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A Triple Stage Bioreactor Design utilizing Banana Peels and Guava leaves in the Purification of Harvested Rain water.

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Abstract

When water containing sediments, ionic constituents and bacteria are passed to a system containing the three meshes formulated by unique combination of baby metal, charcoal and sand as the initial mesh followed by meshes of banana peel and guava leaves. The sediments are collided with the baby metal and are sediment under normal physiological conditions .The smaller particles which escapes the collision are absorbed by charcoal to its pores. Charcoal also absorb other toxic chemicals and clean the water. The antioxidants present in the guava leaves are used to kill the bacterial growth and add flavor and medicinal property to the drinking water. The nutritive value of water is also enhanced. When this water is finally passed to the banana peel powder, an ionic bond is developed between the surface of banana peel powder and the phenolic as well as the cationic constituents of water that holds the dissolved metal ions and toxic agents and prevents its motion with water current. Hence it is removed from the water and clean pure water with increased nutritive and decreased pollutant is obtained .This type of system is cost effective and the quality of water produced is comparable with that of high branded water purifiers. Once made, the powder can be used for ten complete purification cycle and charcoal can accommodate twenty purification cycles. The cheap availability of every material needed for this process is the key factor of this experiment. With little efforts, a huge aim of water purification can be attained with house hold organic waste, banana peel and guava leaves. This experiment clearly reflects the wise use of nature to sustain natural processes and is clearly a new innovation to water purification as well as the waste management system.

Keywords: Rain water, Purification, banana peel and guava leaves.

Introduction

The goal of the water purification is to remove unwanted constituents in the water and to make it safe to drink or fit for a specific purpose in industry or medical applications. In the project, we will be using some common materials to create a water purification system. Industrial waste has resulted in high metal ion introduction to water. These ions consumed in small amount results in accumulation of these particles in human body. It adversely affects the consumers at higher tropic level. Several microorganisms and plant have the potential to detoxify the effects of these ions either by adsorption through negative charge in cell surface or through complexation by organic acids like citric acid, oxalic acid, gluconic acid and malic acid A simple water filter can be made with paper, water bottle and towel. This could remove the floating waste and other sedimented particles and make physically clean. Thus waste water treatment system can be pulled out with this casual approach Oil spills in water has the potential to contaminate it and posses health

issues. Charcoal along with gravel can remove these particles when passed through it. Heavy metals like mercury, lead, cadmium and copper causes poisoning. Several micro organisms and plant species trap these hazardous metal ions in their cell membrane and makes water free from metallic ions. Surface active compounds can emulsify oil in water and facilitates it's removal Toxic heavy metals which contaminate the water can be removed with help of biomass. Banana peel can be used to remove metallic ions like copper and cadmium ions from water. Banana peel when minced and dried, act as a super absorbent and absorb the metal ions by interacting them with ionic bonds. Banana peels were successively used in the extraction of copper from river water. The rate of absorption was directly proportional to time of contact and was irrespective of alkali medium and surface area of absorption Different species of banana peels were used for the comparative study of amount of metal ions absorbed. The result showed small deviations with change in species. But with slight change in time of contact, a great change is observed in the percentage of absorption. The deviation in pH value was observed indicating the reduction of acidic nature of the water which reflects that metal ions are absorbed by the peels. Organic waste materials like fruit peels and vegetable remaining can be modified into absorbent which has the potential to absorb ionic as well as phenolic contents from water. The organic materials containing alkaloids and tannin in them act as source for establishing ionic bond between its surface and ionic contents. The treated waste materials thus put forward cheap alternatives for water treatment systems. The dissolved ions present in water can be removed by ion exchange method. In this method ions which are capable to bond with a particular ion is introduced into water or water is allowed to flow through it. In this way, the ions built ionic bond between each other and got fixed to a point while water flows out. Thus water alone can be obtained.

Materials and Methods

Water treatment system was made with Pipes connected accordingly (Figure 1). Preparation of meshes are done with three combinations of items. First mesh is made with charcoal and baby metal. Charcoal as well as baby metals are collected and rinsed well in water to clean it. These are then stuffed into the pipe. Second mesh is prepared with guava leaves. Fresh tender leaves of guava plants are collected and then washed and left for sun dry (Figure 2). After they are dried for two days, they are taken for washing and are washed under pressure to release natural color. The washed leaves are then dried under sun. This process is repeated three times. Then the dried leaves are powdered and stuffed to mesh and inserted to pipe. The third mesh contains banana peels which are our prime super absorbent. Banana peels collected from riped fruit is washed and rinsed several times to remove the remaining of fruit as well as the contaminants. These peels are then dried for removing water. Then they are minced to smaller pieces to increase surface area. Minced banana peels are sun dried for days. The product obtained is then washed under pressure to remove natural color and other matters. Washed peels are then sundried. This process is repeated thrice. Then the final product is powdered and stuffed into mesh and inserted to the pipe. (Figure.1)

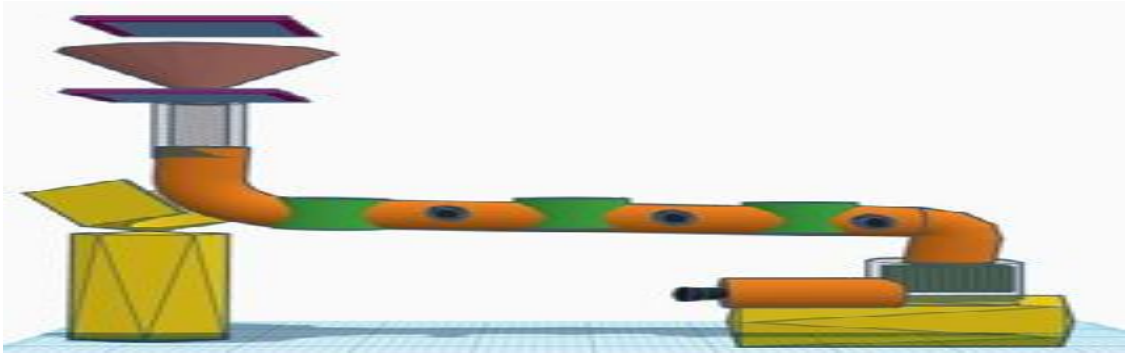

Figure 1:-construction of a novel water treatment system

Figure 2:- Banana Peels and Guava leaves washed and dried

First Mesh

Sand, charcoal and baby metals were collected. Metals were handpicked relatively with the size and put to a chamber .Then it was rinsed and washed for three times and cleaned. Charcoal was hammered and broken into smaller pieces and was put in a mug. The water was used to remove small powders of charcoal from its surface. Sand was taken in a sieve and filtered. This sand was put in thick cheese cloth to make a water conductive bundle .All the three necessities in combination were wound by cheese cloth and was stuffed in a mesh and was inserted to the slot allotted for the first mesh.

Second Mesh

Fresh guava leaves were collected taking care that they are not infected. They are transferred to a tray. Then the leaves were washed in plenty of water. After rinsing and dipping for 5 minutes, exactly 500g of leaves were taken for drying (Figure 2). The leaves were dried under sun for 23 hrs. The dried leaves were washed in a tray under constant pressure so to remove its natural color and flavor. The washed leaves were dried for 5 hrs. This step is repeated for many times until the color and flavor was discarded. Then the leaves were powdered to get 90g of guava leaf powder. 15g of this powder is taken in a cheese cloth and stuffed with the mesh.

Third Mesh

Fresh banana peels were collected and is put to a tray (Figure 2). The procedures are repeated as same as guava leaves to obtain 135g of activated banana peel powder. 20g of powder is put in cheese cloth and stuffed with the mesh.

Results

The water which passed through the system showed several characteristic changes which is described in table 1. This characteristic changes are signs of the chemical interaction between the system and water. This result clearly shows that quality of water was affected by the mesh. Increased pH value showed that the ionic concentration of the water is reduced. Changing of water taste from slightly bitter to normal sweet taste is a sign of removed alkaloid and phenol groups that might have been occupied with water. The maintained transparency of water is a clear indication that no impurities are dissolved in water after passing through banana peel.

Table 1:-The evaluation of various features of water collected before and after treatment.

Sl No	Features	Before Treatment	After Treatment
1	Color	No color	No Color
2	Flavor	Tasteless	Slight Sweet
3	Odour	Nil	Nil
4	pH	Decreased	Increased

Discussion

The aim of the experiment was to build an effective combination to purify water. This result shows that an additional treatment of water with dried guava leaves and minced banana peel along with charcoal, sand and baby metal gave us high quality water as output. The enhanced quality along with reduced pollutants suggests that banana peel can be used for the water treatment and removal of metallic ions which can't be removed by ordinary filtration or purification. The principle behind the purification is adsorption by baby metal and sand, absorption by charcoal. Banana peels, with its ionic bond act as superabsorbent and holds the ions from moving with the current. Cheap cost of making system, better rate of removal of ions from water and Eco-friendly nature presented its advantages.

This experiment is really a true example of utilizing organic matter for treating contaminated water and to make it edible pure water. The Water when passed through dried, minced and crushed banana peel undergoes purification process and high quality change. Metal ions are removed from water due to ionic bond between banana peel and cation. The combination of guava leaves and banana peel along with traditional combination of charcoal, sand and baby metal is found to be more effective in water purification and facilitates a novel approach to further future research in rain water harvest and treatment systems.

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