

Improvement of Sustainable Nano Based Herbal Potable Water System For Rural and Semi Urban Areas

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Abstract- Sustainability of good health of living organisms depends upon the purity of water. Because of its inherent dissolution capacity, water naturally picks up minerals and salt present in the earth crust during the runoff and percolation process. Water is used for several purposes by human beings and the level of purity of water consumed is very crucial as it has a direct and telling effect on health. Nearly 1.6 million people are constrained to use contaminated water and more than a million people die from diarrhea every year due to water borne diseases especially in developing countries in the conventional method of water purification, aluminium sulphate (alum) and calcium hypochlorite are used as water coagulants. These coagulants are more expensive and financially they prove to be an over-burden. To overcome this several works have been carried out to identify the appropriate herbs for the removal of contaminants from water in a cost effective way. Hence, the primary objective of this project work is to design a water purification kit using electro spinning method. This involves the nano-fibrous membrane which is the mixing of biocompatible polymer, silver nano particle and the herbal Nano-powder. The silver nano-particle might be used prevent the bio-fouling and enhance the life time of the aromatic herbal incorporated membrane and to select and maintain the homogenous unique porosity all over the membrane based on the contaminant of the water. This will provide a sustainable solution for the drinking water problem in rural communities in cost effective way.

Keywords: Coagulant, herbs, contaminant, Nan powder, sustainable

I.INRODUCTION

In a water treatment process the removal of organic and inorganic material from raw water is essential before it can be supplied to human for consumption. This is being carried out by chemical coagulation. In developing countries like India, this system is inappropriate because of the expensive and low and non-availability of chemical coagulants. The high cost of treated water makes more people in the rural communities to resort to readily available sources which are normally of low quality exposing them to waterborne diseases. The chemical coagulation process also change the water from liquid to a semi-solid state and causes adverse impact on human health. As a consequence of the above mentioned drawbacks, there was a need to develop alternative, cost effective and environmentally friendly coagulants. Hence the detailed studies have to be carried out by using herbal coagulants like Neem, Moringa Oleifera, Luffa Cylindrical, Orange Peel, Plantago Ovata, and Vetiver for community water treatment as a alternate for chemical coagulants. The effectiveness of these herbals on the removal of the prominent water quality parameters have studied. The results from this study will satisfy the drinking water standards as prescribed by World Health Organization (WHO). Building water treatment plants to produce an adequate supply of potable water is the solution. Such projects require a great deal of money and even when built, tend to fail due to lack of maintenance. So, increasingly there of recognition that small scale projects and point of disinfections using appropriate technology must be part of the answer.

In rural communities and impoverished tenants in the villages of Namakkal district most residents are facing with the challenge of obtaining potable water from remote sources (such as river, tank, spring or well) and those who are fortunate enough to have running water often find that the supply is intermittent at least.

Therefore, most families in this area store water in order to have enough for cooking and other necessities. It is a way to make this stored water potable that must be found. One way to do it is to provide users with a method to disinfect water at home. Hence the findings from this work will give a permanent solution for the problem said above.

2.0 OBJECTIVES OF THIS STUDY

- To identify the appropriate herbals for the removal of contaminants from the water.

- To introduce a membranous potable family based water purification system for rural and semi-urban communities
- To develop the Biocompatible Nanostructure incorporated high purification efficiency water filter membrane
- Training of the community and local administration for creation of awareness of the water quality and public health and operation and maintenance of the plant.
- To improve the health of the residents of rural and semi-urban communities by providing them with a sustainable source of potable water.

Intermediate objective

- Review the technologies of molecular specification based water treatment appropriate to the local physical, chemical and biological characteristics of water in use.
- Identify the ligands for various toxic compounds and microbes which is present in the sources (such as river, tank, spring or well) of rural and semi-urban areas
- Investigation of socio-economic profile of the local population and health status with standard of living
- Identification of problems associated with public health and water supply
- Selection of technology of water treatment economically viable, physically feasible and socially acceptable for adoption by a community
- Investigation of parameters such as porosity, molecular specificity and tensile strength of the water purification membrane without applying pressure like in reverse osmosis

3.0 LITERATURE REVIEW

National Status

(A) Cost Effective Treatment Methods For The Drinking Water In Rural Areas.

Name of the Institution: Center for water resource development management (CWRDM)

Project Associate(s): Harikumar, P S et al,

Name of collaborator: Rajiv Gandhi National Drinking Water Mission (RGNDWM) CGO complex, New Delhi-110003

Project abstract: Water quality problems of Kerala were investigated and treatment methods appropriate for rural Kerala were studied. The cost effectiveness of the treatment system developed using medicinal plants and clay was worked out. The results of the experiment indicate that 0.2g of the material can remove 50-85 per cent of the contaminants like fluoride, hardness, coliforms and phosphates from 250ml of water. The only plant material, which is comparatively costlier, is clove, which has been found to be the most efficient material for removing fluoride. Experiments were done to separate heavy metals using montmorillonate clay separated from black cotton soil found in Palakkad district. The clay was separated from the soil using chemical treatment method and found that 1 g of clay can remove 95 per cent of copper from 1litre of water. Filter column using other filtering materials were also worked out.

(B) Improving availability of Safe drinking water through S and T application and community participation.

Name of the Institution: Center for Water Resources Development and Management (CWRDM)

Project Associate(s): Jayakumar, P. et al,

Project abstract: The Project aims to implement and propagate. Water harvesting systems appropriate for respective regions in the districts of Malapuram, Kozhikode, Kannur and Palghat, as a cost effective and long-term solution for problems related to water quality and scarcity. This is planned to be achieved by training the target groups/NGO's of the area to identify appropriate method of water harvesting and implementing it through them

(C) Community initiatives in rooftop rainwater harvesting for drinking water

Name of the Center: Center for Human Resource Development (CHRD)

Project leader: Sivaram.P

Primary information was collected from a total sample of 20 families through group interviews and focus group discussion method. Secondary data were collected from the Directorate of Public Health Engineering Dept. (PHED), Panchyat and Rural Development Departments and NGOs.

(D) Community interventions in rural water supply -drinking water

Name of the Center: Center for Human Resource Development (CHRD)

Project leader: Mohan Rao, M J

In collaboration with TATA Consultancy Services Ltd., Pune CSV has introduced a low cost filter made from rice husk ash for villagers. The filter is very cheap and can be fabricated at the village level by the women folk, with

very little investment. The filter is very hygienic and kills about 98% bacterial in the water and keeps it free from fluorides and arsenic. Village women have now come out with a programme of constructing nearly 500 filters and they have already started working on the same.

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(E)Electrospun polymer nanofibrous membrane for filtration (2011) pub

Name of the Institution: Indian Institute of Technology Madras

Project Associate(s): Rajesh K.P

Sulfonated poly (ether ether ketone) nanofibers membrane were fabricated by electrospinning method. The surface and cross sectional morphologies are characterized using scanning electron microscopy. Further the membrane is characterized for pore size distribution and pure water permeability. This work can be extended for exploring the use of electrospinning nanofibrous membranes for filter application.

International Status

9(A)High flux ultrafiltration membranes based on electro spun nan fibrous PAN scaffolds and chitosan coating

Name of the Institution: Department of Chemistry, Stony Brook University, Stony Brook, USA

Project Associate(s): Kyunghwan Yoon

Project abstract: In this work they have demonstrated a new type of high flux UF/NF medium based on an electro spun nan fibrous scaffold (e.g. polyacrylonitrile, PAN) coupled with a thin top layer of hydrophilic, water-resistant, but water-permeable coating (e.g. chitosan). Such nan fibrous composite membranes can replace the conventional porous membranes and exhibit a much higher flux rate for water filtration. The interconnected porosity of the non-woven nan fibrous scaffold can be controlled partially by varying the fiber diameter (from about 100 nm to a few micrometers) through the electro spinning processing. The membrane, containing an electro spun PAN scaffold with an average diameter from 124 to 720 nm and a porosity of about 70%, together with a chitosan top layer having a thickness of about 1 μm, although not yet fully optimized, exhibited a flux rate that is an order magnitude higher than commercial NF membranes in 24 h of operation, while maintaining the same rejection efficiency (O99.9%) for oily waste-water filtration. of operation, while maintaining the same rejection efficiency (O99.9%) for oily waste-water filtration. of operation, while maintaining the same rejection efficiency (O99.9%) for oily waste-water filtration.

(B)Development of high efficiency nanofilters made of nanofibers

Name of the Institution: Pusan National University, Republic of Korea.

Project Associate(s): Y.C. An

Project abstract: Nylon 6 electrospun membrane were fabricated and investigated. Nylon 6 nan filters using nan fibers of 80–200 nm in diameter are designed and evaluated the filtration efficiency and pressure drop across the filter. When the Nylon 6 concentration is 15 wt.%, electrospun fibers have an average diameter of 80 nm, but there are many beads, and the concentration increases to 24 wt.%, the fiber diameter gradually thickens to 200 nm, but there are not any beads. When the spinning distance is small, the thinner nanofibers are produced and the more fibers are collected on the grounded electrode. The filtration efficiency of Nylon 6 nanofilters is 99.993% superior to the commercialized HEPA filter at the face velocity of 5 cm/s using 0.3 μm test particles. Even though the high pressure drops across the nan filter, they show the potential to have the application of HEPA and ULPA grade high efficiency filter.

4.0 METHODOLOGY

(i) *Selection of the study area*

The selected research area is based on the people suffering due to water borne and other related diseases in Namakwa district especially villages.

(ii) *Data needs*

Data are to be collected for this research are primary and secondary data from the public health departments

(iii) Sample collection

Water sample has to be collected from various sources of water supply that has been used by villagers in order to identify the pollutants in it.

(iv) Organization of the study

The organizational study consists of the following sections – Brief description of the various diseases already exists in the villages, Methods for identifying the diseases, remedial measures, procedures for identifying the pollutants which are causing the diseases, Description of the methodology, benefit of this research and users.

(v) Analytical design

The water purification system is a simple but effective in a way to produce potable water. The filter units are inexpensive and affordable to the villagers. Filter design has to be made in order to satisfy the standards of drinking water.

DELIVERABLES OF THIS STUDY

This project will be helping to incorporate proper hygiene to the rural community. It also stresses the importance of making the rural community to realize that pure water is a key to human life and also paves a way to reduce the incidence of diarrhea and other deadly water borne diseases.

CONCLUSION

This water purification has to be designed using Electro spinning method. This involves the nanofibrous membrane which is the mixing of biocompatible polymer, silver nanoparticle and the herbal Nano-powder. The silver nanoparticle might be used prevent the bio-fouling and enhance the life time of the aromatic herbal incorporated membrane. And also we could select and maintain the homogenous unique porosity all over the membrane based on the contaminant of the water. This will provide a sustainable solution for the drinking water problem in rural communities in cost effective way.

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