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Solar Power Ultraviolet Water Purification System

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***Abstract*: -- Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from water. The goal is to produce water fit for a specific purpose. Most of the purifiers work using non-renewable sources of energy which are costly and not available in remote areas. So, here we are collecting solar energy by using solar panels as an energy source which is available in plenty at all places to generate electricity. "Water purification using the solar ultraviolet system" is an effective method of purifying water since it uses the non-conventional source of energy to run the ultraviolet system which makes it cheap and maintenance free. Ultraviolet (UV) rays penetrate harmful pathogens in water and destroy illness-causing microorganisms by attacking their genetic core (DNA). This is extremely efficient in eliminating their ability to reproduce. UV systems destroy 99.99% of harmful microorganisms without adding chemicals or changing your water's taste or odor, unlike other treatment methods. It is a set and forgets type of system which requires just changing UV bulb annually.**

***Index Terms* – Photovoltaic panel, ultraviolet bulbs, pumping system, UV tank ,settling and Storage tank.**

I. INTRODUCTION

The aim of our project is to purify water by solar energy in rural areas of India . Over 75% of the earth surface is covered with water and only 3% of the Earth's water is freshwater , and not all of that is suitable for drinking . Most of the villages are facing problems from impure water. So for making smart villages, we are designing the system which gives pure drinking water at low cost. And purify the water by using UV process. We are using solar energy because in rural areas the amount of electricity is not sufficient. Sunrays are available in our country and by using the sun ray, we will produce electricity. purification. A parabolic trough is a type of solar thermal collector that is straight in one dimension (Z-axis) and curved as a parabola in the other two (X and Y-axis), lined with a polished mirror like finish metal. The energy of sunlight which enters the collector parallel to its plane of symmetry is focused along the focal line where the vacuum tube is placed. The vacuum that surrounds the outside of the tube greatly reduces convection and conduction heat loss, therefore achieving greater efficiency than flat-plate collectors. Thus with higher concentration ratio and with appropriate acceptance angle, the parabolic trough will concentrate more thermal radiation on the tube where it will absorb heat and will transmit it to the water inside, to raise its temperature to 80°C and more(i.e.to the pasteurization temperature of water) to kill or deactivate all classes of pathogens including protozoan cysts that have shown resistance to chemical disinfection and viruses that are too small to be mechanically removed by microfiltration. As the water heats due to radiation from the sun, the increased temperature will kill or inactivate an important part of commonly waterborne pathogenic bacteria, viruses, helminthes, and protozoa at a temperature between 65° and 75°C (i.e.149-167°F) (Backcountry Drinking Water)[2],thus making water drinkable.

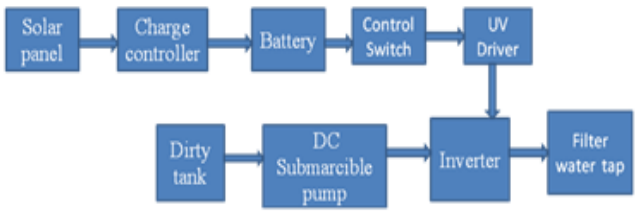

Fig.1:- Block Diagram of Solar Water Purification

II. AIM AND OBJECTIVE

Harnessing the solar thermal energy for water pasteurization process and use of carbon filter to remove sediments thus, purifying water without using any non-renewable energy source. Objectives of the project are: [1]. Removing sediments and particulate matter from water. Elimination of pathogens, viruses, other diseases causing elements from water. [3]. Generation of minimum 25 litres of pure day per day The problem definition for our project is as follows: ―Design and fabrication of Solar Water Purifier by using carbon filtration and concentrated solar power technology to generate minimum 25 litres of pure water per day‖.

III. DESIGN & COMPONENTS

Solar panel city from sunlight. They are typically made of silicon crystal slices called cells, glass, a polymer backing, and aluminum framing. Solar panels can vary in type, size, shape, and color. In most cases the "size" of a PV module refers to the panel's rated output wattage or electricity generating potential. Solar panels also have voltage ratings. Those with of 12 or 24 Volts are generally preferred for off-grid systems

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with battery banks. Other solar panels come in less common nominal voltages such as 18, 42, and even 60 Volts. These modules are typically used in grid-tied applications to accommodate the working of grid-tied inverters. Solar panels can be used alone or combined into arrays by wiring them in or in to achieve the needed . The price of most large residential or commercial PV modules can range between $2.20 and $3.40 per rated watt.

Charge controllers or voltage regulators protect batteries from being overcharged, which can shorten their life as well as the life expectancy of the equipment being powered. Electronic circuitry in the regulator measures battery voltage, which rises as the battery state-of-charge (SOC) increases. At some voltage (which is different for different types of batteries at different temperatures), the regulator will limit the charging of the battery.

Regulators for photovoltaic (solar electric), wind and water powered systems perform the same function as a voltage regulator in an automobile. However a regulator from a car will not work in a remote power system due to a few differences. Advanced features found in most charge controllers are: low voltage disconnect (LVD), lighting controls, adjustable settings for different battery types, auto equalization, fusing, temperature compensation and reverse polarity protection. Some regulators charge using pulse width modulation (PWM) while others use simple on/off schemes.

The in-battery protection circuitry is usually intended to act as a gross fault protector and it is strongly recommended that it not be relied on as a means of charging control. As a means of gross short circuit protection it may be suitable as long as the values they choose for max Iout are acceptable to you. For charging, use of one of the large number of Lion charger ICs is recommended.

A major factor is that the over voltage circuit does not remove the applied voltage when the CC charging current falls to a low value. This means that the battery is "floated" indefinitely with the risk (I'm told) of plating out metallic Lithium. A PV panel (solar panel) that is nominally 12V rated and intended for charging lead acid batteries, will have a loaded Vout of about 18V and an O/C or light load Vout of over 20V. The maximum voltage that you need AT the battery pack is 4.2V/cell or 12.6V in your case. PV panel available Iout values are a reasonable approximation to being linearly related to isolation A solar charge controller is fundamentally a voltage or current controller to charge the battery and keep electric cells from overcharging. It directs the voltage and current hailing from the solar panels setting off to the electric cell. Generally, 12V boards/panels put out in the ballpark of 16 to 20V, so if there is no regulation the electric cells will damaged from overcharging. Generally, electric storage devices require around 14 to 14.5V to get completely charged. The solar charge controllers are available in all features, costs and sizes. The range of charge controllers are from 4.5A and up to 60 to 80A. The most essential charge controller basically controls the device voltage and opens the circuit, halting the charging, when the battery voltage ascents to a certain level. More charge controllers utilized a mechanical relay to open or shut the circuit, halting or beginning power heading off to the electric storage devices.

Generally solar power systems utilize 12V of batteries. Solar panels can convey much more voltage than is obliged to charge the battery. The charge voltage could be kept at a best level while the time needed to completely charge the electric storage devices is lessened. This permits the solar systems to work optimally constantly. By running higher voltage in the wires from the solar panels to the charge controller, power dissipation in the wires is diminished fundamentally.The solar charge controllers can also control the reverse power flow. The charge controllers can distinguish when no power is originating from the solar panels and open the circuit separating the solar panels from the battery devices and halting the reverse current flow.

IV. ULTRAVOLET SYSTEM

UV Disinfection System is an extremely effective way to combat microbial contamination in water. However, microbes have to be exposed to UV-C light in the proper amount in order to effectively disinfect the water. UV Disinfection Systems are used in many different applications ranging from the purification of drinking water in individual homes to disinfecting water supply of entire townships. UV treatment for water is recognized as the safer and more cost-effective way to disinfect water for industrial applications UV water purification is a method of water filtration which uses ultra-violet to kill all bacteria. Ultraviolet water purification is a simple but effective process that destroys around 99.99% of harmful organism in water. The UV purifier require very less energy for operation approximate the same amount of energy as a 60W bulb. UV rays do not damage plumbing system .UV purifiers are easy to maintain as a lamp.it is replaced only once a year.

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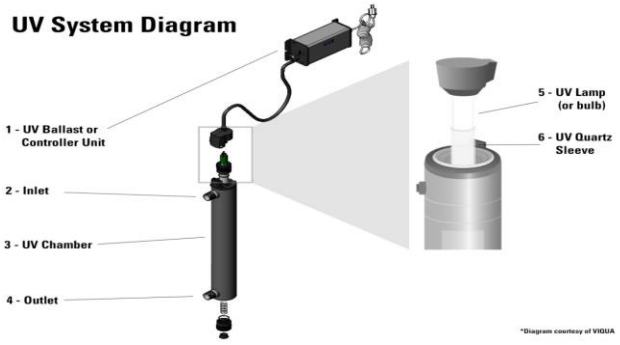

Fig. 2:- Ultra Violet System

Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses short-wavelength ultraviolet (UV-C) light to kill or inactivate microorganisms by destroying nucleic acids and disrupting their DNA, leaving them unable to perform vital cellular functions.

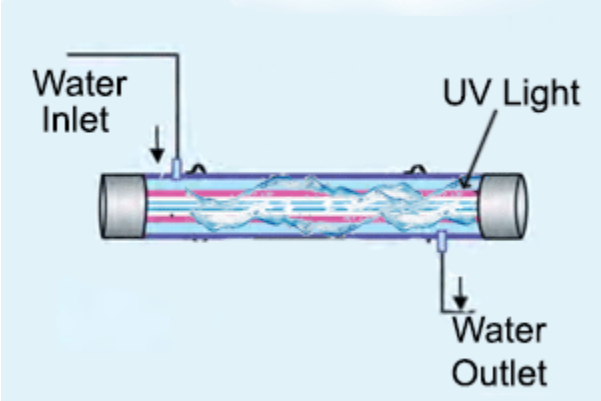

Fig. 3 UV Chamber

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a motor close-coupled to the pump body.

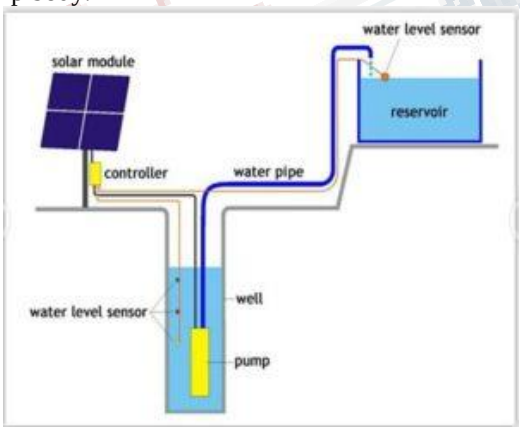

Fig. 4:- DC submersible pump

The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevent pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps

V. CONCLUSION

The setup of ―Solar Water Purifier‖ was fabricated according to the design calculations within the prescribed time period and in the end sample of purified water from the setup was sent to water testing laboratory and from the results obtained it was found that the sample was free from particulate matter and disease causing pathogens and hence the water was fit for drinking. Temperature from the setup easily rose up to 70℃ in 2 hours and thereby killing the pathogens through the process of ―Water Pasteurization‖. Also, comparison was made between the existing filters like which were dependent on electricity like R.O filter, U.V. filter and it was found that ―Solar Water Purifier‖ had many advantages over the conventional filters in terms of manufacturing and maintenance cost and also it successfully implemented in rural and slum areas where there is lack of electricity but abundance of solar energy.

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