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# EXPERIMENTAL INVESTIGATION ON DRINKING WATER PURIFICATION AND PROVIDING A FAMILY BASED WATER FILTER UNIT

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***Abstract :*** Ground is one of the major sources for drinking water. But direct use of water for drinking is not suitable. Because drinking water parameters are not in standard range, developing countries facing problems in potable water because of inadequacy of economic support and technology. They are need to adopted water treatment. The natural herbs used to removal of contaminants from water and treatment kit at affordable cost. The natural herbs were used to remove total hardness and total dissolved solids. All parameters where in the range of drinking water standards after treatment. This made us to provide a portable kit. For providing safe potable water, an inexpensive portable filter will be the solution. The herbal materials like Vettiver and the material like luffa cylindrical pad which are very cheapest filter materials proves the reduction of hardness and the mud filter which is more economical and hygienic one to put in use. Thus this kind of appropriate technology will be the sustainable solution for the drinking water purification in rural communities.

***IndexTerms*** - **Vettiver ,Luffa cylindrica ,hardness and total dissolved solids**

## I. INTRODUCTION

Water is the most important compound for the existence of man. Although we have many sources of water in Nigeria, but safe drinking water is one of the challenges of people of Nigeria as the cost of water treatment is extremely high and consequently has led to continuous increase in water borne diseases as majority of Nigerians cannot afford safe drinking water (Krishnamurthy et.al. 2009). Drinking water conditions have great impacts on people. Sinking water conditions have great impacts on peoples everyday life, especially in developing countries where access to safe drinking water is very limited [S. C. Agbo .,et 2015]. Surface water often is the only source, thus water contaminations are hard to avoid (WHO, 2004) .Unsafe drinking water causes diarrheal and other water borne diseases. According to World Health Organization (WHO) over 99.8% of death caused by poor quality of drinking water in the developing countries avoid (WHO, 2004) . Strongly suggesting a need of safe (free from physical, chemical and biological contaminations) and adequate amount of drinking water. In order to improve water quality, various water treatment techniques (bio sand filter, ceramic filters, boiling water, solar disinfection) are in common practice at household level of many developing countries where centralized water treatment systems are limited. Among many options for household water treatment methods, ceramic filter candles are one of the promising techniques for the developing countries [Clasen T. and Boisson S. 2005 ]. The main three mechanisms of CS are inhibiting the enzymatic activities, corroding the bacterial cell membranes and negatively interacting with nucleic acids [Daniele S. Lantagne. 2001]. The purpose of the Low-Cost Water Filtration Project is to provide a design for a low-cost, electricity-free water filtration unit capable of eliminating the physical and chemical contaminates of water. [Lopamudra priyadarshini 2013] The contaminants may be particulate matter, dissolved minerals or microorganisms. There are number of methods for purifying water but those are not economical feasible for rural people. Purification of water is most essential for living a healthy life as water acts a major role in day today life, especially in the rural areas the access to safe drinking water is crucial. Drinking of contaminated water may lead to fatal diseases [Agrawal V. K. and Bhalwar R, 2009]. Every house hold should be able to develop its own drinking water purification system. The main aim is development of a low-cost water purification technique. The proposed technique of water purifier consists of combination of materials which are naturally available [Lopamudra priyadarshini 2013 and Chauhan Shweta and K. C. Gupta, Singh Jyoti (2015] (coarse aggregate, sand, pebbles, charcoal, cotton, rice husk) these materials have tendency to eliminate 75-85% of impurities of water. The main aim for implementing this project is to provide a clean, hygienic water for the people residing in rural households who cannot afford the RO, UV purifiers which are expensive. This method can be made cost effective, portable and user friendly. Low scale water treatment techniques, boiling, chlorination, solar water disinfection, natural coagulation and bio-sand filtration are used to remove water related disease causing microorganisms. Bio-sand filter can remove protozoa up to 100 % [G. Palmateer.,et 1999]. Some of these techniques reduce the quality of water, and

the side-products have an adverse effect on consumer health. Chlorine in water combines with natural organic compounds to yield substances such as trihalomethanes, haloacetic acids, and chlorophenols that exhibit potentially carcinogenic, teratogenic and mutagenic activities [ X. Yang and C. Shang 2004]. Ceramic water filtration is the process of passing water through a porous ceramic material. It is a promising way to reduce the burden of water-borne diseases; it is affordable in terms of cost and made from local resources [S. C. Agbo .,et 2015]. Ceramic filters can be designed in shape of a flower pot, disc, and candle [S. Lamichhane and B. R. Kansakar ].

## II.METHODOLOGY

### STUDY AREA

Kumbakonam is a city municipal corporation in the Thanjavur district in Tamil Nadu.The latitude longitude is 10.97˚N 79.42˚E .The population of kumbakonam in 2021 is 228,918.

**Table 1. WATER SAMPLE COLLECTION AREAS**

| NUMBER OF SAMPLES | NAME OF THE STREET |
|---|---|
| SAMPLE 1 | Gandhi Nagar |
| SAMPLE 2 | Thangavilas Nagar |
| SAMPLE 3 | Chekangani Nagar |
| SAMPLE 4 | EB Colony |
| SAMPLE 5 | Arun Nagar |

The above table explains the samples in kumbakonam district and area which will be noted here, the sample were collected in July, September and November months. The samples were collected from the Borewells in kumbokonam area.

### FILTER

In this project work a gravity filter (Slow sand filter) for the removal or reducing the concentration of impurities is designed. The sand that is used in this filter is free from clay, loam, vegetable matter, organic impurities, etc. For the economic purpose, a mud filter (Terracotta Work) is designed. The Filter kit has three components namely:Raw water portion, 2.Filter media tray, 3.Filtered Water portion

Here the filter kit is made up of mud. The raw water portion has the fine holes for filtering purpose. In this portion the top layer consists of luffa 42ylindrical pad of 2 cm thickness and then below it the herbal material khas (vetiver), which is finely cut and crushed, is placed. The third layer consists of fine sand and the of 3 cm thickness and the gravel at the bottom most layer consists of 3cm thickness.

### DESIGN OF FILTERING KIT

Quantity of water required per person per day
(Both cooking and drinking) = 10 litres
Diameter of the filter = 20 cm.
Depth of the filter = 24 cm
Volume of the filter = 3.14 X 0.1 X 0.1 X 0.24
= 7.5 litres.

**Details of Filter Media**

Depth of luffa 42ylindrical = 2 cm
Depth of Vettiver roots = 4cm
Depth of gravel layer = 0.03m(3 layers)
Depth of sand layer = 0.03m(3 layers)

**Figure 1 potable water kit**

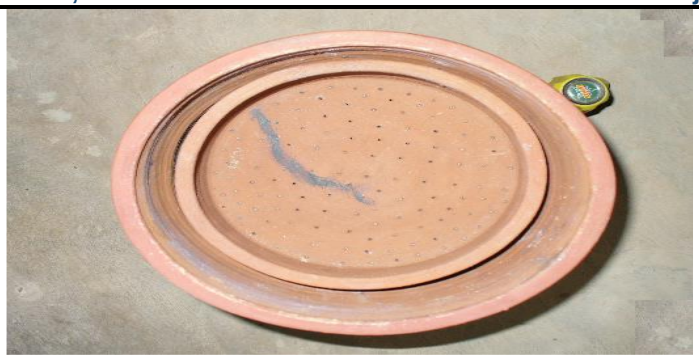

**Figure 2 top of water kit**

## PROCESSING OF HERBALS

Vettiver and Luffa Cylindrica were collected and washed with water to remove dust and other impurities.They were dried in the Sun for 3 to 4 days or oven dried (60°C, 1 day).They were cut into fine pieces. Formaldehyde Wash were performed with oven dried at 60°C for 1 day. Then they were washed with 1% formaldehyde solution to remove the colour and then dried in an oven for 24hrs. Similarly acid wash were conducted for Vettiver and Luffa Cylindrica were placed under oven at 40°C for 24hours.The pretreated Vettiver and Luffa Cylindrica were binded with terracotta clay and burnt to obtain a porous filter pad. The filter pad was placed in the filter disk.

## CHARACTERISTICS OF WATER SAMPLES

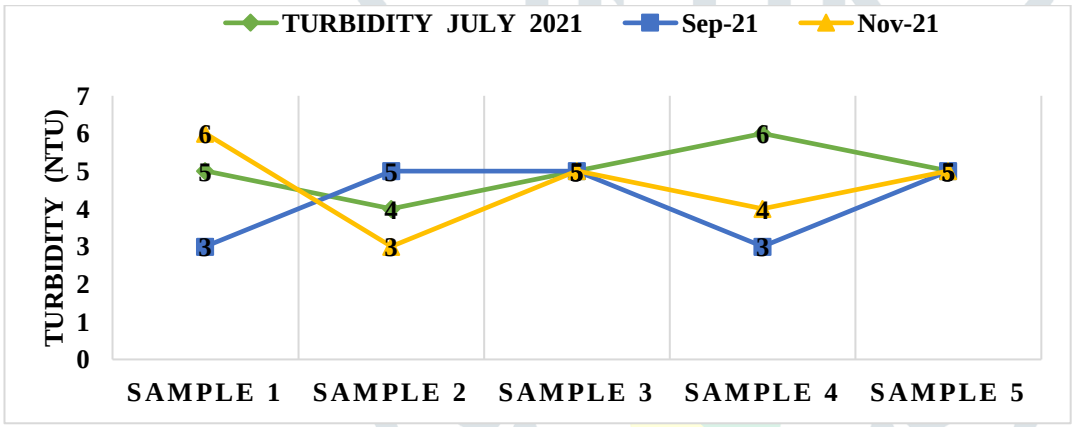


**Figure 3 showing the turbidity for various samples**

The graphs showing turbidity values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed during the month of September the sample 4 showed less turbidity which indicates the clear sample free from any suspended impurities. Similarly, the same turbidity was observed in sample 2 during the month of November. However, all the samples were within the permissible limit.

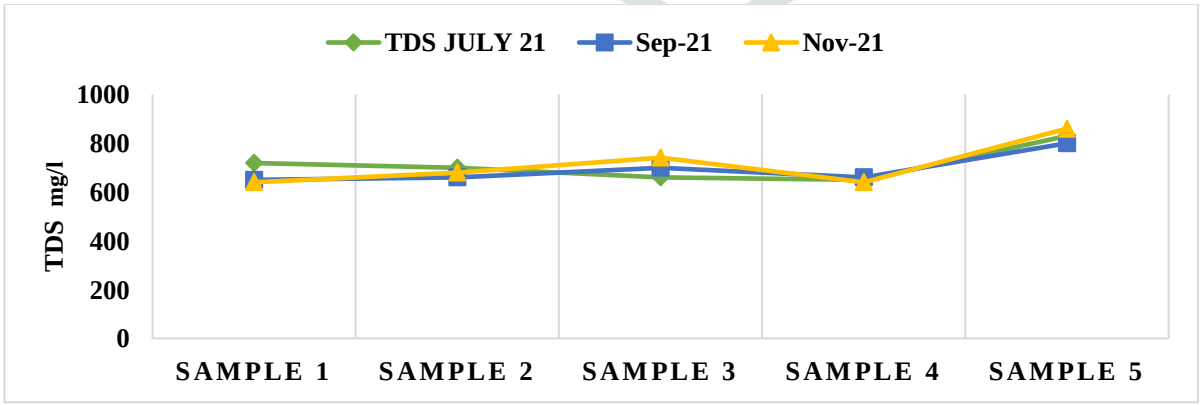


**Figure 4 showing the TDS for various samples**

The graphs showing total dissolved soilds values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed during the month of November only the sample 1 and 4 showed less TDS when compare with other two months.

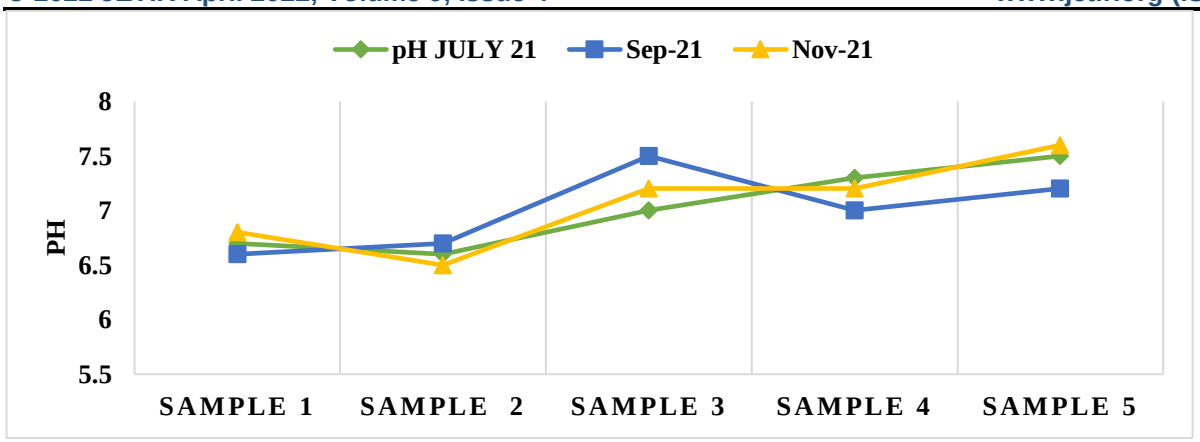


**Figure 5 showing the pH for various samples**

The graphs showing pH values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed during the month of September it indicates less. However, during july and November month equal values were obtained.

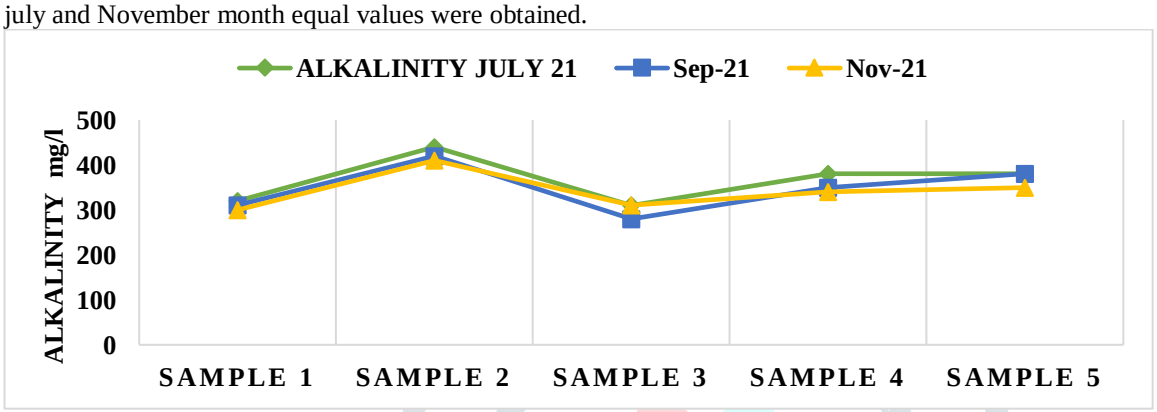


**Figure 6 showing the Alkalinity for various samples**

The graphs showing Alkalinity values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed that alkalinity was maximum in july and minimum during the month of November.

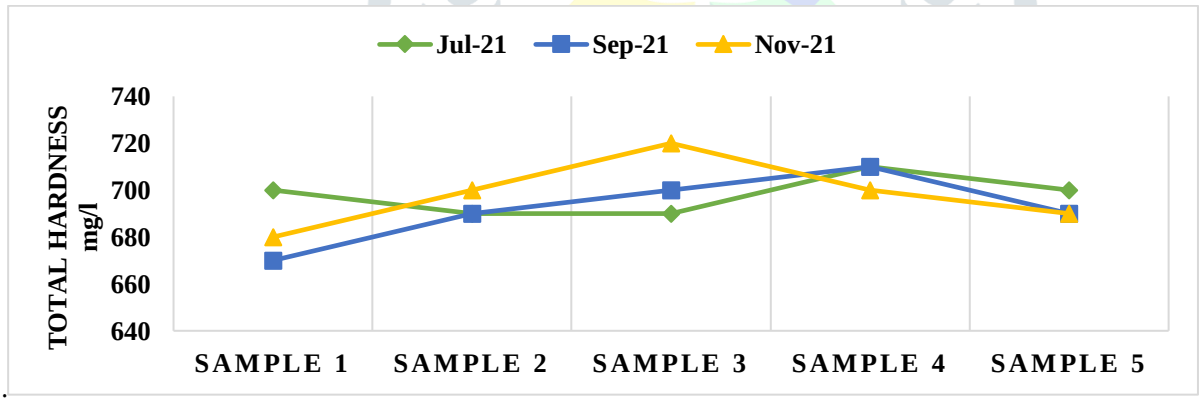


**Figure 7 showing the Total Hardness for various samples**

The graphs showing Total Hardness values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed that the values were not in permissible limit..

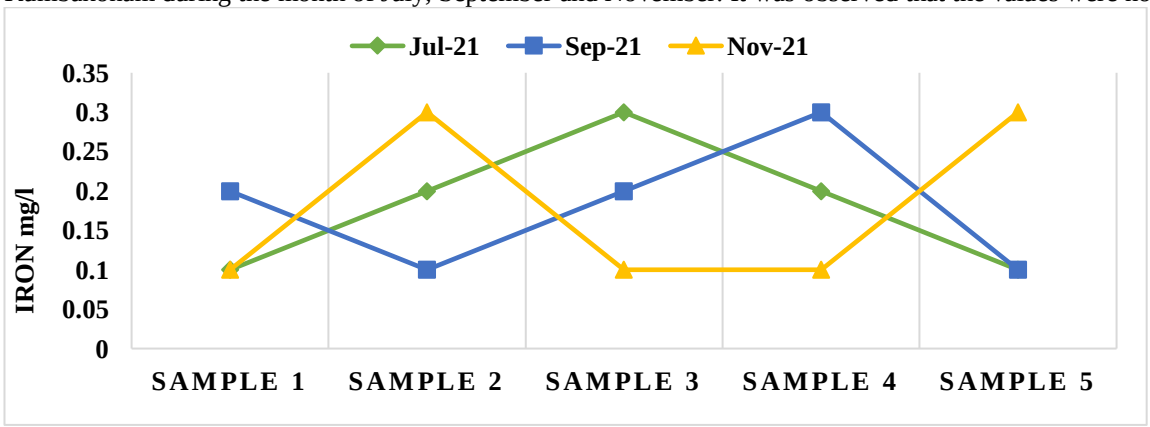


**Figure 8 showing the Iron for various samples**

The graphs showing Iron values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. The iron values were maximum in the month of November and September and at the same time a minimum Iron content was observed during the month of September.

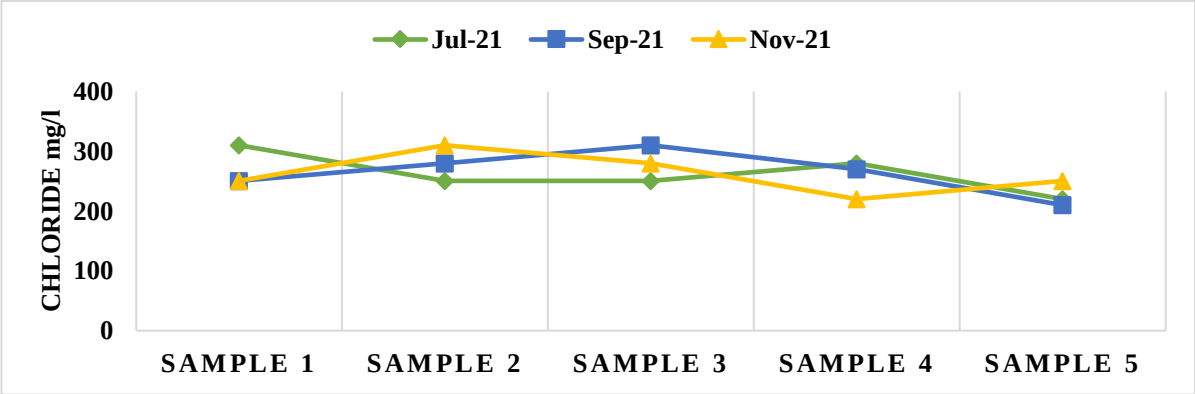


**Figure 9 showing the chloride for various samples**

The graphs showing Chloride values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed that during the month of September the sample 5 showed less value of chloride which indicates the sample was free from any suspended impurities.

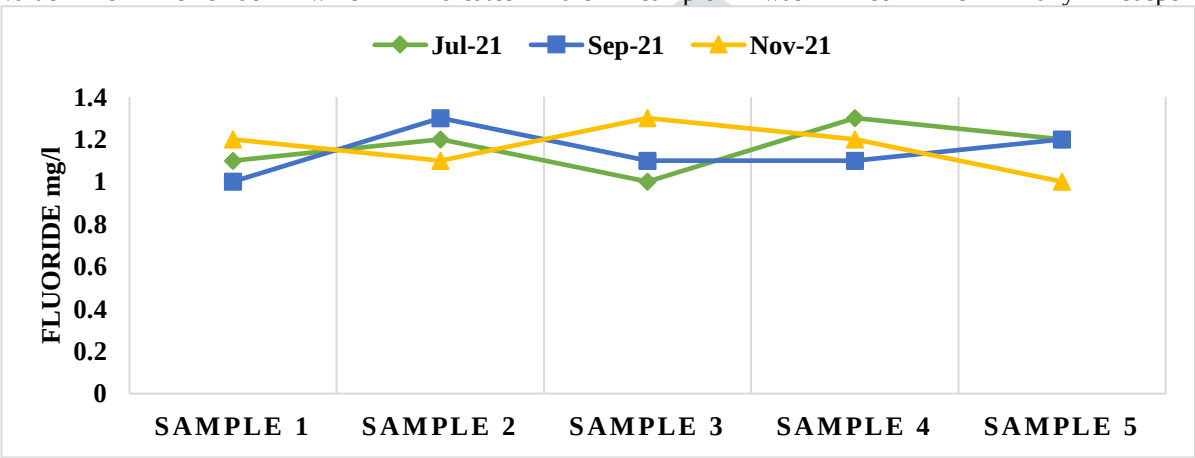


**Figure 10 showing the Fluoride for various samples**

The graphs showing Fluoride values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. The fluoride values were less in the month of November and higher in the month of September the values are in permissible limit.

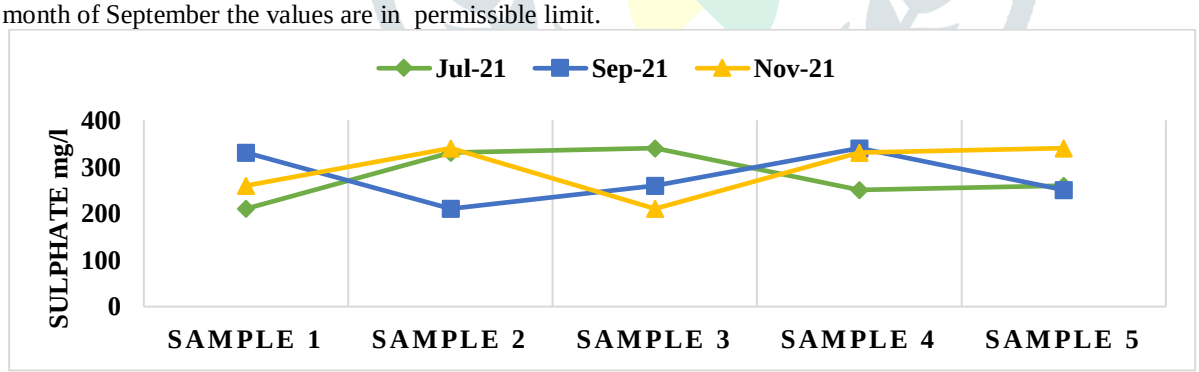


**Figure 11 showing the sulphate for various samples**

The graphs showing sulphate values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. The sulphate values minimum in the month of September and maximum in the month November. However, they were in permissible limit.

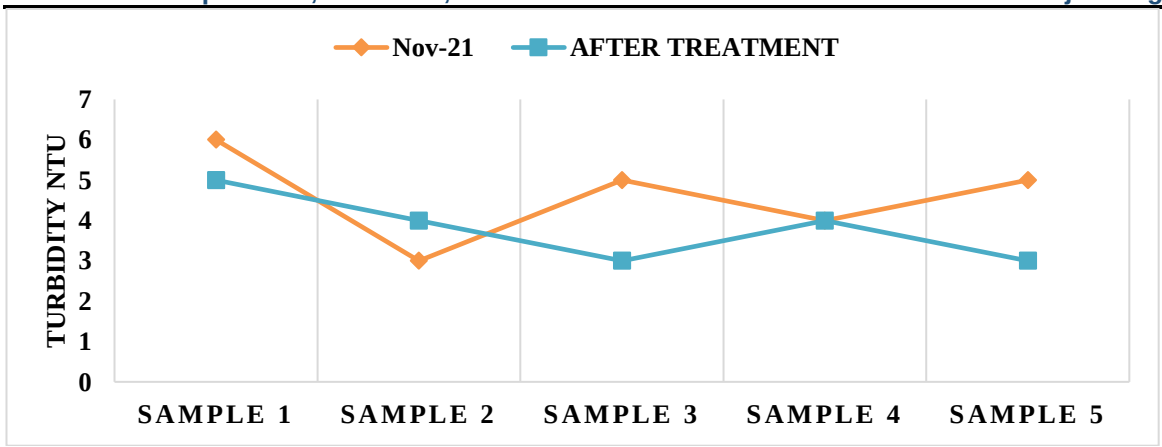


**Figure 12 showing the Turbidity After water Treatment**

The graphs showing turbidity values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed that after treating the water the turbidity were reduced in all the samples and they were in permissible level.

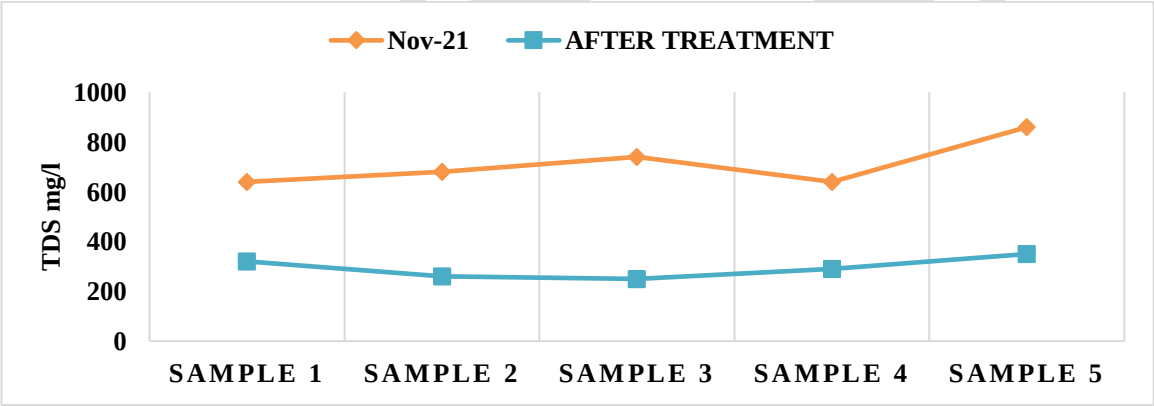


**Figure 13 showing the TDS After water Treatment**

The graph shows the quantity of Total Dissolved Solids values after water treatment using filter pad. During the month of November the water samples were taken for treatment from five different locations in Kumbakonam. It was treated by filter pad comprised of natural herbs. The sample showed less TDS when compared to the samplewhich was observed before the treatment.

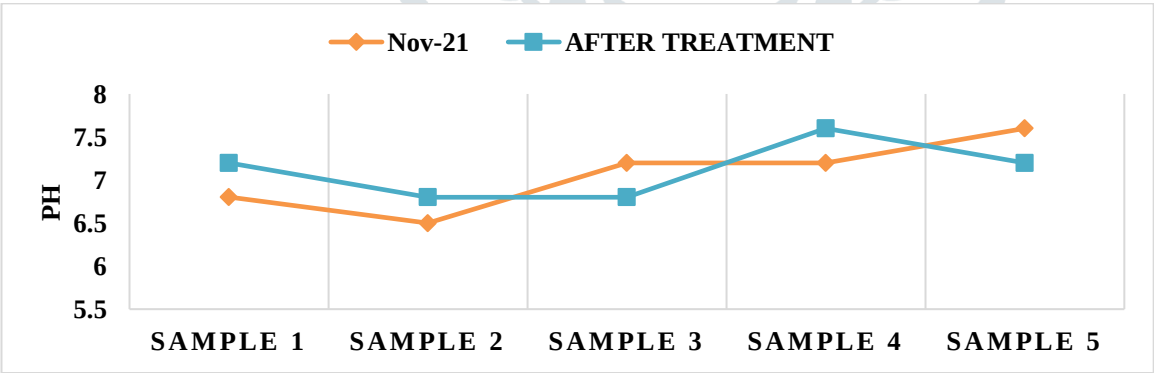


**Figure 14 showing the pH after water Treatment**

The graphs showing pH values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was in permissible limit during the previous three months and after treatment the pH values were also in permissible limit itself.

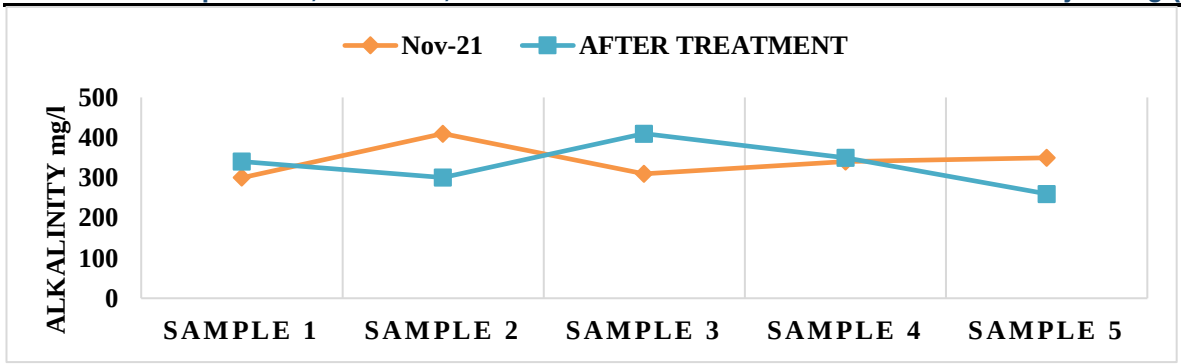


**Figure 15 showing the Alkalinity After water Treatment**

The graphs showing Alkalinity values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. Here, both during treatment and after treatment the values were within the permissible level.

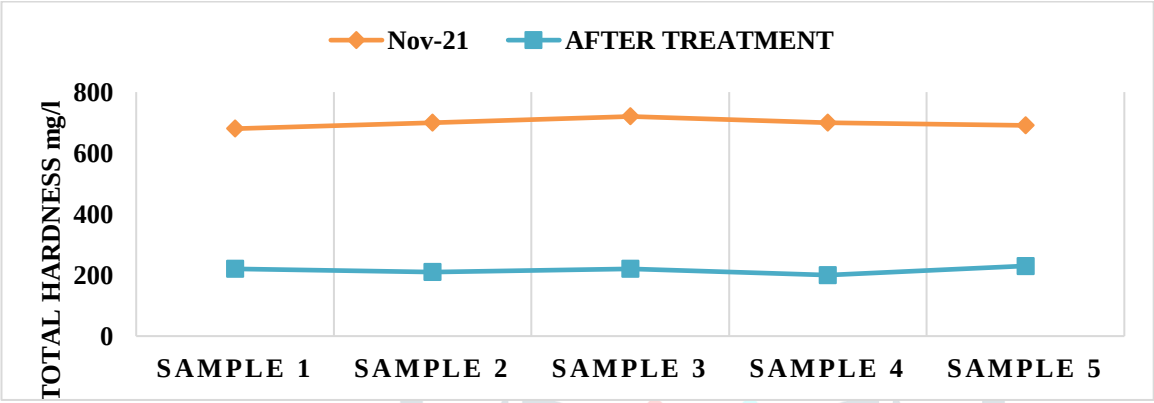


**Figure 16 showing the Total Hardness After water Treatment**

The graphs showing Total Hardness values after water treatment by herbs. The samples of water taken for treatment is November month were collected from five different locations in Kumbakonam. It was treated with filter pad made of Vettiver and luffa cylindrica and the sample showed less hardness after treatment. After treatment the total dissolved solids was observed within the permissible limit.

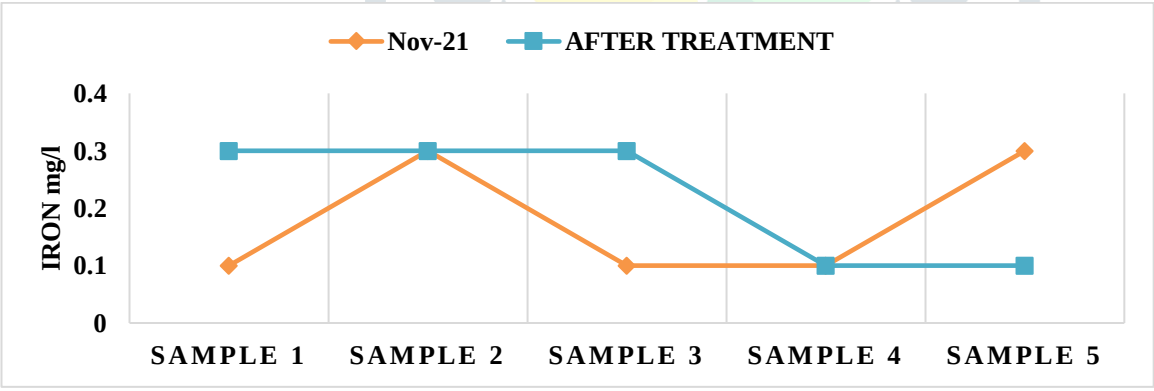


**Figure 17 showing the Iron After water Treatment**

The graphs showing Iron values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. The iron content was observed within the permissible limit before and after treatment.

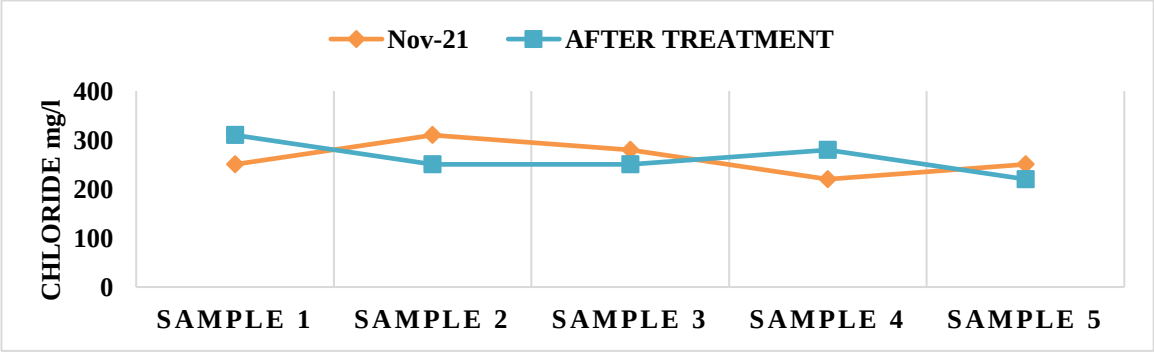


**Figure 18 showing the Chloride After water Treatment**

The graphs showing Chloride values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It has a permissible limit during previous sampling periods and after treatment values were also in permissible limit itself.

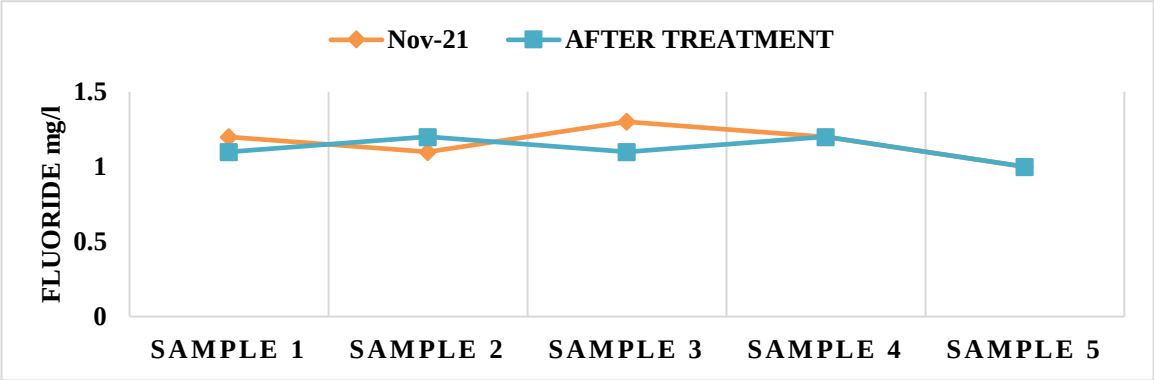


**Figure 19 showing the Fluoride After water Treatment**

The graphs showing Fluoride values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. All the samples were in permissible limit before and after treatment

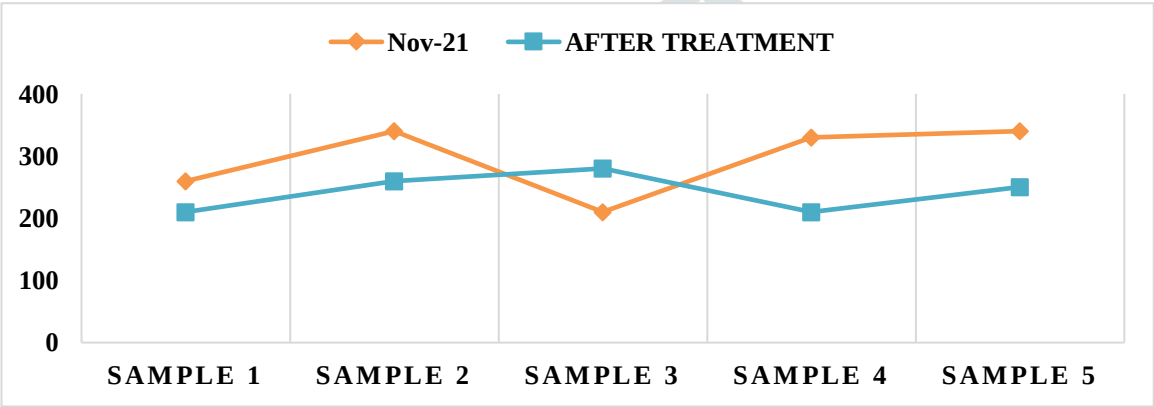


**Figure 20 showing the Sulphate After water Treatment**

The graphs showing Sulphate values of various samples. The samples were collected from five different locations in Kumbakonam during the month of July, September and November. It was observed that all the values were in permissible limit before and after the treatments.

## III.CONCLUSION

There are several Conventional methods of Water Treatment for domestic use namely Reverse Osmosis, Ultra violet treatment, Ion exchange, Ozonation and so on. Even though they provide an effective solution, it is very expensive. It is an uneconomical method for a common man. This made us to provide a portable kit. For providing safe potable water, an inexpensive portable filter will be the solution. The herbal materials like Vetiver and the material like luffa cylindrical pad which are very cheapest filter materials proves the reduction of hardness and the mud filter which is more economical and hygienic one to put in use. Thus this kind of appropriate technology will be the sustainable solution for the drinking water purification in rural communities.

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