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Reduction in Heavy Metals and Microflora of Potable Water of Gwalior Region with the Application of Plant Extracts

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Abstract--This study was aimed to improve the quality of drinking water of municipal supply of Gwalior region (M.P.) with the application of plant extracts of Moringa oleifera, Vigna unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn). Analysis of treated and untreated sample water for heavy metals and microbial counts was performed. The results showed the significant decreased, up to 90% in the reduction of microbial counts. It also helped in the coagulation of the heavy metals like lead, copper, nickel etc. present in the treated water samples. It has been examined that seeds and leaves extracts were also more effective in clearing and in sedimentation of suspended organic and inorganic matter present in water samples. In control water samples, total bacterial count (TBC) was 1200 cfu / ml but the total bacterial count in the treated samples was reduced to 30 cfu / ml. 95% of heavy metals were also removed in treated samples. This work evaluates the use of plants, which are an economical and eco-friendly.

Keywords--Water, Moringa oleifera, Heavy metals, Microbial counts

I. INTRODUCTION

Water is a chemical compound with the chemical formula H_2O. A water molecule contains one oxygen and two hydrogen atoms connected by covalent bonds. Water is a liquid at standard ambient temperature and pressure. Water cover71% of the earth's surface,(CIA- The world fact book, 2008) on earth, 96.5% of the planet's water is found in oceans ,1.7% in groundwater ,1.7% in glaciers and the ice caps of Antarctica and Greenland ,a small fraction in other large water bodies and 0.003%in the air as vapor clouds (formed of solid and liquid water particles suspended in air),and precipitation[5] only 2.5%of the earth 'water is freshwater and 98.8%of the that water is in ice and groundwater less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere, and an even smaller amount of the earth's freshwater (0.003%) is contained within biological bodies and manufactured products (Gleick, P.H., ed. (1993). Safe drinking water is essential to humans and other life forms even though it provides no calories or organic nutrients. Access to safe drinking water has improved over the last decades in almost every part of the world, but approximately one billion people still lack access to safe water and over 2.5 billion lack accesses to adequate sanitation (MDG Report 2008). Increasing amounts of discharged sewage progressing urbanization, the chemicalization of agriculture and industry, as well as anthropogenic activities all affects the quality of underground waters. The final effect of water degradation is the limits as to the use of drinking water reservoirs. Frequently this state is coupled with microbio-logical contamination resulting n in the penetration of potentially pathogenic bacteria or microorganisms detrimental to underground waters through the soil (S. Orgen. E (1995) hence, these bacteria may become the source of various diseases, the intensity of which would largely depend on microorganism pathogenecity and disease potential. Some of the bacteria such as *Pseudomonas or Aeromonas*, is threat to human health due to their ability to multiply in drinking waters (Havelaar A. H. Versteegh.J.F.M. during M. (1990) others, especially those which constitute natural micro flora of human and animal food tracts, can induce acute or chronic gastric diseases (Payment P. Franco Siemiaty Ckil. J 1991). Bacteriological contamination is most dangerous in the case of shallow reservoirs. Chemical (Kochanska E. 1990, Kochanska E. Niewolaks 1997) and sanitary and bacteriological studies (Niewolaks A. 1994) showed that waters of the reservoir should also be monitored as regards potentially pathogenic bacteria consequently; the aim of the research was to monitor the supplies of drinking water. Especially in terms of quantitative and qualitative frequency of bacteria from the family *enterobacteriaceae* and the species *Pseudomonas Aeruginosa* and *Aeromanas Hydrophila* as potential waterborne pathogens.

Pollution of surface and groundwater from agriculture, domestic and industrial activities has not been regularly monitored and recorded as a problem. This is due to the lack of monitoring facilities (Litidamu *et. al.* 2003). The quality and accessibility of drinking water are importance aspect to human health. Drinking water may contain disease-causing agents and toxic chemicals and

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to control the risks to public health, systematic water quality monitoring and surveillance are required. Thousands of chemicals have been identified in drinking water supplies around the world and are considered potentially hazardous to human health at relatively high concentrations (World Health Organization 2004). Heavy metals are the most harmful of the chemical pollutants and are of particular concern due to their toxicities to humans (Manahan 2005). Metals and metalloids with atomic weights ranging from 63 to 200.6 g/mol and densities greater than 4.5 g/cm3 are stable in nature (Lata and Rohindra 2002) There are 59 elements classified as heavy metals and out of these five are considered to be highly toxic and hazardous heavy metals (Lata and Rohindra 2002). These are cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb) and zinc (Zn) which is released into the environment by human activities or through natural constituents of the earth's crust.

Zinc is an essential trace element found in virtually all food and potable water in the form of salts or organic complexes (World Health Organization 2004). Zinc is found in industrial waste and used in metal plating. Therefore, sources of zinc in water are mainly from industrial discharge and natural sources (Xue and Sigg 1994). The removal of zinc is important for water treatment processes in producing good quality water (Fatoki and Ogunfowokan 2002). This paper evaluates Plant seeds and leaves extracts as coagulants and reports an economical and environmentally safe method of water purification. This will show the way to improve the quality of drinking water in the rural areas. This paper also reports the use of other locally produced seeds such as peanuts (*Arachis hypogaea*), cowpeas (*Vigna unguiculata*), urad *(Vigna mungo*), corn (*Zea mays*) that have almost similar types of cationic polyelectrolytes as in *Moringa* seeds (Whitaker and Tannenbaum 1977) and compares their effectiveness in purifying drinking water.

II. METHOD AND MATERIAL

A. Sample Collection

All the reagents and media were purchased from Hi-media (Vijay Scientific Center, Gwalior, India) .The analysis of the water samples were carried out soon after collection and stored in a refrigerator for further analysis. Water samples were collected in sterile bottles from different sources of Gwalior (M.P).

B. Identification Of Microbial Counting In Water Sample

Microbial limit test was performed on the entire water sample. Firstly the R_2A agar media was prepared and with the help of micropipette, 1 ml-1ml of each water sample was poured in the sterile petri plates and them at about 45 ^{0}C temperature of the R_2A agar media poured in those petri plates and rotated in clock and anticlockwise direction. After some time the media was solidified, then it will kept into the Incubator at 35^{0}C for 5 days. Then regularly observation was taken and results were noted.

C. Preparation Of Plant Extracts (Seeds And Leaves) Of Moringa Oleifera, Arachis Hypogaea (Peanuts), Vigna Unguiculata (Cowpeas), Vigna Mungo (Urad) And Zea Mays (Corn)

Firstly leaves and seeds were collected from V.R.G college garden, then after drying them fine powder was obtained with the help of grinder, then extracts were collected.

D. Application Of Plants Extracts

Plants extracts (seeds and leaves) were applied in water sample.

Treatment A = Control (water sample without any treatment).

Treatment B = Combine plant extracts (seeds and leaves) of *Moringa oleifera, Arachis hypogaea (peanuts), Vigna unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn)* at the concentration of 0.01%, 0.1%, 0.2% and 0.3% were added in 100 ml of each water sample.

E. Parameters Evaluated

This include Sensory evaluation test and microbiological evaluation

Sensory Quality - The treated and Control Water Samples were examined on the basis of appearance, Taste, Color, pH, odor and for micro logical evaluation , Total bacterial counts were taken for each treated water sample and control, by pour plate method and membrane filtration method on R2A agar media plates.

III. RESULTS

Table 1 shows reduction in total bacterial counts for seeds and leaves extracts treated water sample with maximum reduction in

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sample C.

Water Sample	Physical appearance	pH	0.01%	0.1%	0.2%	0.3%	Control
Sample A	Clear	6.8	520 cfu/ml	430 cfu/ml	320 cfu/ml	210 cfu/ml	1100cfu/ml
Sample B	Clear	6.9	200 cfu/ml	190 cfu/ml	130 cfu/ml	110 cfu/ml	800 cfu/ml
Sample C	Clear	7.0	10 cfu/ml	10 cfu/ml	10 cfu/ml	10 cfu/ml	1000 cfu/ml
Sample D	Clear	7.0	80 cfu/ml	60 cfu/ml	30 cfu/ml	10 cfu/ml	1200 cfu/ ml
Sample E	Clear	6.8	50 cfu/ml	10 cfu/ml	10 cfu/ml	10 cfu/ml	1200 cfu/ ml

Figure 1. Shows total bacterial counts for treated and control water sample and highest counts were found in control water samples with out treatments , all the treated (0.3% of plants seed and leaves extracts) water sample shows bacterial counts with in limit.

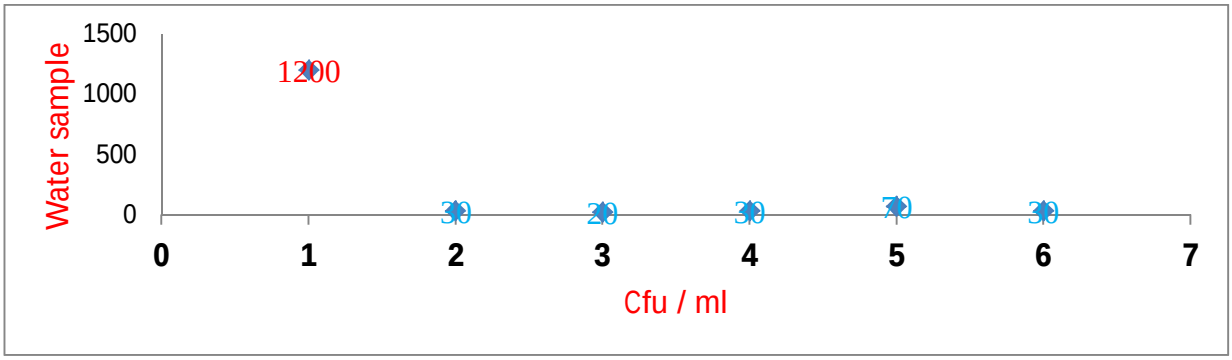

Figure 2. Chart indicates combine treatment of plants extracts in water sample with total bacterial counts with in limits and untreated water showing mainly high bacterial counts.

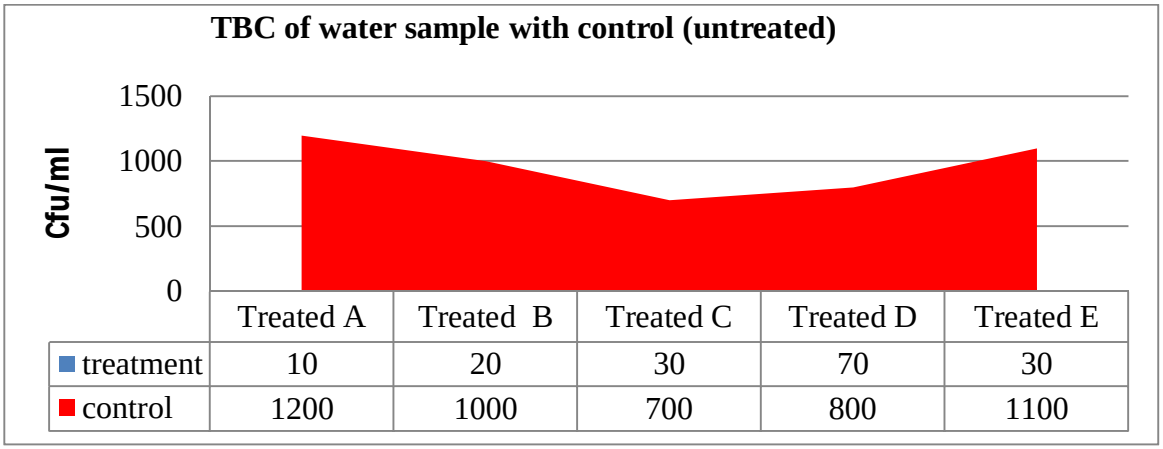

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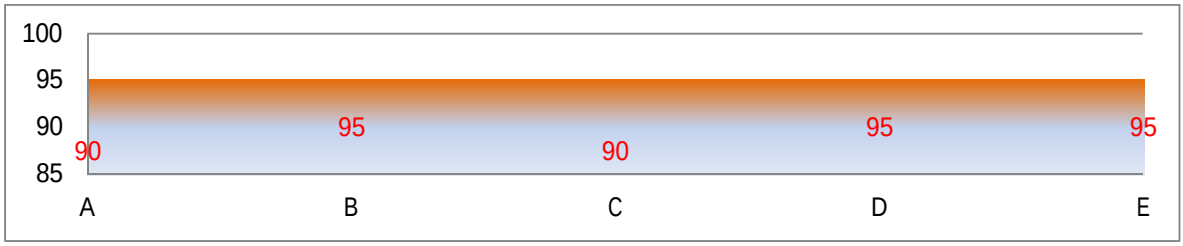
Figure 3 Indicates removal of heavy metals present in treated water sample up to 95 %



IV. DISCUSSION AND CONCLUSION

The seeds and leaves extracts of plants *Moringa oleifera, Arachis hypogaea (peanuts), Vigna unguiculata (cowpeas), Vigna mungo (urad) and Zea mays (corn)* were significantly decreased the total bacterial counts up to 90% and in control water samples, total bacterial count (TBC) was 1200 cfu / ml for water sample D. It also helped in the coagulation of the heavy metals like lead, copper, nickel etc. present in the treated water samples. It has been examined that seeds and leaves extracts were also more effective in clearing and in sedimentation of suspended organic and inorganic matter present in water samples. 95% of heavy metals were also removed in treated samples. This work concluded that application of combine seeds and leaves plant extracts can be highly recommended for domestic drinking water for purification and this technique can be applied for water purification in developing countries, where people are used to drink contaminated turbid water. It will also improve the both health and wealth. . This technology will encourage small-scale enterprises to be established in the rural areas.

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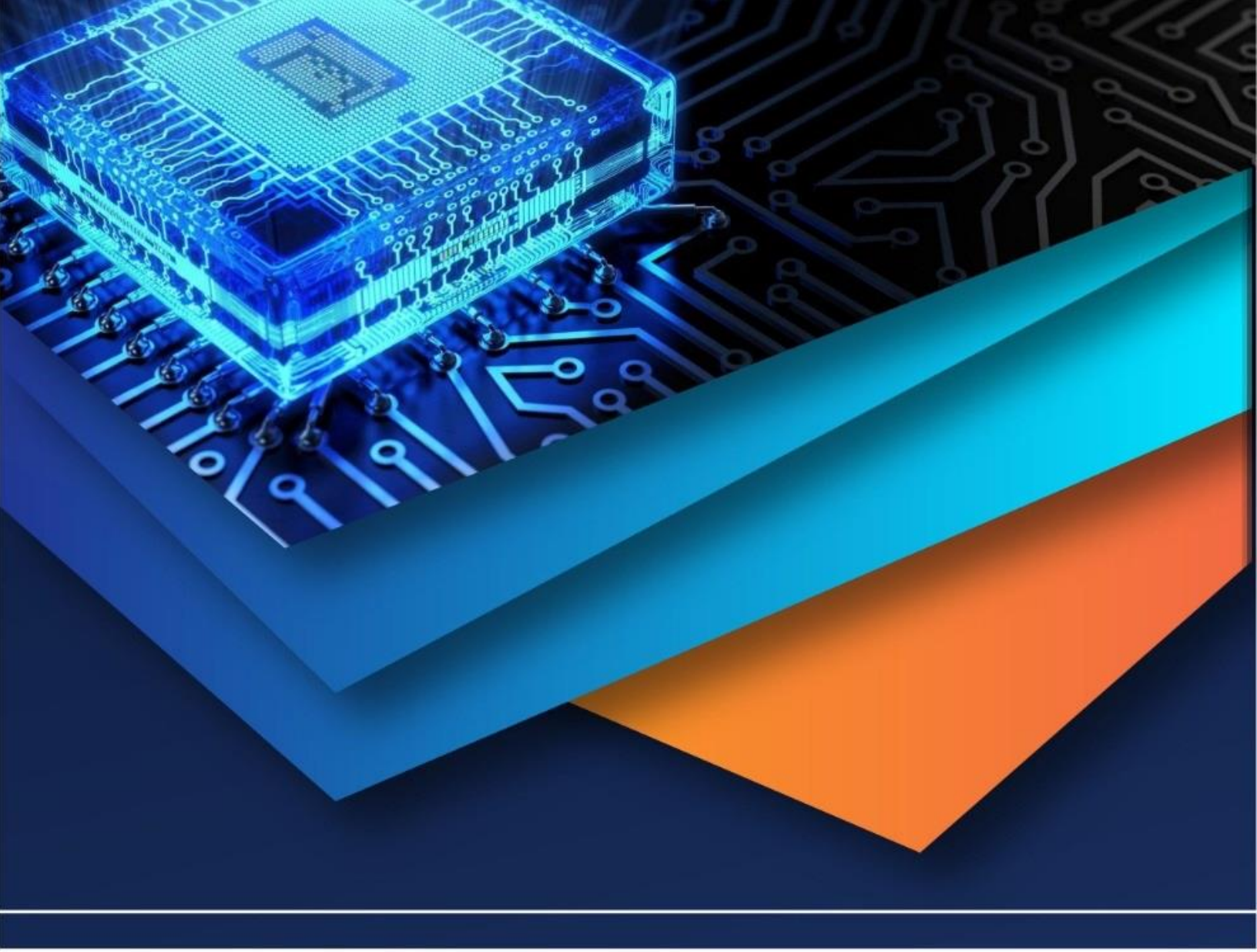

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