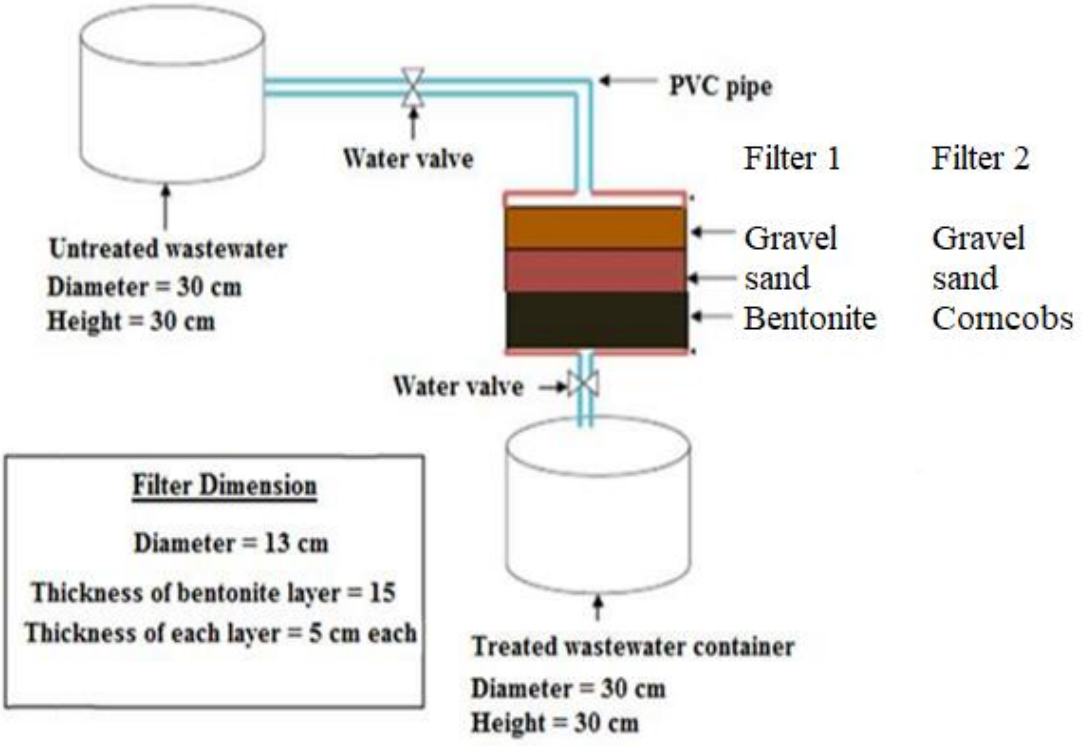

Figure 5. Illustration of filter 1 using bentonite and filter 2 using corncobs.

Using these two types of filters, they have checked for the four parameters mentioned above. The samples were tested in an authentic laboratory. They claim that the filtration using corncobs has removed microorganisms in the water compared to the other filter.

Adie Lukman et al[6]., have a similar work where they have collected water from two different rivers and treated them with sand, activated corn cob, activated charcoal, and activated bones. The fact of using activated bones was difficult to handle due to permission and also due to the presence of calcium ions in it. The setup of the filtration process had bone char, gravel, corn cob, timber char, and sand. For making activation of carbon, charcoal was first cleaned and then it was sundried, later it was burnt in red-hot descent at 500 C and used a chemical for activating.

Adewale et al.[7], have reported on filtering pharma active compounds present in water before it seeps into the surface or groundwater as it might contaminate the water bed and make it unsafe to consume such water for drinking. The contaminated water may affect humans, animals, and the environment. Figure 6 shows the pathway from all sources in which pharmaceutically active compounds can get into the groundwater. This shows that there is an immediate necessity to take measures to prevent pharmaceutical waste from getting into the water bed.

The authors in their work have presented a review of different works done to tackle the issues. Some methods include chemical, physical and biological approaches such as coagulation, membrane filtration, photocatalysis, sedimentation, microbial degradation, electrochemical processes, and adsorption. But it should be noted that the sedimentation and coagulation process cannot remove Pharmaceutical waste due to the high solubility and mobility of some compounds in water. However, they report that ultra, nano, and micro filtrations could be beneficial to tackle pharmaceutical waste, and also several steps have been taken to upgrade these techniques.

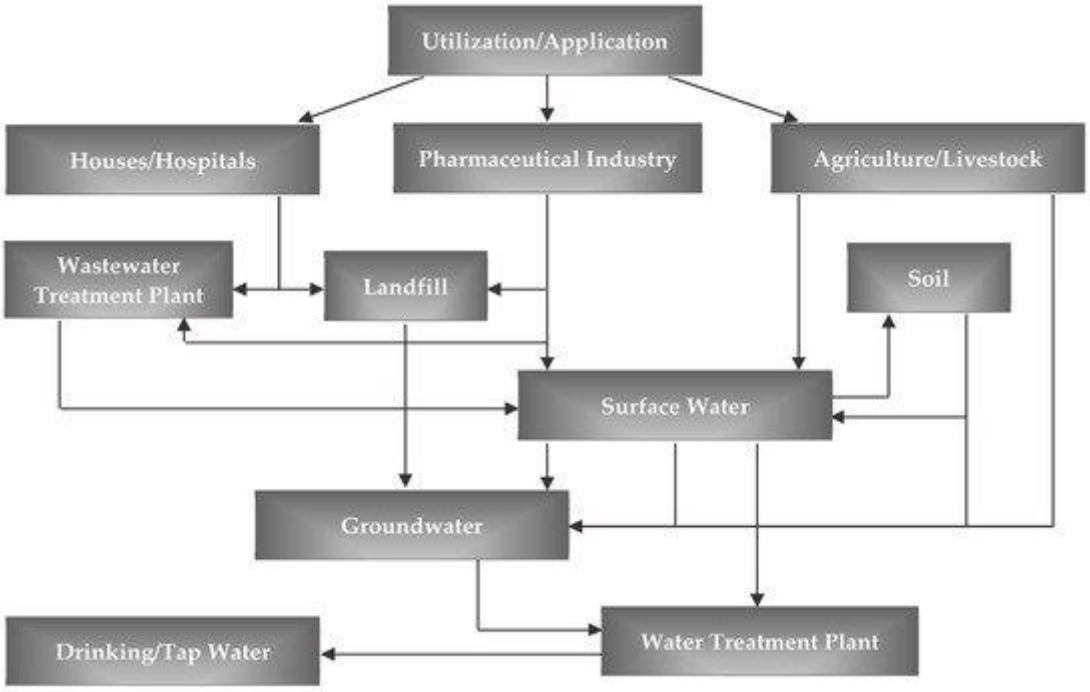

Figure 6. Pathways of pharmaceutically active compounds introduced into the environment

Enas N Mahmoudet al[8]., have reported on using olive-treated filtration where they have filtered Cd, Cu, and Lead. After Aquatic Utilizing Treated Olive Process Strong Residue. Firstly, olives were cleaned, crushed, and dried for 15 days under the sun and kept in a broiler at 50°C for one week to ensure water evaporation to total dryness. The dried olive was used to filter the water. They have reported that Cadmium particle Cadmium cation (Cd2+), copper(II) cation (Cu2+), and Lead (II) particle (Pb2+) particles have been removed.

Khazaria M.AI-Qahtani [9-10]., has suggested in their paper that heavy metallic pollutants in aquatic structures have ended up a severe chance and have a large ability to reason environmentally-derived cancers due to the fact those alloys are indestructible and consequently persevering. Alloys are assembled and transported to food webs as they reach out of landfills, contaminated soil, and water.

Undiluted solution of Cd, Cr, and Zn was purchased and used to treat the removal of hazardous compounds. 5 ml of this solution was taken and thinned to 50 ml, Kiwi fruit yap was used to eliminate cadmium, chromium, and zinc respectively to some extent. Later it was again passed through a banana bar and found to remove 88%, 67%, and 43% cadmium, chromium, and zinc respectively. Also, barks of various fruits were used to adsorption weighty alloys present in water. The chief benefits of using these constituents include obtainability, less price, and the point that they do not necessitate culture or fusion for fabrication.

Mika Anna et al.[11], in their work, have reported that the agricultural waste tray as shown in Figure 7 is perceived as an environmental problem in the social order. But waste trays as a biomass-rich material in lignocellulose have stimulated new opportunities to produce renewable, cost-effective, and maintainable adsorbents for liquid handling tenders. This analysis has stimulated new opportunities for water treatment.

Figure 7. Figure showing agricultural waste used in filtration

This work summarizes the ability of various shell-based adsorbents to adsorb organic and inorganic contaminants. Various treatment techniques were available to control/minimize water pollution and have varying degrees of success. However, most of the drawbacks of these processes are toxic sludge generation and complex processing.

Pomelo rind as a bio adsorbent using the ZnCl2 activation technique was used to remove lead from wastewater. The adsorbent was able to eliminate 90% of Pb2 + from the effluent. Grapefruit peel: The adsorption potential of lemon zest has also been studied which was used for removing deuce anionic detergent colors, methyl group orange (MO), and Congo red (CR), from aqueous resolutions. The adsorption volumes of the lime zest adsorptive for the dye remained to create to be 50.3 and 34.5 mg / g for MO and CR, correspondingly.

Generally, most water purification filters use Reverse Osmosis purification and the main drawback of household RO systems is that they remove most minerals from the water and leave it acidic. Also, the setup could be expensive and it is noted that water is wasted during the filtering process as rejected water.

CONCLUSION

In this work, an effort was made to study different methods of water filtration used for different purposes. We report on different ways to filter water by using different bio adsorbents. By and large, the studies reveal that corn cobs could be an effective adsorbent for water filtration purposes. The methods mentioned could be used for gardening, flushing, and other applications including drinking. The ways of filtering water could be very easily available and also very cost-effective.

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