

Water Purification System Using Solar Energy

1Prof.STM Zaheer, 2Minal Pal, 3Shivam Mahale, 4Rahul Sunkarwar, 5Sanket Awathare, 6Vishal Shinde

1Assistant Professor,2,3,4,5,6UG Students

Department of Electrical Engineering,

Government College of Engineering Chandrapur, Chandrapur Maharashtra, India.

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ABSTRACT : In this project, we are making a water purifier which works on solar energy. The basic working principle of this project is Reverse Osmosis. We are using renewable source Solar energy which is an abundant and cheap. We are using 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 Power supply consists of solar panel, charge controller and battery. Purification unit consist of Reverse Osmosis system and control circuit contains sensor. High pressure is created by booster pump to carry out reverse osmosis process. The Relay keeps watch to level of the water tank and prevents it from the overflow. By using this process, we obtain pure water in the water tank. This purifier is suitable to use in remote and rural areas where there is no electricity. It must be used in places affected by natural disasters. It provides pollution free water purifier.

Keywords: Reverse Osmosis, Solar Panel and Water Purifier

I. INTRODUCTION:

Fresh water is one of the critical and essential things for human life. Without water, human beings can survive for a few days only. Only 2.5% of the world's water is fresh water, which is stored in lakes, rivers as well as groundwater and usually cannot be directly used for human life because the conditions of the water are far from the clean water standards. It is well known that poor water quality can lead to water-related diseases such as waterborne diseases, malnutrition, diseases related to vector contamination and metal poisoning, which result in 2.2 million people dying globally every year and

mostly in developing and underdeveloped countries.

Each person on earth requires at least 20 to 50 liters of clean and safe water a day for drinking, cooking and safely keeping themselves clean. Polluted water is not dirty it is deadly. In 2018 around 2439 people died because of waterborne diseases such as Cholera, Diarrhoea, Typhoid and viral hepatitis. In all more than 1.3 crore people were diagnosed with these Diseases. In the past five years 11768 people have died due to these diseases by seeing above problems it is necessary to behaving system which gives us pure and clean water with minerals. The available water in many areas in the country is brackish, saline or impure. Salinity is a major problem in the coastal areas of thane and Mumbai.

Objective of our project is to provide Fresh Drinking water, avoid waterborne diseases especially in rural India, Using renewable sources of energy, affordable purification for the poor. Utilizing Solar Power to provide the facility to remote places. To Maximize the use of renewable energy for day to day activities and to provide clean and pure water for rural India.

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.

Development of water purification system by using solar energy is possible. 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. METHODOLOGY:

The solar radiations are collected by solar panel. A battery charger is a device that stores energy in a battery by running an electric current through it. The charging protocol depends on the size and type of the battery being charged. This energy is then stored in a battery. The battery is connected to the purification unit through the electromagnetic relay. The purification unit consists of high pressure motor, reverse osmosis system and the water tank. The high pressure creates the necessary pressure required to carry out reverse osmosis. The Relay keeps a watch to the level of water in the water tank send signal to the relay and prevents it from over flow. Through this process we obtain the purified water in the water tank.

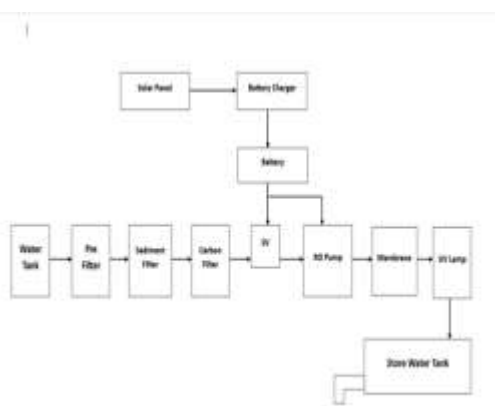


Fig.1 Block Diagram

SOLAR ENERGY:

Solar energy can be a major source of power. Its potential is 178 billion MW which is about 20,000 times the world's demand. But it cannot be developed on large scale. Sun's energy

can be utilised as thermal and photovoltaic. The solar power where sun hits atmosphere is 1017 watts, whereas the solar power on earth's surface is 1016 watts. The total world – wide power demand of all needs of civilization is 1013 watts. Therefore, the sun gives us 1000 times more power than we need. The energy radiated by the sun on a bright sunny day is approximately 1kw/m², which may be used in driving the prime movers for the purpose of generation of electrical energy. Some applications of solar energy are solar water heater, solar cookers, Solar furnaces, Solar ponds, Solar energy collectors, Solar energy storage etc.

SOLAR PANEL

In this paper, solar energy is being collected by using a solar panel. The collected solar energy is being stored in the battery. In case of rural and remote areas and the areas affected but natural disasters where electricity is a big problem, this stored energy can be used for the purification of water. The charge controller used here controls the required amount of solar energy to be stored in the battery.



Fig. 2 Solar Panel

REVERSE OSMOSIS

When two solutions of different concentrations are separated by a semi-permeable membrane, solvent (water) flows from a region of lower concentration to higher concentration. This process is called osmosis. This driving force in this called osmotic pressure. If a hydrostatic pressure in excess of osmotic pressure is applied on the higher concentration side, the solvent flow is reversed i.e., solvent flows from higher concentration to lower concentration. This process is called reverse osmosis. Thus, in the process of reverse osmosis pure water is separated from salt water.

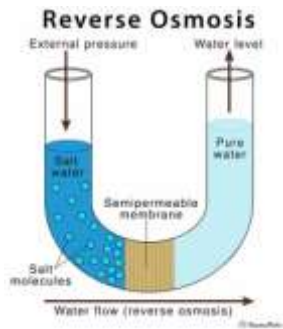


Fig.3 RO Membrane

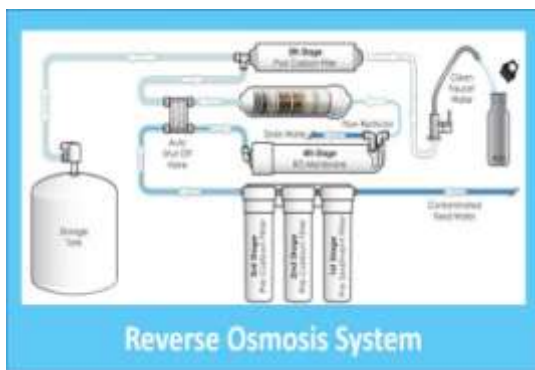


Fig.4 Reverse Osmosis (RO)

HARDWARE KIT:

The Design of Solar Water purifier has solar panel mounted on adjustable frame. The frame (Blue) can be moved up and down like socket. The frame can be fixed at any location using pin. This adjustment feature helps to incline solar panel at different angles at different seasons so as to acquire maximum efficiency. The bottom storage box has 2 sections one section stores inlet impure water and one section is needed to place batteries and charge controller. On the back face of stand purifier is fitted using nut and bolts and purified water is received from back side. Tap is provided to collect pure water.

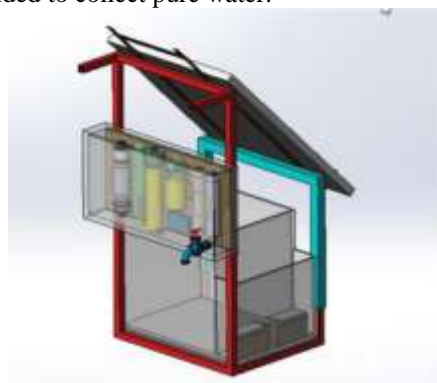


Fig.5 Water Purification System

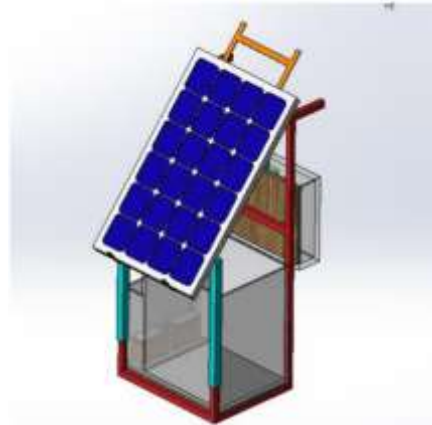


Fig.6 Panel Arrangement

OBSERVATIONS:

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

IV. CONCLUSION:

As sun's free solar energy is being used for the purification of water, which is cheap and abundant, it can be used everywhere where electricity is not available. Here, the controller which is used also prevents the water from overflowing. Moreover, reverse osmosis is a good water hardness removing process. So, we designed the photovoltaic system, battery system, structural design for water purification system and we have analysed the benefits of photovoltaic system along with case study and environmental benefits. We have also specified types of solar cells available in market and we have compared them with different points and selected suitable one. This project has only capital cost and almost no running cost. Hence, it will prove to be useful in the near future.

REFERENCES:

- [1]. Nimal, R.J.G.R., Hussain, J.H., Effect of deep cryogenic treatment on EN24 steel, International Journal of Pure and Applied Mathematics, V-116, I-17 Special Issue, PP113-116, 2017
- [2]. Parameswari, D., Khanaa, V., Deploying lampont clocks and linked lists, International Journal of Pharmacy and Technology, V-8, I-3, PP-17039-17044, 2016
- [3]. Parameswari, D., Khanaa, V., Case for massive multiplayer online role-playing games, International Journal of Pharmacy and Technology, V-8, I-3, PP-17404-17409, 2016

- [4]. Parameswari, D., Khanaa, V., Deconstructing model checking with hueddot, *International Journal of Pharmacy and Technology*, V-8, I-3, PP-17370-17375, 2016
- [5]. 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.
- [6]. 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).
- [7]. 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.
- [8]. 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).