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Treatment of sewage waste water using an agricultural waste corn cobs

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ABSTRACT

Corncobs are agricultural wastes obtain in maize cultivation. It is less utilized part of the maize plant. Due to rigidity and their porous structure they can be used as an absorbent. Corncobs are available in large quantity, it may be burnt or given as food for animals. But if corncobs are burnt it causes air pollution which we already saw what happen in Delhi (Capital of India) and if corncobs are given as food to animals, they also not take it as it contains hemicellulose content in it and acts as an obstructing agent in the elementary canal of the animals. So, it is a good idea to use corncobs agricultural waste to treat wastewater. Sometimes they are thrown away but naturally, they take too much time to biodegrade. In this treatment no need for chemicals and electricity. The wastewater can be treated naturally using corn cobs as an absorbent. As corn cobs are cheap, this is more economical treatment. It is also easy and simple to operate. So, it can be adopted in villages also.

Keywords— *Corncobs, Economical, Natural absorbent, BOD, COD, filter*

1. INTRODUCTION

Water is a very precious source available on earth. Water is important for any living thing on the earth planet. Though 71% of the earth is covered by water only 2% of it is fresh. Further 1.6% of that fresh water is contained in glaciers and polar ice caps. More than half of the rivers in India are highly polluted with numerous others at levels considered unsafe by modern standards. The waters of the Yamuna, Ganga and Sabarmati flow the dirtiest with a deadly mix of pollutants both hazardous and organic.
A few statics from the World Bank highlight the consequences the country is facing:

- 163 Million Indian population lack access to safe and proper drinking water
- 210 Million Indians lack access to efficient sanitation
- 21% of communicable diseases are related to unsafe water
- 500 children under the age of five die from diarrhoea each day in India

As India is a developing country, there is rapid industrialization and unfortunately many industries without taking any action on wastewater they flow down the wastewater with pollutants in the river directly. But we can easily take action in the villages by knowing them the importance of water. The industries can afford the STPs if they require but in villages, the people can't afford it, so in accordance to it, an efficient, low cost (economical) domestic waste water filter can be introducing to them and use that treated water for the gardening purposes or for farming, etc. People are struggling or we can say striving for the water. Nowadays it is very difficult to find portable water and amazingly they are buying it for living.

1.1 Objectives

- To remove turbidity from water
- To remove solid particles from the water

- To determine different characteristics of water
- To access the reuse of water

2. LITERATURE REVIEW

"Defluoridation of Ground Water Using Corn Cobs Powder", by Lavanya H D1, Madhushree C1, Vani A2, Manjula2 (2017): Flocculation and adsorption are 2 methods for removal of fluoride content in water. Flocculation means a process of contact and adhesion whereby the particles of a dispersion form larger-size clusters which conclude as a precipitate. In adsorption, the adhesion of atoms, ions or molecules from a gas, liquid or dissolved solid to a surface using activated agents such as activated alumina, activated carbon, bone char etc. But as these active agents are not economical, alternative adsorbents such as corn cobs, crushed tamarind seed, laterite soil, moringa olifera etc., can also be available to use. In this particular study, corn cobs are to be used as adsorbing agent. According to WHO guideline throughout the world nearly or more than 200 million people drink the groundwater which is the important source of drinking water in many areas with fluoride concentrations greater than 1.5mg/l. The majority of these cases occur in the developing world. The ground water reacts very differently with the increasing percentage of fluoride than surface water. Because there is a different impact of water rock reactions in aquifers. There are some effects shown in the people through drinking water which have the fluoride content. This is the truth that there is the presence of fluoride in every single unit of natural water. Sea water basically contains about 1mg/l while rivers and lakes generally have concentrations less than 0.5mg/l. In groundwater's, however, low or high concentrations of fluoride can occur, depending on the nature of the rocks and the occurrence of fluoride-bearing minerals. High fluoride concentrations may therefore be expected in groundwater's from calcium-poor aquifers and in areas where fluoride-bearing minerals are common.

"Case Study on Removal of Water impurities by using Corn Cob and Neem Leaves as Bio – Adsorbents from Ambazari Lake.", by Ms Pooja .P. Malode, Ms. B. M. Mamilwar (2017): As India is a developing country there is rapid development in the technology and lifestyle changes day to day. The effects of that are the addition of contaminants into the air, water and land increasing which is unsafe for living organisms. Also, there are many sources like domestic, agricultural and industrial sectors which releases the pollutants which greatly affects the quality of water and causes harm to aquatic organisms. From the agricultural activities, the fertilizers are enhancing the problems in the water while through industries the effluents of toxic liquid of heavy metals directly thrown away in the river which harms the aquatic life. Prevention is always better than cure, the best solution is taking care not to happen it again and again. In addition to that, due to the rapid modernization of society, the youth has led to use of the materials which have less value but not have any fruitful use. Such materials are generally considered as waste, and their disposal is a big problem. Also, there are some materials present in nature that have small or no use. The utilization of all such materials as low-cost adsorbents for the treatment of sewage wastewater may make them of some useful value. A work has to be done to give an excellent idea about by using low cost adsorbent as a filter for the treatment of wastewater, not only utilization of those waste done but also the water can be treated.

"Corncobs as Low-Cost Bio-Adsorbent for Water and Waste Water Treatment", by Ashwani Kumar Singh 1, Mayank Srivastava 2, Narottam Kumar Rajneesh 3, Shikhar Shukla 4 (2015): In India, there are 234-Sewage Water Treatment plants (STPs). Most of these were developed under various river action plans (from 1978-79 onwards) and are located in (just 5% of) cities/ towns along the banks of major rivers (CPCB, 2005a). In class-I cities, oxidation pond or Activated sludge process is the most commonly employed technology, covering 26% of total installed capacity. Series of Waste Stabilization Ponds technology is also employed in 28% of the plants, though its combined capacity is only 5.6%. According to World Bank Report (1986), the stabilization ponds are used in the greater extent and this is a great opportunity in developing countries like India where the land is easily available and skilled labour are not available to work. The main objective of our project is to search for a cheap method of cleaning waste water from domestic and industrial sources by utilizing one of the most under-utilized agricultural wastes. The present study in the world is based on the scientific principles of Adsorption by immobilizing the contaminants present in wastewater with the help of corn cobs. Corn is a major crop plant in India, every part of which is utilized except the cob. In this project, the non-utilized part is utilized for a better cause treatment of wastewater.

D. "Use of maize cobs derived products for removal of selected inorganic ions, colour and turbidity from contaminated water", by Daniel Muvengei Mwangangi I56/CE/21443/2010 (December 2015): Majority of Kenyans lack access to clean water due to increased population growth, high rate of industrialisation and poor waste management. The situation may worsen if immediate measures are not taken. Lead and cadmium are the main heavy metals in contaminated water and their harmful effects such as lung cancer, mental retardation and nerve disorder cannot be underestimated. Available methods for removing these metal ions from water such as the use of activated carbon are very expensive and unaffordable to low-income earners. Maize cobs have minimal use after maize harvesting can be utilised to reduce environmental pollution. The primary aim of this study was to investigate the ability of maize cobs derived products to adsorb both lead (II) and cadmium (II) ions and remove methylene blue and turbidity from contaminated water. Corn cob charcoal was prepared by heating cob in the furnace in the presence of air. Activation was done by use of 1.0 M sulphuric acid and heating the mixture in a closed vessel. Maize cob ash was created by heating dry maize cobs in a furnace. The ability of these sorbents to adsorb lead (II) and cadmium (II) ions from the solution was investigated by carrying out the batch experiment and varying parameters such as contact time, initial metal ion concentration, adsorbent dose, temperature and shaking speed. The data obtained were fitted into Langmuir and Freundlich models. Activated charcoal gave the best fit in Langmuir for lead ions with a maximum adsorption capacity of 13.0 mg/g.

E. "Agricultural waste corn cob as a sorbent for removing reactive dye orange 16: Equilibrium and Kinetic study", by Daniela Suteu, Teodor Malutan and Doina Bilba (March, 2010): The potential of corn cob, a natural low-cost lignocellulosic effective material, was tested for the removal of reactive dye Orange 16 from an aqueous solution. Sorption isotherms were observed at 3 temperatures (5, 18 and 45 °C), in solutions with initial dye concentrations in the 37.05-370.5 mg L-1 range. The

equilibrium data were analysed using Langmuir, Freundlich, Dubinin-Radushkevich and Tempkin isotherm models. The Langmuir isotherm model well described the sorption equilibrium. According to the Langmuir isotherm, the maximum sorption capacity was estimated as 25.25 mg g-1 (18 °C). The values of the mean free energy determined with the Dubinin-Radushkevich equation (9.713 kJ mol-1 at 18 °C, as well as the thermodynamic parameters, suggests that the mechanism of reactive dye sorption onto corn cob is a combination of physical sorption and electrostatic interactions. The kinetic data were studied in terms of pseudo-first and pseudo-second-order kinetic models. Corn cob, an agricultural waste product obtained from maize or corn, has become more and more important, and new uses, such as the production of activated carbon, manufacture of biofuels20 or as an adsorbent for removing some pollutants, 20-23 are developed each year. The aim of this paper was to evaluate the potential of the corn cob to remove the Orange 16 reactive dye from aqueous media as a function of initial dye concentration, temperature and contact time physical sorption.

3. MATERIALS USED

3.1 Corn cobs

- Corn cobs with a longitudinal section
- Smaller pieces of corn cobs
- The powder form of corn cobs

3.2 Sand

- Fine sand having diameter 1 to 2 mm
- Course sand having diameter 4 to 8 mm
- Gravel having size diameter 8 to 16 mm

The corn cobs are obtained from the farmers nearby the area and the sand is collected from the “Waghur Water Treatment Plant” situated at Jalgaon.

4. METHODOLOGY

- First of all, wash all the corn cobs obtained from the farmers with the hot water then dry it under the sun for 2 to 3 days.
- The sun-dried corn cobs are cut into the longitudinal sections.
- Also, some corn cobs are cut into the small pieces to absorb the pollutants.
- The powdered form of corn cobs can be made by continuous hammering on the small pieces of corn cobs.
- The charcoal is also made from the corn cobs.
- To make charcoal the small pieces of corn cobs are put into a small size can and that small can is put into a large size drum to heat it up.

Fig. 1: Small pieces of Corn cobs

Fig. 2: Longitudinal sections of Corn cobs

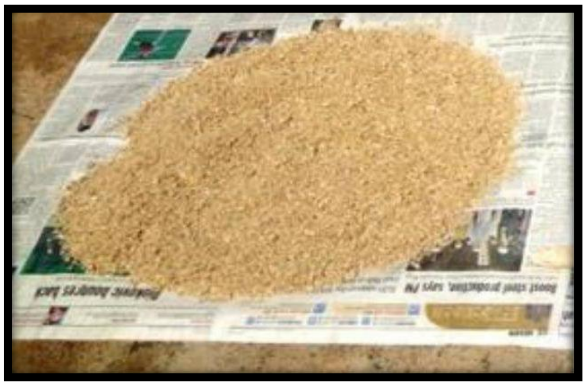

Fig. 3: Powder form of Corn cobs

Fig. 4: Charcoal of Corn cobs

- A small hole is made on the small can on the upper side.
- A fire is made up inside the large drum and place that small can have corn cobs in the middle.

- When the can starts heating up the corn cobs inside starts shivering and we can see the smoke is coming through the hole at top of the can. This helps to release the pressure and stops the can from popping.
- The charcoal is made in the presence of oxygen in order to make it efficient.

Fig. 5: Powder form of activated charcoal of Corn cobs

Fig. 6: Fine and Course Sand

Fig. 7: Gravel

- Initially, if we hold a flame outside the hole at top of can the smoke will immediately put it off. After a while, it releases a flammable gas which when exposes to flame will immediately catch on fire. When this flame goes out to try to reignite it again.
- When the flame won't reignite easily, it is the indication that our coal is ready now.
- Cool down the can and take the charcoal outside of the can. Crush the charcoal pieces to form powder charcoal.
- But the charcoal is not activated yet, to activate it we have to do something more interesting.
- Combine calcium chloride and water in a 1:3 ratio. Anyone can also use bleach or lemon juice as an alternative to calcium chloride.
- Transfer the charcoal powder into a beaker and add the solution in it. Stir it well until the mixture reaches to paste.
- Cover the beaker for 24 hours and let the charcoal sit down. After that, drain as much as moisture.
- Return the charcoal in a metal pot and heat it up nearly for 3 to 4 hours to activate it. After that also place that charcoal under the sun for 3 hours to make sure the charcoal is completely moisture free.
- Now placed these different forms of corn cobs in a sequence in an arranged manner to remove the contaminants from the wastewater.
- Tests are conducted in the college laboratory to know that the treated water is usable or not.
- Test for detergent was done by hand shaking the filtrate to mark foam.
- Visual observation was made to find out the presence of coloured dyes.

Fig. 8: Arrangement of layers

Arrangement of layers of corn cobs to make sure treated water is coming out is as follows:

(a) Longitudinal sections of corn cobs
(b) Small pieces of corn cobs
(c) The powdered form of corn cobs
(d) Activated charcoal
(e) Sand filter where further suspended particles and impurities get absorbed

5. RESULT AND DISCUSSION

Table 1: Results of Test Conducted in the Laboratory on a Sample

Name of test	Before treatment	After treatment
BOD	460 mg/l	187 mg/l
COD	466 mg/l	194 mg/l
TSS	514 mg/l	220mg/l
Detergent	Soapy and cloudy	Clear
Turbidity	31 NTU	19 NTU
Ph.	8	7
Colour	Present	Absent

There are 3 main characteristics of the wastewater which are to be considered are as follows:

(a) Physical Characteristics: Turbidity, colour

(b) Biological Characteristics: BOD (Biochemical Oxygen Demand). It is very important.

(c) Chemical Characteristics: COD (Chemical Oxygen Demand), TSS (Total Suspended Solids)

BOD is the measure of the amount of oxygen required for the bacteria to degrade the organic components present in waste water. It is a very important characteristic of the water. It directly affects the quality of water. When the BOD levels are high, the Dissolved Oxygen (DO) levels automatically decreases because the oxygen present in the wastewater is consumed by the bacteria in a great manner. In the results of which the less DO is available in the water and as it is less the fish and other aquatic organisms present in the water body may not survive. Moderately untreated sewage averages between 200 to 600 mg/l.

COD is a total measurement of all chemicals including organics and in organics in the waste water. This is the main difference between the BOD and COD. BOD decomposes only organic matter while COD decomposes both organic as well as inorganic. Also, BOD is always equal to or less than the COD or vice versa. The same thing happens if COD value is too high like the BOD.

6. CONCLUSION

The water can be easily reused if good efforts have to be taken in the right direction. As there is no space science include in this simple process anyone can easily operate this treatment system for his home or commodity. The papillae present at the surface area of the activated charcoal absorbs the maximum impurities. Greater the surface area more of the porous structure.

Also, there is no need of electricity so the transmission of power is not necessary. It is totally natural. Again, the agricultural waste can be useful without any pollution. Now this treated water can be easily drained out in the river or else one can use it for the farming or gardening purpose. If we can treat it again in an effective manner then it can be used for different purposes.

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