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AGRICULTURAL WASTE MATERIALS AS POTENTIAL ADSORBENT FOR TREATING INDUSTRIAL WASTEWATER

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ABSTRACT:

The textile industry generates huge amounts of wastewater which must be treated effectively in a bid to prevent water scarcity through re-use. In this chapter, the use of bio adsorbents from agricultural waste which included corn stalk and saw dust were used as bio adsorption carriers for textile water.

Color removal from textile effluents on a continuous industrial scale has been given much attention in the last few years, not only because of its potential toxicity, but also mainly due to its visibility problem. There have been various promising techniques for the removal of dyes from wastewater. However, the effectiveness of adsorption for dye removal from wastewater has made it an ideal alternative to other expensive treatment methods. In this review, an extensive list of sorbent literature has been compiled. The review evaluates different agricultural waste materials as low-cost adsorbents for the removal of dyes from wastewater. The review also outlines some of the fundamental principles of dye adsorption on to adsorbents.

Keywords: Agro waste, bio adsorbents.

1. INTRODUCTION

Dyes are widely used in industries such as textiles, rubber, plastics, printing, leather, cosmetics, etc., to color their products. As a result, they generate a considerable amount of colored wastewater. There are more than 10,000 commercially available dyes with over 791000 tonnes of dye stuff produced annually.Among various industries, textile industry ranks first in usage of dyes for coloration of fiber. The total dye consumption of the textile industry worldwide is in excess of 107 kg/year and an estimated 90 % of this ends up on fabrics. Consequently, 1,000 tones/year or more of dyes are discharged into waste streams by the textile industry worldwide (Marc1996).Discharge of dye-bearing wastewater into natural streams and rivers poses severe problems to the aquatic life, food web and causes damage to the aesthetic nature of the environment. Hence, these pose a serious threat to human health and water quality, thereby becoming a matter of vital concern.

Agricultural waste materials have little or no economic value and often pose a disposal problem. The utilization of agricultural waste is of great significance (Geopaul1980). A number of agricultural waste materials are being studied for the removal of different dyes from aqueous solutions at different operating conditions. Agricultural waste includes curcuma longa leaves powder (Namasivayam and Kavitha2002), Saccharum Officinarum leaves (Rajeswari et al. 2001), Cocos Lucifer shell (omatayo sarafadeen amuda et al. 2006), rice husk (Malik 2003), straw (Kannan and Sundaram2001), Saw dust (Banat et al. 2003a), oil palm trunk fiber (Hameed and El-Khaiary2008a), durian (Durio zibethinusMurray) peel (Hameed and Hakimi2008), guava (Psidium guajava) leaf powder (Ponnusami et al. 2008), almond shell (Ardejani et al. 2008), pomelo (Citrus grandis) peel (Hameed et al. 2008a), broad bean peel (Hameed and El-Khaiary 2008b), peanut hull (Tanyildizi 2011),Citrullus lanatusrind (Bharathi and Ramesh2012).

1. MATERIAL PROPERTIES

CURCUMA LONGA LEAVES POWDER

Properties	Values (%)
Crude protein	6.47
Crude fat	2.7
Moisture content	13.2
Crude fibre	4.80
NFE	69.05
Ash	3.49

(Table 1. properties of curcuma longa leaves powder)

SACCHARUM OFFICINARUM LEAVES POWDER

Properties	Values (%)
Silicon dioxide	78.34
Dialuminium	8.55
Ferric oxide	3.61
Calcium oxide	2.15
Sodium oxide	0.12
Potassium oxide	3.46
Manganese oxide	0.13

Titanium oxide	0.50

(Table 2. Properties of saccharum officinarum leaves Powder)

PROPERTIES OF COCOS NUCIFERA SHELL POWDER

PROPERTIES OF RICE HUSK POWDER

Properties	Values
Aluminum oxideAl_2O_3	0.36
Calcium oxide, CaO	0.74
Ferric oxide,Fe_2O_3	0.28
Potassium oxide,K_2O	2.51
Magnesium oxide,MgO	0.76
Sodium oxide,Na_2O	0.20
Silicon dioxide,SiO_2	84.7
Chloride,CL	0.18
Phosphorous pentoxide,P_2O_5	0.62

(Table 4. Properties of rice husk powder)

PROPERTIES OF SAW DUST POWDER (POWDERY WOOD WASTE)

Properties	Values (%)
Carbon	60.8
Nitrogen	0.9
Hydrogen	5.2
ligin	5-10
Oxygen	33.8

(Table 5. Properties of saw dust powder)

2. COMPARISONS BETWEEN DIFFERENT TYPES OF WATER

S.no	Properties	Drinking Water	Untreated Waste Water
1	pH	7.54	10.27
2	Conductivity (µmho)	359	591
3	Chlorides (mg/l)	64.97	335.97
4	Total Hardness (mg/l)	710	1210
5	Calcium Hardness (mg/l)	96.1	380.25
6	Total Acidity (mg/l)	115	350
7	Chemical Oxygen Demand (mg/l)	480	736

3. RESULT

The various tests are conducted for treated industrial water. They are,

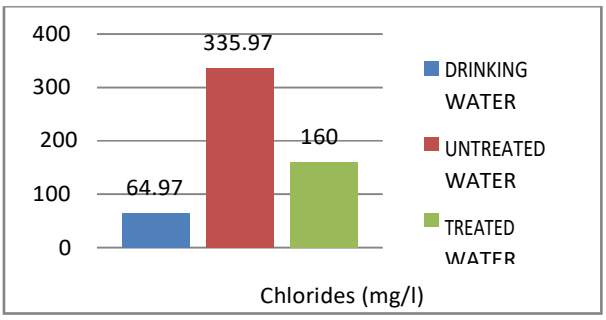
1. Ph
2. Conductivity
3. Chloride content measurement
4. Total acidity
5. Calcium hardness
6. COD

pH

The term pH refers to the measure of hydrogen ion concentration in a solution and defined as the negative log of H+ ions concentration in water and wastewater.

5.2. CHLORIDE CONTENT

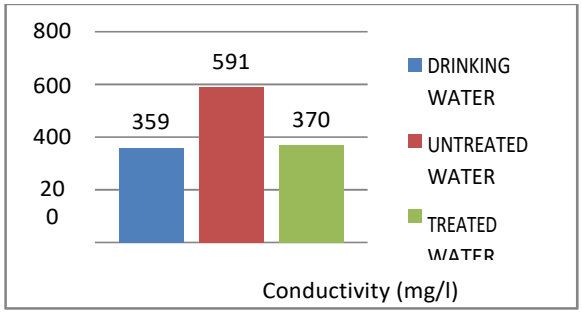
The amount of chloride present in water can be easily determined by titrating the given water sample with silver nitrate solution. The end of titration is indicated by formation of red silver chromate from excess Silver nitrate. The results are expressed in mg/l of chloride (Cl^- with a molecular weight of35.453 g/mol)



CONDUCTIVITY

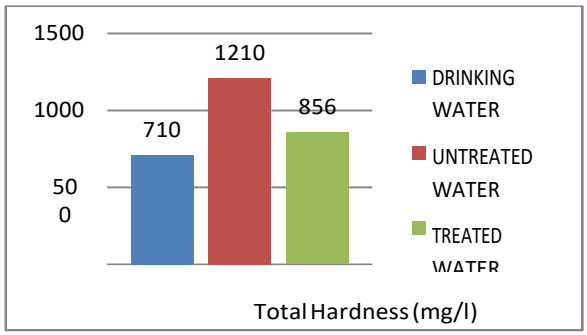
Conductivity (G), the inverse of resistivity (R) is determined from the voltage and current values according to Ohm's law. i.e., R=V/I then, G=1/R=I/V. The meter converts the probe measurement to micro mhos per centimetre and displays the result for the user.

Chart 5.3 Conductivity Value of Different Types of Water



TOTAL HARDNESS

The hardness of good quality water should not exceed 250mg/l measured as calcium carbonate equivalents. Waters softer than 30 to 50 mg/l may be corrosive to piping depending on pH, alkalinity and dissolved oxygen.



CALCIUM HARDNESS

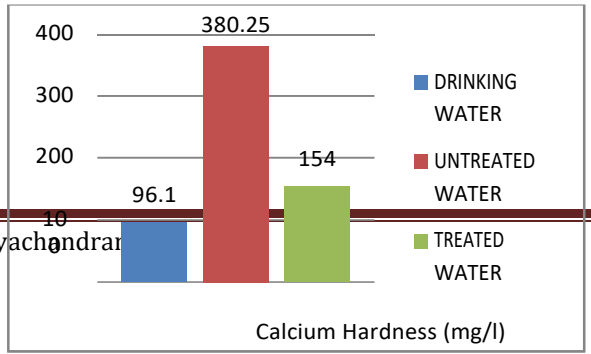


Chart 5.5 Calcium Hardness Value of Different Types of Water

TOTAL ACIDITY

The volume of standard alkali required to titrate a specific volume of the sample to pH 8.3 is called phenolphthalein acidity (Total Acidity). The volume of standard alkali required to titrate a specific volume of the water sample (wastewater and highly polluted water) to pH 3.7 is called methyl orange acidity (Mineral Acidity).

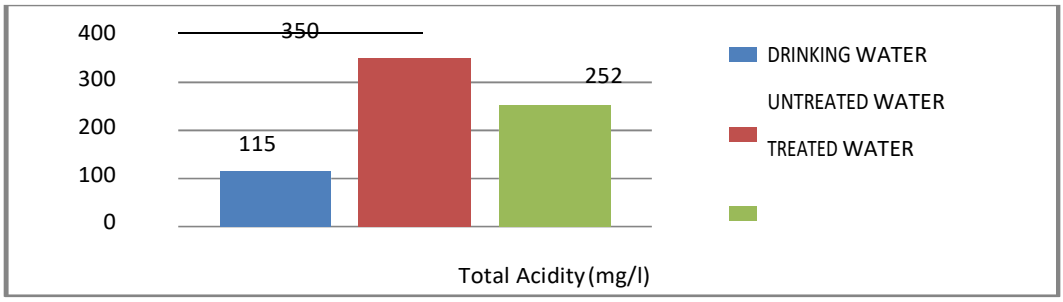


Chart 5.6 Total Acidity Value of Different Types of COD

COD determines the quantity of oxygen required to oxidize the organic matter in water or waste water sample, under specific conditions of oxidizing agent, temperature, and time.

4. CONCLUSION

Application of agricultural waste bio adsorbents in textile wastewater treatment presents an alternative, cheap and easy technology. As from the above results, the coconut shell powder is one of the best Agro waste among all other Agro waste used which reduces the concentration to a maximum of 480mg/l with a addition of 20g of Agro waste at the end of treatment period of 9 days. It is also clear that increase in the addition of Agro waste 20g decreases the concentration of waste water.

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