



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 4 Issue: III Month of publication: March 2016

DOI:

www.ijraset.com

Call:  08813907089

E-mail ID: ijraset@gmail.com

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

Dr. Shweta Chauhan¹, Dr. K.C. Gupta²

^{1,2}Department of Microbiology, Vijaya Raje Government Girls Post Graduate College, Morar, Gwalior, (Madhya Pradesh)

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 H₂O. 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 cover 71% 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 precipitation⁵ 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

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

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 R₂A 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 °C temperature of the R₂A 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°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

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

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 <td 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.

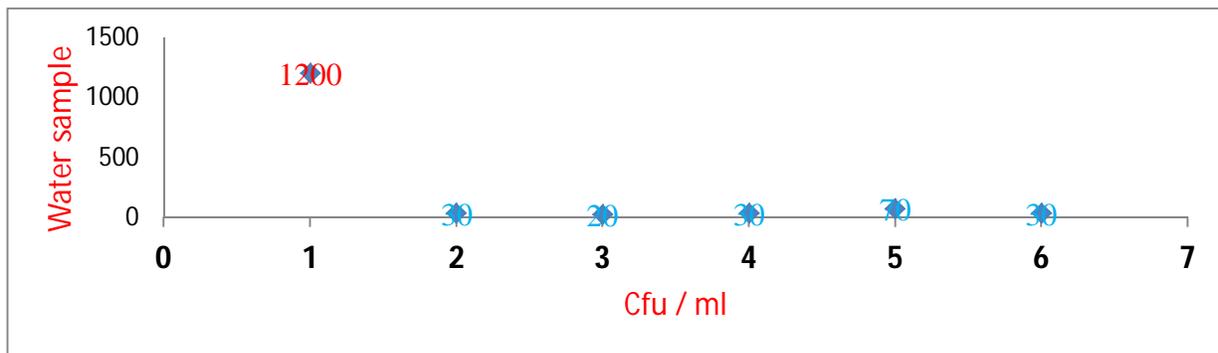
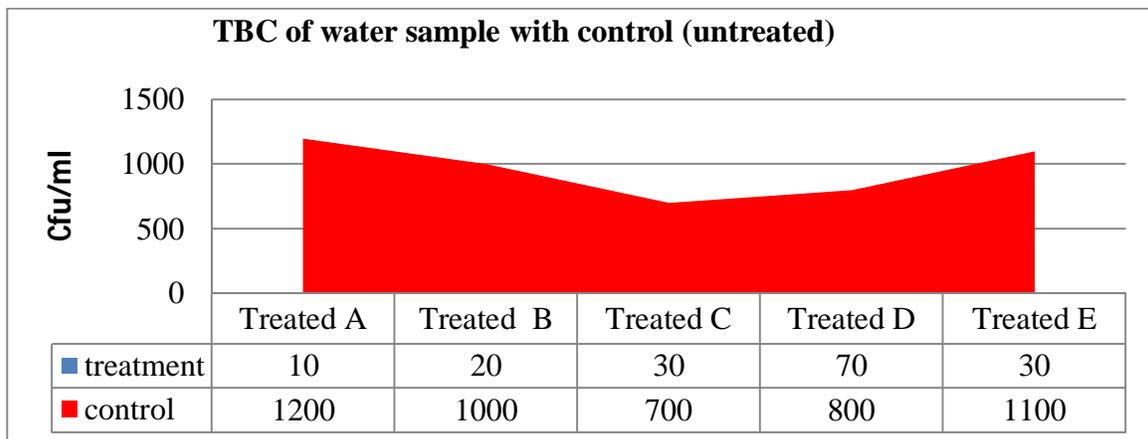
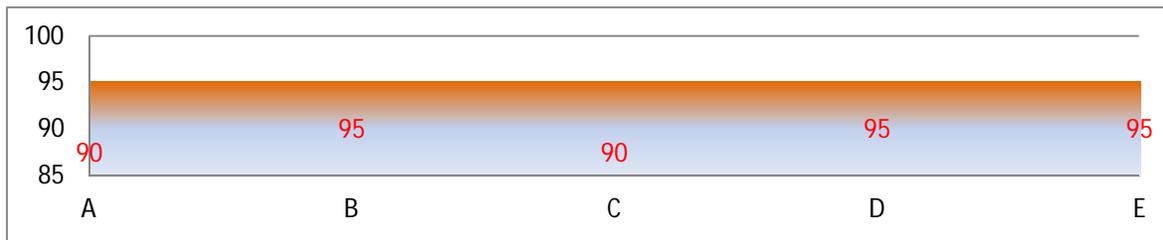


Figure 2. Chart indicates combine treatment of plants extracts in water sample with total bacterial counts with in limits and untreated water showing mainly high bacterial counts.



International Journal for Research in Applied Science & Engineering Technology (IJRASET)

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



IV. DISCUSSION AND CONCLUSION

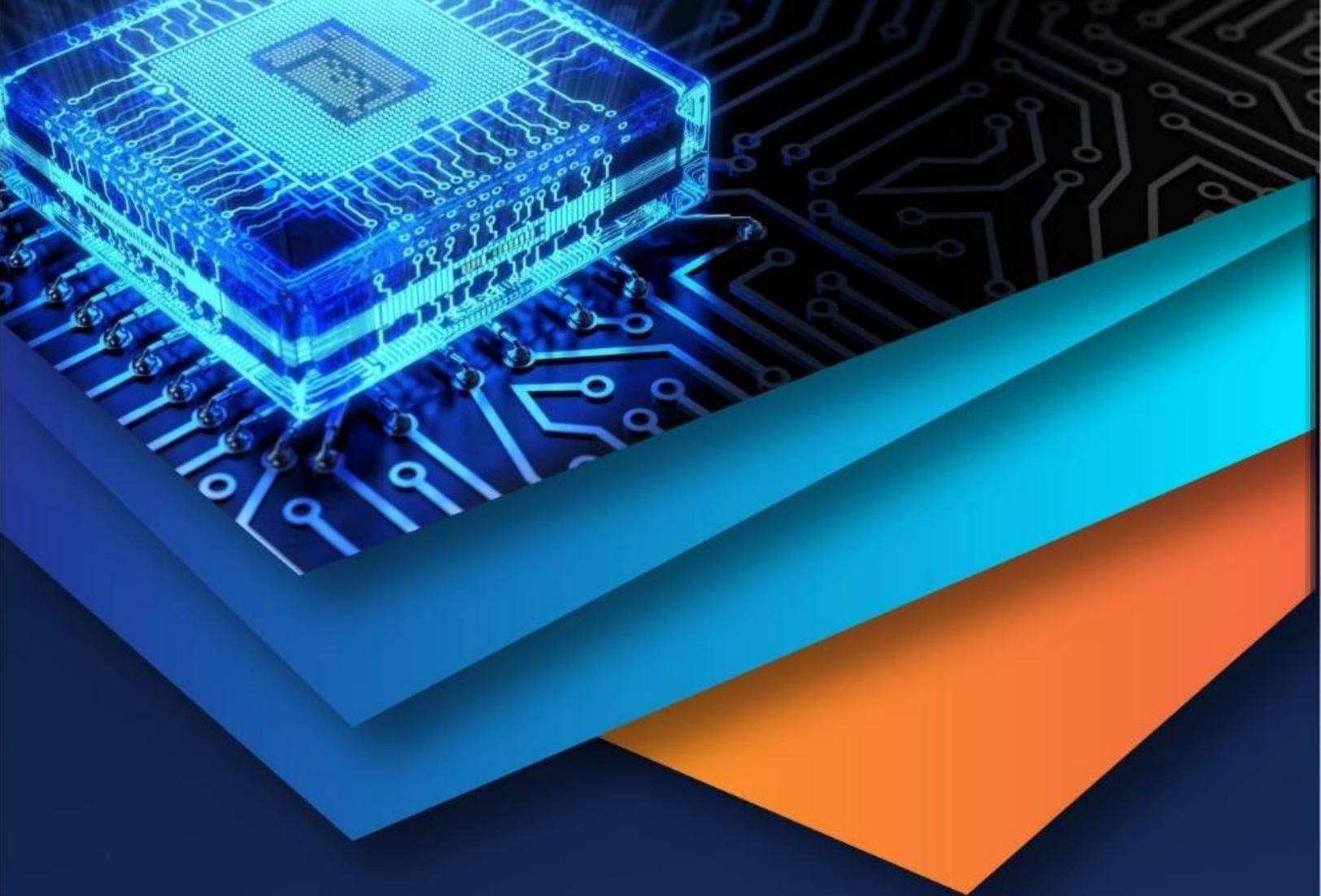
The seeds and leaves extracts of plants *Moringa oleifera*, *Arachis hypogaea* (peanuts), *Vigna unguiculata* (cowpeas), *Vigna mungo* (urad) and *Zea mays* (corn) were significantly decreased the total bacterial counts up to 90% and in control water samples, total bacterial count (TBC) was 1200 cfu / 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.

REFERENCES

- [1] Adams BL et al. (2003) Survival of *Helicobacter pylori* in a natural fresh-water environment. *Applied and Environmental Microbiology*, 69:7462-7466.
- [2] Adesunkanmi LV, Sridhar MKC, Ajayi AA, Oluwande PA, Olawuyi JF (2004). An assessment of the health and socio economic implications of sachet water in Ibadan: A public health challenge. *Afr. J. Biomed. Res.*, 7:5-8.
- [3] Agarwal Ashok K. and Rajwar Govind S. (2010); Physico-Chemical and Microbiological Study of Tehri Dam Reservoir, Garhwal Himalaya, India; *Journal of American Science*, 6(6):65-71.
- [4] A. Kumar (in 2012) Physico chemical analysis and isolation of bacteria from water sample of Maharana Pratap Sagar, Kangra district Himachal Pradesh. Center for Watershed Protection (1999). *Watershed Protection Techniques. Microbes and Urban Watersheds*, 1:551-596.
- [5] "CIA- The world fact book". Central Intelligence Agency. Retrieved 2008-12-20. Engstrand L. (2008) *Helicobacter* in water and waterborne routes of transmission. *Journal of Applied Microbiology*, 90:80S-84S.
- [6] D.M. Lewis (in 2010) Application of phyto disinfectants in water purification vol.5(6) pp.628-635.
- [7] Fenwick A (2006) Waterborne Infectious Diseases- Could they be consigned to history. *Science*, 313: 1077-1081.
- [8] Ganoza CA, Matthias Collins-Richards D, Brouwer KC, Cunningham CB, Segura ER, Gilman RH, Gotzua E, Vinetz JM (2006). Determining risk for severe leptospirosis by molecular analysis of environmental surface waters for pathogenic *Leptospira*. *PLoS Med.*, 3:1329-1340.
- [9] Goodman KJ et al. (1996) *Helicobacter pylori* infection in the Colombian Andes: a population-based study of transmission pathways. *American Journal of Epidemiology*, 144:290-299.
- [10] Gregory BM, Frick EA (1995). Faecal coliform bacterial concentrations in Streams of the Chattahoochee river National Recreation Area, Metropolitan Atlanta, Georgia, May - October 1994 and 1995. *US geological Survey Report*, 00-4139.
- [11] Gleick, P.H., ed. (1993). *Water in Crisis: A Guide to the World's Freshwater Resources*. Oxford University Press. p. 13, Table 2.1 "Water reserves on the earth".
- [12] Harrison KG (ed.). (2003). *State of Michigan's Environment 2003-Second Biennial Report*, December 2003. Office of Special Environmental Projects: Lansing. Mich., Michigan Department of Environmental Quality. p. 84.
- [13] Havelaar A. H., Versiegelel. F. M, DURING M. The presence of Aeromonas in drinking water supplies in the Netherlands *Zentralblatt für Bakteriologie*, 190,236H.D. (1986). "Geochemistry and Aqueous Chemistry of Aluminum." In *Kidney International* p. 29, Edited by J.W. Coburn and A.C. Aifrey. New York: Springer- Verlag.
- [14] Horman A (2005). Assessment of the microbial safety of drinking water produce surface water under field conditions PhD thesis, Helsinki, Finland
- [15] Hopkins RI et al. (1993) Seroprevalence of *Helicobacter pylori* in Chile: vegetables may be as one route of transmission. *Journal of Infectious Diseases*, 168:222-226.
- [16] Harvey H. Harper (2011) Multi resistance faecal indicator bacteria in stream and well waters vol.3(8) pp-371-381 K.A. Ad
- [17] Henniker, J. C. (1949). "The Depth of the Surface Zone of a Liquid". *Reviews of Modern Physics* (Reviews of Modern Physics) 21 (2): 322-341. doi: 10.1103/RevModPhys.21.322.
- [18] K.D. Owolabi (2011) – Multi resistance faecal indicator in streams and well waters, Vol. – 3 (8) pp 371-381
- [19] K.A. Adejojo (2011) Multi resistance faecal indicator in streams and well waters, Vol. – 3 (8) pp 371-381
- [20] K.A. Yongabi (2010) – Application of phytodisinfectants in water purification. Vol. 5 (6) pp. 628 - 635

International Journal for Research in Applied Science & Engineering Technology (IJRASET)

- [21] Kaushik S. and Saksena DN (1995); Trophic Status and Rotifer Fauna of certain water bodies in Central India. *J. Environ Biol.* 16(4):263-91.
- [22] Klein PD et al. (1991) Water source as risk factor for *Helicobacter pylori* infection in Peruvian children. *Gastrointestinal Physiology Working Group. Lancet*, 337:1503-1506.
- [23] Kochanska E, Niewolaks (1997) S. Physico-chemical parameters and heterotrophic microorganisms in groundwater of Omulewskie Reservoir Aquifers in the Mazurian Lake District. *Pol. J. Env. St.*, 6, 37.
- [24] Kochanska E. Wplyw gospodarki rolnej najakosc wod Zbiornika Omulewskiego. Praca doktorska. Mimeographed. Olsztyn, 1990.
- [25] Malusare C.N. (in 2011) Study of *Moringa oleifera* extracts in water treatments. Milind R.Gidde (in 2011) Study of *Moringa oleifera* extracts in water treatments.
- [26] M. Srivastava (2012) Physico chemical analysis and isolation of bacteria from water sample of Maharana Pratap Sagar, Kangra district Himanchal Pradesh. "MDG Report 2008". Retrieved 2010-07-25.
- [27] Niewolaks S. A sanitary and bacteriological estimation of water bearing formations in the Omulewski Aquifer, Mazuria. *Pol. J. Env. St.*, 3, 43, 1994.
- [28] Obliri-Danso K, Adjei B, Stanley KN, Jones K (2009). Microbiological quality and metal levels in wells and boreholes water in some peri-urban communities in Kumasi, Ghana. *Afr. J. Environ. Sci. Tech.*, 3(1): 059-066.
- [29] O. Oyediji (in 2011) Multi resistance faecal indicator in streams and well waters, Vol. – 3 (8) pp 371-381
- [30] P.O. Olutiola (in 2011) – Multi resistance faecal indicator in streams and well waters, Vol. – 3 (8) pp 371-381
- [31] P.L. Harris- (in 2010) Application of phytodisinfectants in water purification. Vol. 5 (6) pp. 628 - 635
- [32] Payment P. Franco E., Selmiatycki (1991) Gastrointestinal health effects associated with the consumption of drinking water by point-of-use domestic reverse-osmosis filtration units. *Appl. Environ. Microbiol.*, 57, 945.
- [33] Pollack, Gerald. "Water Science". University of Washington, Pollack Laboratory. Retrieved 2011-02-05. "Water has three phases – gas, liquid, and solid; but recent findings from our laboratory imply the presence of a surprisingly extensive fourth phase that occurs at interfaces."
- [34] Rahman GA, Abubakar AM, Johnson AW, Adeniran JO (2001). Typhoid fever presentation in Nigerian children: an analysis of 106 operative cases. *Pediatr. Surg. Int.*, 17: 628-630.
- [35] S. Rawat (2012)- Physico chemical analysis and isolation of bacteria from water sample of Maharana Pratap Sagar, Kangra district Himanchal Pradesh.
- [36] Steven Clarke (2006)- Ultra violet light disinfection in the use of water purification Simmons GM Jr. (1994). Potential sources of faecal coliforms in tidal inlets, In: *Proceedings of the Interstate Seafood Seminar*. Rehoboth Beach, Delaware, USA, pp. 49-67.
- [37] S. Orgen K. E. (1995) Thirteen-year survival study of an environmental *Escherichia coli* in field mini-plots. *Water, Air, and Soil Pollution*, 81, 315.
- [38] Thompson T, Khan S (2003). Situation analysis and epidemiology of infectious disease transmission: A South-Asian regional perspective. *Int. J. Environ. Health Res.*, 13: S29-S339 "United Nations". Un.org. 2005-03-22. Retrieved 2010-07-25.
- [39] V. Bhushan (2012) – Physico chemical analysis and isolation of bacteria from water sample of Maharana Pratap Sagar, Kangra district Himanchal Pradesh.
- [40] WHO, UNICEF (2010). Millennium Development Goals: Progress on Sanitation and Drinking - Water: 2010 Update Report, Geneva: WHO/UNICEF Joint Monitoring Programme for Water Supply ISBN 978-92-4-156395 and WHO (2004); Guidelines for Drinking-water Quality, Vol. 1: 3rd ed. World Health Organization-103.



10.22214/IJRASET



45.98



IMPACT FACTOR:
7.129



IMPACT FACTOR:
7.429



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089  (24*7 Support on Whatsapp)