

# DESIGN & CONSTRUCTION OF SOLAR WATER PURIFIER

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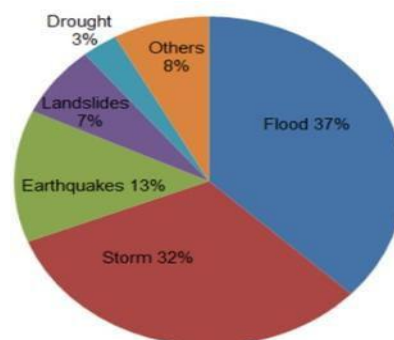
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**ABSTRACT:** The first domestic filter to be made was by Greek scientist Hippocrates called the Hippocratic sleeve. The lack of clean water is a major problem of plagues many area of the world in today. There are various technology available in the market such as RO membrane, UV radiation UF filtration. But these technologies are very expensive and consume too much power to be effective in rural area. Most of the rural area there is no availability of electricity. So we decide to use the solar power. Water purification is the process to remove the contaminated water from the surface water. Due to contaminated water can cause the various diseases like as Kidney Stone, Malaria, Stomach Pain, untold misery and brain damage. Pure water flushes out toxins, improves your complexion, relieves headaches, promotes weight loss, and aids in digestion. So when your water is of poor quality, your mind and body can't function properly. You may feel sluggish, bloated, and dehydrated without the proper amount of high quality water. Hence we can use the RO membrane technology to purify the water using solar power.

## I. INTRODUCTION

Water purification is the process to remove the contaminants from the ground water for the specific purposes. The contaminants like as particulate matter, dissolved minerals. This are various technologies are available in the market to purify the water such as distillation, ion exchange, filtration, RO membrane filtration, ultraviolet(UV) radiation or a combination of more than one and more technology. The mostly used technology is membrane filtration and UV radiation. Due to poor quality of water and also the various chemicals are present in the surface water. Because of these water many borne diseases are spared, which cause the untold misery. In these water the various types of bacteria also present. Lead metal can cause the brain damage and it is very dangerous to human health. The RO membrane removes the particles as small as 0.0001 microns from the contaminated water or ground water.

Water is an essential element to ensure the continuation of life on earth. Approximately 70% of the earth's surface is covered with water, out of which only 2.5% is fresh water [1]. However, availability of potable water is a challenge in many developing countries. Countries in Southeast Asia are facing huge environmental challenges due to climate change effects caused by global warming [2]. The most common disasters are severe thunderstorms and flooding. Floods make up approximately 40% of all natural disasters in Asian countries as shown in figure 1.



A major concern during floods is illness due to water related health issues such as communicable diseases, predominantly faecal oral diseases [4]. The spread of these diseases occur when faecal matter is consumed orally due to contamination of drinking water and food. This happens as decline in sanitation and lack of access to safe drinking water is common during floods. Other diseases such as Leptospirosis are also common during floods due to

increased amount of rodent excrement in flood water. Table 1 shows some examples of waterborne diseases caused by consuming contaminated water.

## **II. LITERATURE SURVEY**

**M. Gowtham et al. (2012)** In this research work the performance of solar concentrated distiller with latent heat storage capacity is compared with solar concentrated distiller with trays on the basin. Paraffin wax is used as the latent heat storage material. Experiments are conducted for improving productivity and this is done by various factors like heat storage capacity, exposure area and maintaining low depth. Hourly Productivity of the concentrated solar distiller is obtained for experimental duration 9AM to 5AM water was measured every hour by maintaining low depth. Analysis was made between two types of basin. Sponges were added to increase the exposure area by capillarity effect. It is observed that due to the presence of sponges, the water output is increased to 40.83% in latent heat storage distiller and 19% increase in tray basin type, while comparing with the plain basin type. Overall productivity was improved by a maximum of 48% by using various modifications [1].

**Peramanan et. al (2014)** has studied the fabrication of Human Power Reverse Osmosis Water Purification Process. The device use pedal to harms human motion to convert it into usable power to run a reverse osmosis filtration system. Osmosis is a natural process in which a liquid from a less concentrated solution flows through a semi permeable membrane to more concentrated solution. Reverse osmosis is an effective method of reducing the concentration of total dissolved solid sand many impurities found in water[2].

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**Jayant Gidwani et. al (2016)** has done the fabrication and experimental investigation of pedal powered water pump along with the purification system which is use for pure drinking water supply and garden irrigation purpose. The design has the working of centrifugal pump which is been operated by pedal power[4].

## **III. METHODOLOGY**

### **Procedure**

For water purification technologies, the disinfection contribution, primary use, affordability, and appropriateness of each technology were analyzed as a basis for selection. Four criteria established for technologies were: disinfection capability to remove or inactivate microbiological contaminants for safedrinking water; primarily applied to domestic use; affordable to the user; and appropriate for cultural and social conditions. Based on the above selection criteria and the technology information, the most appropriate technologies were: Media filtration (sand filtration) Reverse osmosis (RO)

Chemical disinfection (chlorine bleach)

Ultraviolet radiation (UV)

Flocculation/coagulation plus sedimentation (or filtration).

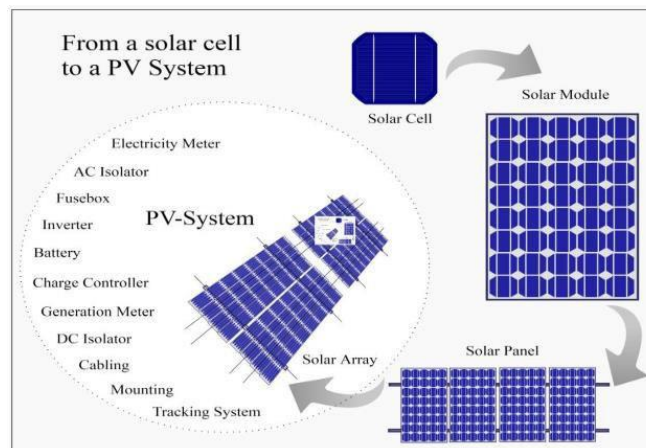
These represent the least costly alternatives, and in some cases, require no technology orenergy/power.

Pure water requirement for a Family:

Specification of Community Size for Evaluation of Water Purification Systems

For the selected technologies, a community with a population of 1,000 people was selected as a representative size based on the fact that a reasonable estimate of the common population of the communities and neighborhoods in the selected countries or regions was 500 to 800 people.

**Solar Panels:** The solar panels are made up of photovoltaic cells, which convert sunlight into direct current Electricity throughout the day. The amount of power produced depend on the intensity of light.



**Solution and Effect**

As clean and purified water is need of humans we can use “Solar Water Purifier” for purification of water. The mobile solar water works on solar energy which is free in nature with no cost. Alsosolar energy is a clean source of getting energy. In rainy days when solar energy is insufficient ornot available we are using electricity from electric company.

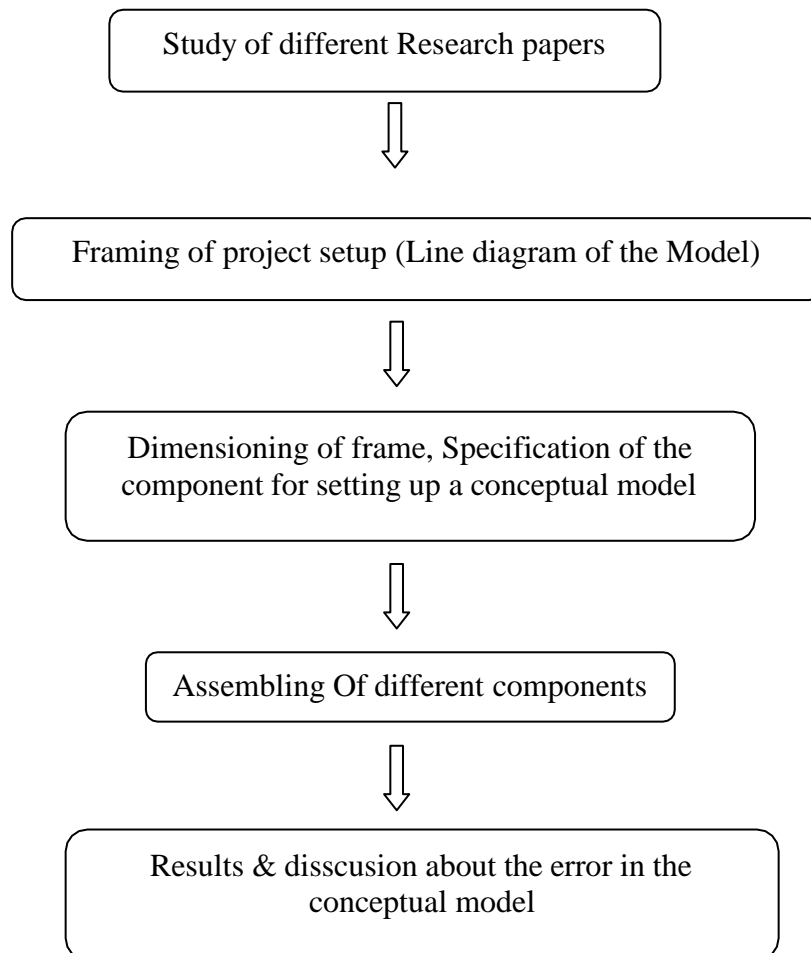
As we are using solar energy for getting electrical supply to purify water it is cost free. So customer will not pay electricity bill for purification of water and it is monthly saving ofa customer. In this experiment we intend to make a low cost purifier which provide safe drinking water to rural and urban areas.

The “Mobile Solar Water Purification” has a advantage that the purifier is movable from one place to another so it can be used anywhere in absence of electrical supply also.

**METHODOLOGY:**

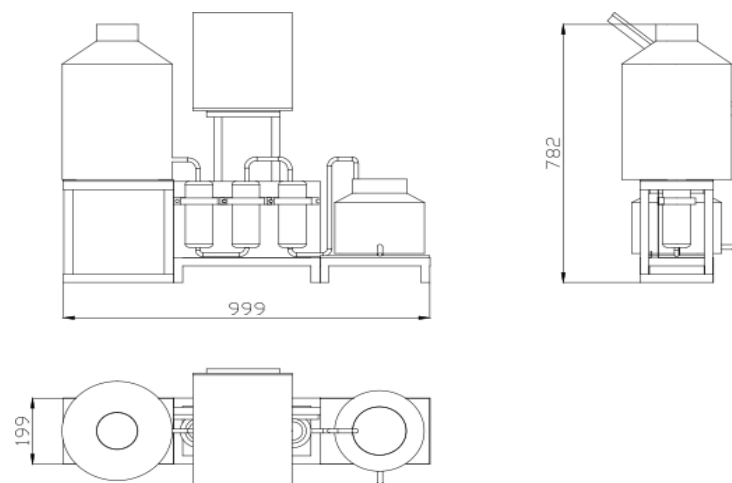
The goals of the treatment are to remove unwanted constituents in the water and to make it safeto drink or fit for a specific purpose in industry or medical applications. Widely varied techniques are available to remove contaminants like fine solids, micro-organisms and some dissolved inorganic and organic materials, or environmental persistent pharmaceutical pollutants. The choice of method will depend on the quality of the water being treated, the cost of the treatment process and the quality standards expected of the processed water. Theprocesses below are the ones commonly used in water purification plants. Some or most may not be used depending on the scale of the plant and quality of the raw (source) water.

1. Pump pumps the water to filter with pressure where dissolved inorganic solids areremoved from water.
2. Then water is pumped to carbon filter which removes organic matters, chemicals,containsments and chlorides using chemical absorption.
3. After carbon filter water is passes through the RO membrane.
4. Here water is converted into pure water, where impure water is collected in container.
5. Block Diagram of Project work



Flow Chart For Working Process

Designed using CATIA V5R20:



## Calculation of Incident Radiation:

### Energy Calculation

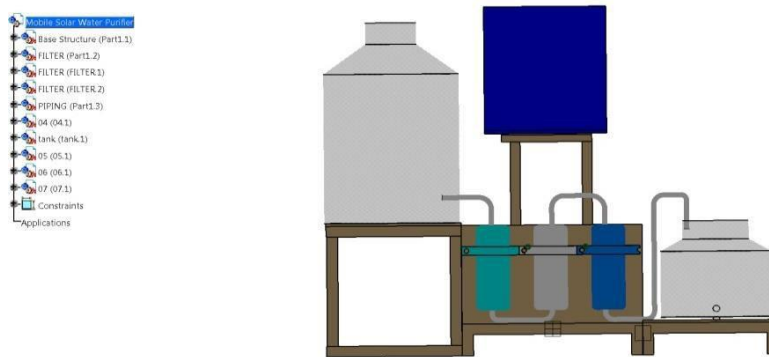
Energy calculation for capacity of solar panel and battery is shown in this paper to justify the design. Battery capacity is measured in Amp Hours (e.g. 8AH).

It is needed to be converted to Watt Hours by multiplying the AH figure by the battery voltage (e.g. 12V).  
 Power available in battery (watt hours) = X (Battery size in AH) x Y (Battery Voltage)  
 ..., (1)

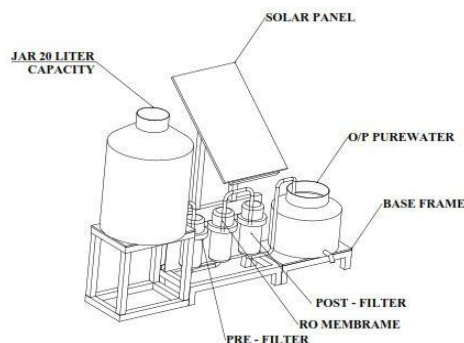
By applying equation (1), power in battery = 8 x 12 WH  
 = 96 WH

Time to charge the battery fully = power available in battery (Watt Hours) / power of solar panel (Watt) ..., (2)  
 So, from equation (2), time to charge the battery fully by using a 10 Watt solar panel = 96/ 10Hours = 9.6 Hours

## System Design:



## Drafting done using AutoCAD Software:

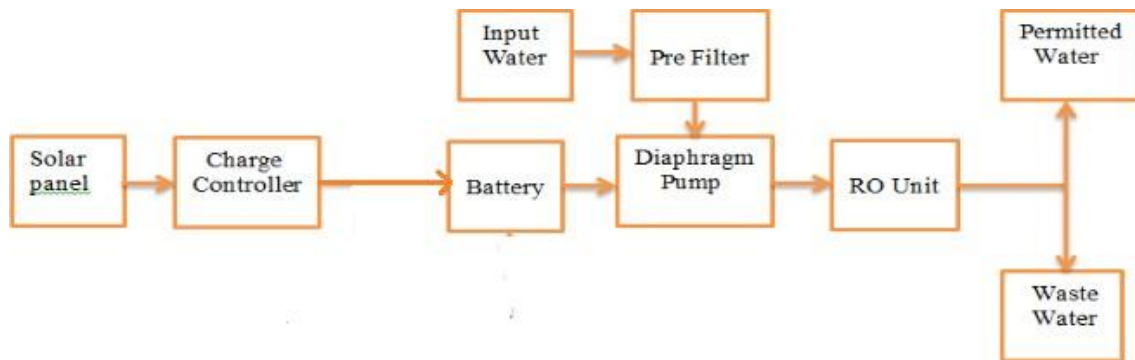


## Proposed Work:

Now a day's electricity is one of the important things in our life. All the conventional ones are depleting day by day. So we have to shift from conventional to non-conventional energy resources. In this project, a combination of energy resources takes place, i.e., solar energy. This process revives the sustainable energy resources without damaging the nature. In this project, we are going to use a purifier to purify water using a renewable energy source.

The block diagram for "Mobile Solar Water Purifier" is given in fig (1). In "Mobile Solar Water Purifier" we are using a solar panel for getting electrical supply. This electrical supply is fed to a charge controller which charges the battery up to

24 volts. Then supply from battery is given to the diaphragm pump. The input water is given to the pre filter which removes solid dust particles from water then this water is fed to diaphragm pump. The diaphragm pump fed high pressure water to the RO membrane which kill bacteria form the water and we get purified water.



#### IV. CONCLUSION

Safe drinking water is the basic need of human beings. Microbial contamination of drinking water is a major health hazard, to overcome these we can use RO purifier for the clean and freshwater but the main problem in some village areas is that there is no availability of electricity for adequate time, because of which we cannot operate RO water purifier plant. Hence it will be end over with smart approach to get pure drinking water with the optimum use of renewable energy sources with our project.

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