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Ground Water Assessment and Purification Using Activated Carbon Prepared from Anacardium Occidentale Linn

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ABSTRACT

The awareness of increasing water pollution implies studies concerning water treatment. The piece of investigation was carried out to study the ground water quality, nutrient status and physico-chemical characteristic of Ennore, India. Attempts were made to study and analyze the physico-chemical characteristics of the water. Various parameters like Temperature, pH, Electrical Conductivity and Total dissolved solids, Alkalinity, Nitrate, Total hardness (as CaCo3 Alkalinity, pH , Phosphates and nitrates Sulphate, Chlorides Calcium, Magnesium sodium and potassium etc. By observing the result it can be concluded that the parameters which were taken for study the water quality are above the permissible limit of ground water so using activated carbon to treat the ground water and then get purified water which is satisfy the requirement for the use of various purposes like domestic, agricultural, industrial etc.

KEYWORDS : Activated carbon, Anacardium Occidentale L. and physicochemical characteristics

INTRODUCTION:

Water is the most abundant and wonderful natural resource, has become a precious commodity today and its quality is threatened by numerous sources of pollution. Water is an essential requirement of human and industrial development. Water naturally contains minerals and microorganisms from the rocks, soil and air with which it comes in contact. Human activities can add many more substances to water. The healthy ecosystem depends on the physic chemical and biological characteristics of water. Groundwater is an increasingly important resource all over the world. The term groundwater is usually reserved for the subsurface water that occurs beneath the water table in soils and geologic formation that are fully saturated. It supports drinking water supply; livestock needs irrigation, industrial and many commercial activities. Pollution of groundwater due to industrial effluents and municipal waste in water bodies is another major concern in many cities and industrial clusters in India. Polluted groundwater treat various methods followed. Adsorption has advantages over other methods for remediation of pollutant from wastewater because its design is simple; it is sludgefree and can be of low capital intensiveness (Viraraghvan and Dronamraju, 1993). Activated carbon has been reported to have high and fast adsorption capacities (Sirichote et al., 2002) due to its well-developed porous structure and tremendous surface area. The biggest barrier in the application of this process by the industries is the high cost of adsorbents presently available for commercial use.

MATERIALS AND METHODS

Procedure for adsorbent preparation and activation :

Description of the plant:

Anacardium occidentale L is a medium-sized evergreen tree, much branched; grows to a height of 12 m. The root system is a mature tap root system. Leaves simple, alternate, coriaceus, glabrous, obovate, rounded at ends,10-18 x 8-15 cm, with short petiole, pale green or reddish when young and dark green when mature. The inflorescence is a terminal panicle-like cluster commonly bearing male and hermaphroditic flowers. The nut, which is the true fruit, dries and does not split open. Inside the poisonous shell is a large curved seed, nearly 2.5 cm long, edible cashew nut. As the nut matures, the stalk (receptacle) at the base enlarges rapidly within a few days into the fleshy fruitlike structure, broadest at the apex, popularly known as the fruit. This thin-skinned edible cashew fruit has a light yellow spongy flesh, which is very juicy, pleasantly acidic and slightly astringent when eaten raw and highly astringent when green.

Preparation of activated carbon

Collected stem was washed with water to remove dust particles and dried in shade condition and further dried in a hot air oven at 100· C for 24 hours. The completely dried material was cut into small pieces and stored in desiccators for further experiment.

Activated carbon of the material was prepared by treating with the concentrated Sulphuric acid in a weight ratio of 1:1 (material: acid). The resulting black product was kept in muffle furnance maintained at 500○ for 30mins followed by washing with distilled water until it becomes free of excess acid and dried at 90·C. The activated carbon obtained from biomaterial was ground and sieved with 80-mesh siever and was used for metal adsorption experiments.

WATER SAMPLE COLLECTION

Ennore popularly known as industrial area. The communities around the groundwater use the water extensively for drinking, irrigation, and other domestic purposes without prior treatment. Ground water is collected from this area for treatment using activated carbon filter.

The samples collected and stored in clean polythene bottles fitted with screw caps and brought to the laboratory in the sampling for detailed physico-chemical analysis.

EXPERIMENTAL ANALYSIS

Physico-chemical parameters of these samples were determined by using standard procedures.

Table -1
Methods used in physic-chemical analyses of water

SI.NO	Parameter	Method	Instrument
1	Electrical Conductivity		Digital Conductivity meter model :611E
2	PH	Electrometric method	Digital PH meter global make, 0-14 range 0.1 accuracy
3	Turbidity	Turbidimetry	Nepheloturbidity
4	Total dissolved solids Mg/L	Gravimetric method	
5.	Calcium	Titrimetric	
6.	Magnesium	By Calculation method TH-CaH=MgH	
7	Sulphate	Turbidimetric method	
8	Iron	Colorimetric method 470 nm	Spectrophotometric DR 2000
9	Chloride	Argentometric	

10	Alkalinity Total as $Caco_3$	Titrimetric method	
11	Total hardness as $Caco_3$	Titrimetric method	
12	Sodium	Photometry	Flame photometer
13	Potassium	Photometry	Flame photometer
14	Phosphate	Colorimetric method 720nm	
15	Free ammonium as NH_3	Colorimetric method 420nm	Spectrophotometer HACHD-2000
16	No_2	Colorimetric method 535nm	Spectrophotometer HAcl+DR-700
17	No_3	Colorimetric method 220 nm to 275nm	UV spectrophotometer Shimadzu model

RESULTS AND DISCUSSION:

PHYSICAL PARAMETERS

Physico-chemical parameters of the water samples were analyzed as per the standard methods for the examination of water and waste water 9APHA, 20th Edition 1998) Before and after treatment of ground water samples. Various physic chemical parameters are given in Table 2 and 3.

CHEMICAL PARAMETERS

Appearance and odour:

The appearance and odour of both before and after treatment of water was clear and colourless no specific odour was found in both the water samples.

Turbidity (NTU) :

The turbidity of before treatment of water was recorded as 1mg/L and after treatment of water as 0.5mg/L. Increase Turbidity of water may be due to presence of increased total dissolved solids. But after treatment Turbidity was decreased with permissible limit.

Total dissolved solids (TDS) and Electrical Conductivity (EC):

Total dissolved solids value of before treatment of water was recorded as 2500mg/L and after treatment of water as 1166 mg/L. In water, total dissolved solids are composed mainly of carbonates, bicarbonates, chlorides, phosphates and nitrates of calcium, magnesium, sodium, potassium and manganese, organic matter, salt and other particles.

Electrical Conductivity (EC): electrical conductivity value of before treatment of water was recorded as 3502 mg/L and after treatment of water as 1777 mg/L,the electrical conductivity increases as the concentration of ions increases. TDS and electrical conductivity are interlinked (Prashant Mehta et al., 2014) But after treatment electrical Conductivity was decreased with permissible limit.

Chemical parameters:

Total hardness (as CaCo3)

Total hardness is defined as the sum of calcium and magnesium concentration in mg/L. Total hardness value before treatment of water was recorded as 360 mg/L after treatment of water as 255 mg/L. (Jayalakshmi et al., 2011)

Alkalinity

Alkalinity denotes the acid neutralizing capacity of water. Alkalinity measures the various substances related to the basic property of water. The solubility of various substances directly depends on the levels of alkalinity. The Alkalinity value of before treatment of water was recorded 400 mg/L but after treatment of water as 250 mg/L. (Jayalakshmi et al., 2011)

PH

pH of an aquatic system is an important indicator of the water quality and the extent pollution in the watershed areas (Kumar et al. 2011). The ph of the both before and after treatment of water value was slightly different after treatment of water more suitable for drinking purpose compared with before treatment.

Phosphates and nitrates:

Phosphate and nitrate value of before treatment of water was recorded increasing levels of both phosphates and nitrates can lead to eutrophication, which increases algal growth and ultimately reduces dissolved oxygen in the water (Murdoch et al., (2001). But after treatment of water reduces the content for drinking purpose. The amount of ammonia, nitrite and nitrate are interrelated.

Sulphate

Sulphates are common in natural waters, but levels can be increased from industrial contamination. The highest sulphate value was recorded before treatment of water. But after treatment sulphate value was decreased and used various purpose. (Jayalakshmi et al., 2011)

Cholrides:

Cholrides value of before treatment of water was recorded high level .The high content of chloride in the aquatic systems is responsible for a large amount of organic matter which in turn causes eutrophication. the high concentration of chloride can be attributed to the mixing of industrial effluents in sewage which build up high amounts of organic and inorganic ions like chlorides. but after treatment of water value was decreased. (Jayalakshmi et al., 2011)

Calcium, Magnesium sodium and potassium :

Some of the activities such as industrialization and domestic usages and agricultural by products are important factor for Calcium, Magnesium sodium and potassium pollution. Calcium, Magnesium sodium and potassium value of before treatment of water was recorded 100 mg/L,45 mg/L,555 mg/L,70 mg/L and after treatment of water value was recorded 85 mg/L,25 mg/L,375 mg/L,45 mg/L and use this water drinking purpose.

Table 2
PHYSICAL PARAMETERS

Physical parameter	Before treatment water	After treatment water
Appearance	Colourless& Clear	Colourless& Clear
Odour	None	None
Turbidity NTU	1	0.5
Total dissolved solids mg/L	2500	1166
Electrical conductivity (mico mho/cm)	3502	1777

Table 3
CHEMICAL PARAMETERS

Chemical parameter	Before treatment water	After treatment water
PH	6.2	7
Alkalinity ph (as $CaCo_3$)mg/L	0	0
Alkalinity Total (as $CaCo_3$) mg/L	400	250
Total Hardness (as Ca) mg/L	360	255
Calcium(as Ca) mg/L	100	85
Magnesium (as Mg) mg/L	45	25
Sodium (as Na) mg/L	555	375
Potassium (as K) mg/L	70	45
Iron (as Fe) mg/L	1	0.2
Manganese (as Mn) mg/L	0	0
Free Ammonia (as NH_3) mg/L	3.41	1.12
Nitrite (as NO_3) mg/L	0.04	0
Nitrate (as NO_3) mg/L	56	39
Chloride (as Cl) mg/L	950	500
Fluoride(as F) mg/L	2	1
Sulphate (as SO_4) mg/L	250	235
Phosphate (as PO_4) mg/L	1.0	0.5

Conclusion

The study of physical and chemical characteristics of water provides a considerable insight into the quality of water present in ground water. The water quality is directly related to health and is important for determination of water utility. The increasing concentration of various chemicals generating from the industries and their subsequent release to their surrounding as well as the domestic water released into the drains raised a wide spread and increasing public concern over their adverse effects on human health and environment. Treatment of polluted water is important , so activated carbon is used for treatment of waste water in low cost. Before treatment of water was not suitable for drinking purpose but after treatment of water by using activated carbon filter is suitable for drinking, irrigation and fisheries etc.

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