A Compilation of Modern and Affordable Water Purification Systems for Rural Areas Constituting to Developing and Third World Countries

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A brief exposure towards the present scenario of water in the world says that out of 100% water available, just 1% water could be used for day to day purposes out of which about 90% of the water tends to be polluted in nature. If we consider a scenario of a developing country like India where most of the food production is held via the source of agriculture, it becomes quite the requirement of using fertilizers and pesticides for efficient and large-scale production but then again using all this also tend to serve as a prime cause for pollution to all sorts of water resources present around the area in form of drainage surfaces, canals, and other irrigational facilities. The causes towards polluting water is like causing eutrophication, reduction on BOD, disturbing the odor and taste of water, increasing microbiological activities in water also disturbing the Ph levels of water and making the water hard therefore making the water insecure for day to day usage. Certain ways of making the water secure is reduction of all the parameters stated above but then the causes are so very wide spread and also to meet extreme food demands it has almost become impossible to reach out to close 100% purification rates. Reaching out to such problems it is quite obvious that with such doses of pollution it may happen that people may not be able to survive due to lack of purified water which isn't feasible!! To get through this there has been certain hardcore research going on in terms of getting to easy and affordable water purification solutions abiding to those certain research held recently are like: -

1. The invention by a group of MIT students the making of a purifier that operates on electricity obtained by integrating solar panels in the system that somehow pushes the water to a semi permeable membrane which enables removal of impurities the below is a diagrammatic representation of the system

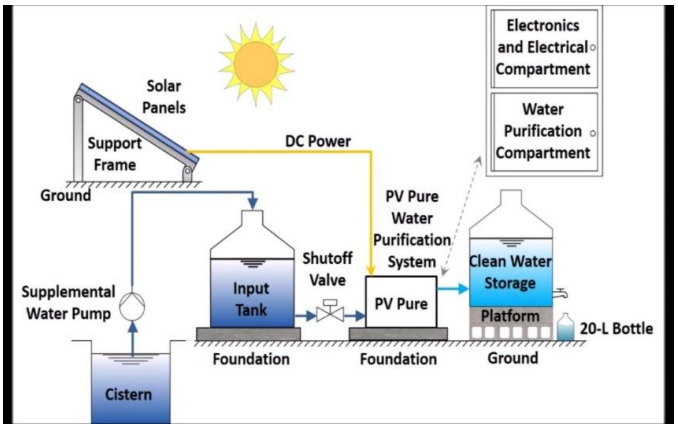

Fig 1: - System diagram of water purification system developed by MIT engineers

2. Life Straw is a recent invention by the Vestergaard Frandsen Group: shaped like a straw but a few inches thick, it uses halogenated resin to kill bacteria and virus. Water is drunk straight through the straw. In tests it could reduce levels of iodine and silver to below toxicity.

   However, it does not remove heavy metals such as Lead (Pb) or Flouride (F), there is one version available that can filter Arsenic. The LifeStraw is an expensive filter, but may well save lives in connection with natural disasters where quick, short-term relief is needed. According to the patent holder: "Halogenated resin compositions are prepared without using halogen acids by combining at least one silicone intermediate, with an optional silicon, an organic halogen-containing ingredient having functional groups selected from the group consisting of hydroxy, amine, and carboxyl groups, and a resin selected from the group consisting of hydroxy- and epoxy-functional resins" Larger-scale family versions of the filter are available for home use.

FIG 2:- Child drinking through a LifeStraw

3. Researchers at Stanford University have developed a Nanofilter that kills bacteria with an electric field. Their filter is ordinary cotton fabric, coated with highly conductive carbon nanotubes and silver nanowires, silver has long been known to have chemical bacteria-killing properties. The coated cotton is layered to about 2.5 inches thick. The pores of this filter are much larger than conventional filters, allowing water to flow through up to 80,000 times faster. Electricity passing through the filter kills the bacteria as they pass through the filter. Electrons pass very smoothly over the filter thanks to the very small size of the nanoparticles, thus only a current of a few milliamperes is needed.

   The silver helps prevent biofouling; buildup of bacteria caught in a filter, because any bacteria that lag behind will likely be killed by the silver nanowires. In tests, 98% of E. coli bacteria were killed when subjected to 20 Volts of electricity during several seconds in the filter. The team are currently testing the filter on different bacteria and using multiple filters to kill more bacteria. They are hoping the filter might be useful in developing countries because it is cheap; so little silver was used for the nanowires that the cost was negligible. The basis of cotton is easily accessible, but the nanomaterials will still be a difficult issue in developing countries.

   Still, killing bacteria with an electric current is an interesting idea, in that it will be much faster than conventional methods of filtering and disinfection with UV-light, if materials are accessible and little electricity is needed.

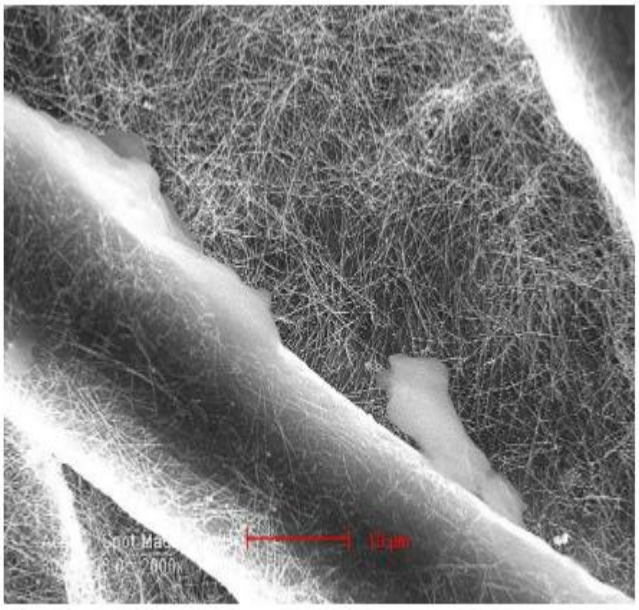

FIG 3:-Nanofilter SEM 2000x

CONCLUSION

The Following Technologies shows the need of purification in different situations and how are the problems solved by different researchers via conducting hard core research in this field for the betterment of different third world countries in the domain of water and sanitation engineering

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