Water Purification System Powered By Solar Energy

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***Abstract*: About one-fifth of people on earth lack the access to safe drinking water, a condition that resulted in the death of 2.2 million people in 2004, as per the records of United Nations. Clean water use being a prime concern in many communities of developing countries. Contaminated water plays significant role in taking numerous lives in these localities, for which a number of efforts are being made for accessing safe purified drinking water. Fortunately, efficient and cheap water purification systems are being utilized and being tried to be accessed worldwide for easy access to clean water. In the following project we had tried to develop a "Cost Efficient Water Purification Technique" using the basic ideas of filtration and try to improve the methodology using the UV Filter, RO Filter, and Activated Carbon filter mechanism. The system developed is standalone and consist of Solar panel, solar charge controller, battery, pump, 3 stage filtration system, UV unit and water tank. As per the observations the system is effective in water purification and has long life. Also, the electricity is not required as the system runs on solar energy.**

Keywords: Solar, Water Purification, Groundwater, Clean Water

I. INTRODUCTION

The rural population of India comprises more than 700 million people residing in about 1.42 million habitations spread over 15 diverse ecological regions. It is true that providing drinking water to such a large population is an enormous challenge. The health burden of poor water quality is enormous. Most of the rural peoples are affected by waterborne diseases and children are affected due to diarrhea are lost due to waterborne disease each year. The problems of chemical contamination are also prevalent in India. The government has undertaken various programmes since independence to provide safe drinking water to the rural masses. Groundwater is the major source of water in our country with 85% of the population dependent on it. While accessing drinking water continues to be a problem, assuring that it is safe is a challenge by itself. Water quality problems are caused by pollution and overexploitation. To maintain the quality of water resources hygiene, environment sanitation, storage and disposal are critical elements.

A lot of progress has been made in recent years in improving the water standard in highly populated areas where there is access to a more developed infrastructure, with electrical grids and a larger demand for clean water. In order to provide cleaner domestic water to rural populations, cheap and cost-effective methods for water sanitation is of vital importance. According to Down to Earth, rural people in India spend at least Rs.100 each year for the treatment of water/sanitation-related diseases. However, supplying clean water alone would not solve health-related problems.

In rural areas, modern water purification technologies might not be viable. In villages, it is important that simple technologies that are easy to use and can be operated without much technical know-how be promoted. The price factor is also important as technologies with high operational and recurring costs might not be useful. The selection of an appropriate technology is governed by acceptance by users. Use of modern technologies such as reverse osmosis and ozonation are effective in the treatment of water but their feasibility in a rural setting needs to be worked out in terms of capital expenditure and manpower in operating and maintaining such systems. There is also a need for proper field testing before any product is launched with proper certification and validation by prescribed authorities. Some of the methods currently used for water purification are: SODIS (Solar water Disinfection), Solar Water Distillation, Solar Water Pasteurization, Solar Water Purification, UV-Purification, Boiling, Mechanical Filtration, Biological Treatment, Chlorination, and Solar Stills.

II. LITERATURE REVIEW

Solar water purification involves purifying water for drinking and household purposes through the usage of solar energy in many different ways. Using solar energy for water treatment has become more common as it is a usually low-technology solution that works to capture the heat and energy from the sun to make water cleaner and healthier for human use and consumption. There are four main types of solar water treatment: solar water disinfection (SODIS), solar distillation, solar water pasteurization, and solar water treatment systems. These technologies are quite simple, easy to implement with low financial input, and are proven effective. The solar powered RO will be very useful in flood situation. Development of water purification system by using solar energy is possible. The modification of different solar concentrated distiller with latent heat storage capacity has been proven effective. Also, with somewhat modifications in existing system will give good efficiency of the system and can be useful for water treatment. The life of the system is also 15-25 years with maintenance of filter membrane system regularly. From literature review, it is found that numerous methods are developed for treatment of water for domestic use. Conventional, Reverse Osmosis systems are used domestically, but at the cost of waste water. Non-conventional water cleansers like a solar still have unlimited potential, but output is limited. The humidification and dehumidification process, and multi effect purification method with hybrid solar water system can be developed.

III. Problem Identification

While conducting survey with people, they want water must be safe for drinking purpose. The treated water must chemical free as smell of water is not good. The system must be reliable having long life with less maintenance cost. And the system does not require electricity. So, to develop the system to run on solar energy is the best way for their needs.

IV. Methodology

A solar powered water purification system is a water project that utilizes sustainable environmental technology to capture solar energy to purify water, making it safe for domestic purposes particularly drinking. The project goal was to provide safe and inexpensive drinking water systems for use, which have the capacity to treat water making it safe for human consumption. The purification system consists of two main parts: a solar cell module and a water purification unit. The solar cell module unit has ts that provide clean electrical power for pump, solar disinfection lamp and charging the batteries. The water purification unit cleans water using proven ultra violet (UV) disinfection technology. The process is a chemical free. The system eliminates bacteria, virus and protozoa, thus providing clean and safe drinking water.

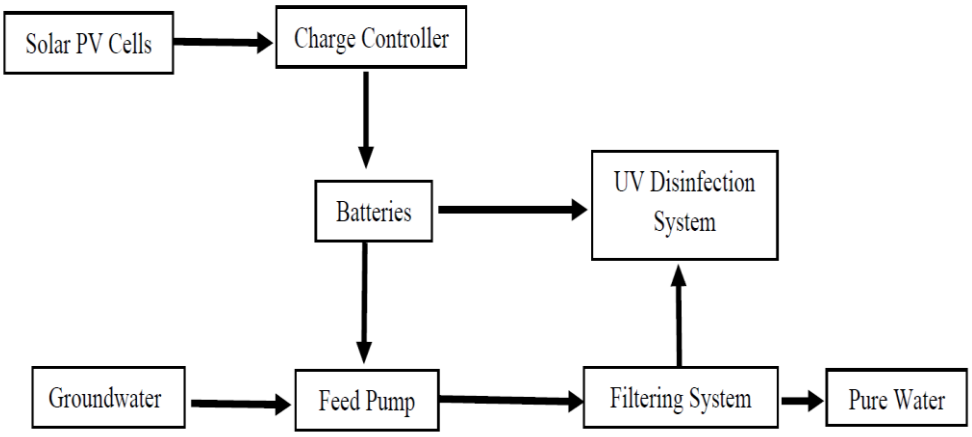

Fig. 1: Flow Diagram of the Solar System

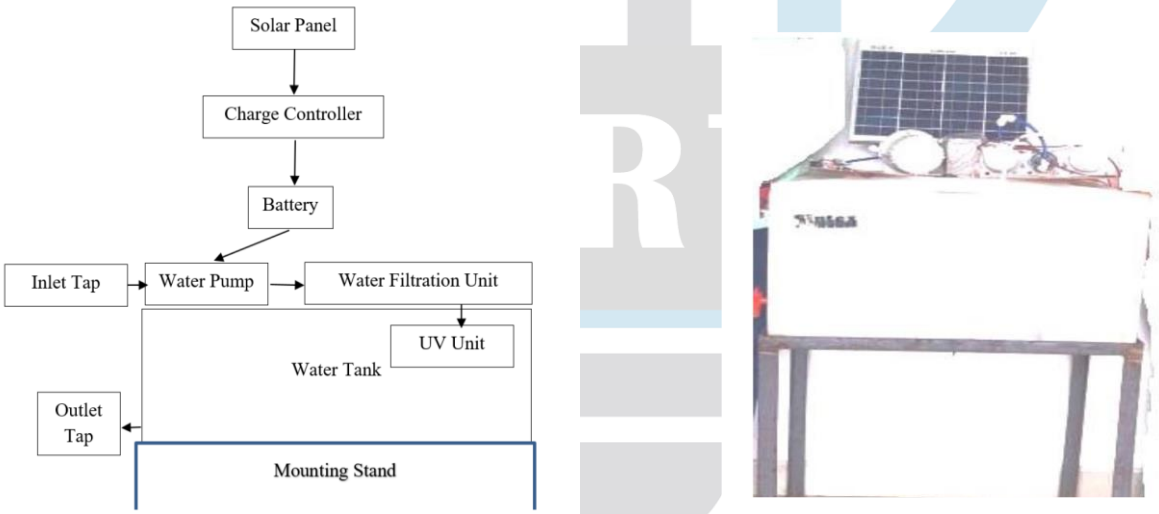

Fig. 2: Schematic and Actual Set Up Diagram

V. Observations

The raw water has been tested before implementation and after implementation of the system. The tests consists of chemical, physical and biological tests.

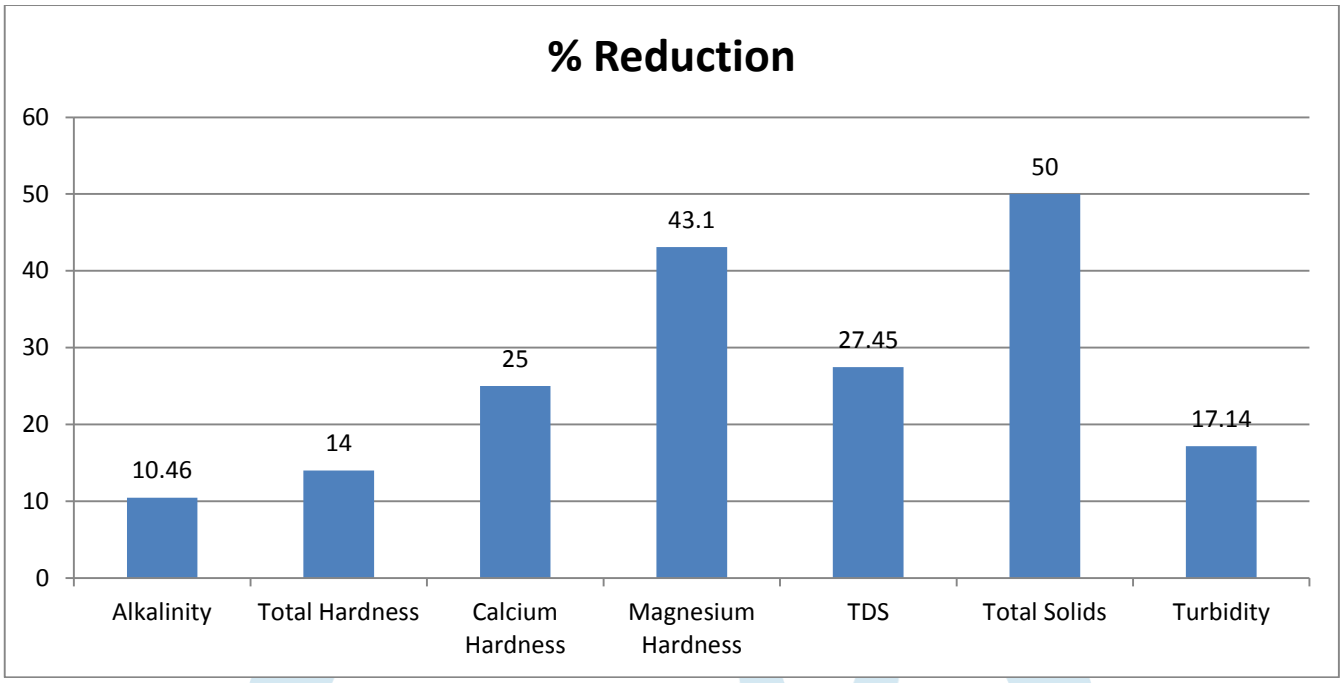

Fig. 3: Percent Decrease obtained in Treated Water

VI. Conclusion

The purpose of this project was to develop solar-powered water purification systems. Through a literature review, several existing concepts were identified. These existing concepts were used to develop the concepts presented in this project. This project focuses on the development of systems that could purify biologically contaminated water by using the solar energy and UV system. Even though the method is new, and requires much further work to reach commercialized implementation, it has already proven to be a relatively simple and reliable method. The study has also, in addition to presenting its own findings, provided a basis for a series of further studies of solar as a sustainable water treatment method. The project can be easily managed perfectly in such a small family and tests showed that the concentrations of all measured contaminants decreased in the treated water.

The conclusion of the thesis is therefore that solar water purification is a functioning and sustainable water treatment method, suitable for implementation in rural areas despite widely varying water contaminants. The study also showed that the method has the potential to be implemented in much greater areas than just the ones with continuous high levels of solar energy available.

References

[1]Phalak, M., Kurkure, P., Bhangale, N., Deshmukh, V., Patil, M., and Patil, M. H., Solar powered reverse osmosis water purifier, International Journal for Research in Engineering Application & Management (IJREAM), vol. 03, no. 01, 2017.
[2]M. Z. H. Khan, M. R. Al-Mamun, S. C. Majumder, and M. Kamruzzaman, "Water Purification and Disinfection by using Solar Energy: Towards Green Energy Challenge," Aceh Int. J. Sci. Technol., vol. 4, no. 3, pp. 99–106, (2015).
[3]Edla, P. J., Sonkar, N., Gupta, B., and Kumar, V., Solar water purifier for Indian villages – A review, International Journal of Engineering Research & Technology (IJERT), vol. 2, no. 6, 2013.
[4]M. S. Chander and M. Gowtham, "Concentrated Parabolic Solar Distiller integrated with latent heat storage material and mini solar pond," Int. J. Chem. Eng. Appl., vol. 2, no. 3, pp. 2–7, (2011).
[5]Zaman, S., Begum, A., Rabbani, K. S., and Bari, L., Low cost and sustainable surface water purification methods using Moringa seeds and scallop powder followed by bio-sand filtration, Water Science and Technology: Water Supply, vol. 17, no. 1, pp. 125-137, 2017.
[6]Nayar, K. G., Sundararaman, P., O'Connor, C. L., Schacherl, J., D., Heath, M. L., Gabriel, M. O., Shah, S. R., Wright, N. C., and Winter, A. G., Feasibility study of an electrodialysis system for in-home water desalination in urban India, Development Engineering 2, pp. 38-46, 2017.
[7]Yin, J., Zhu, G., and Deng, B., Graphene oxide (GO) enhanced polyamide (PA) thin-film nanocomposite (TFN) membrane for water purification, Desalination 379, pp. 93-101, 2016.
[8]Bolisetty, S., and Mezzenga. R., Amyloid–carbon hybrid membranes for universal water purification, Nature nanotechnology, vol. 11, no. 4, pp. 365, 2016.
[9]Deng, D., Aouad, W., Braff, W. A., Schlumpberger, S., Suss, M. E., and Bazant, M. Z., Water purification by shock electrodialysis: Deionization, filtration, separation, and disinfection, Desalination 357, pp. 77-83, 2015.
[10]Wendt, D. S., Orme, C. J., Mines, G. L., and Wilson, A. D., Energy requirements of the switchable polarity solvent forward osmosis (SPS-FO) water purification process, Desalination, 374, pp. 81-9.

[11[Kunduru, K. R., Nazarkovsky, M., Farah, S., Pawar, R. P., Basu, A., and Domb, A. J., Nanotechnology for water purification: applications of nanotechnology methods in wastewater treatment, Water Purification, pp. 33-74, 2017.
[12]Alsyouf, I., Alam, A. and Saidam, A., Implementing product design development methodology for assessing and improving the performance of products, International Journal on Interactive Design and Manufacturing (IJIDeM), Springer Paris, vol. 9, no. 3, pp. 225–234, 2015.
[13]Ward, J., A plastic solar water purifier with high output, Solar energy, 75(5), pp. 433-437, 2003