

# Solar Operated Portable Water Purifier

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## ABSTRACT

In this paper we are making solar operated portable water purifier. The basic principle behind this project is Ion exchanger resin, silver ceramic filter and UV steriliser. Solar radiation from sun is collected by solar panel. Then these collected radiation stored in battery in the form of DC. This DC source convert into AC by inverter connected to the purification unit through electromagnetic relay. Purification unit consist of suction pump and water tank. The microcontroller 8051 keeps watch on water level in the water tank and prevent it from overflow. From this process we obtained purified fresh water in the water tank.

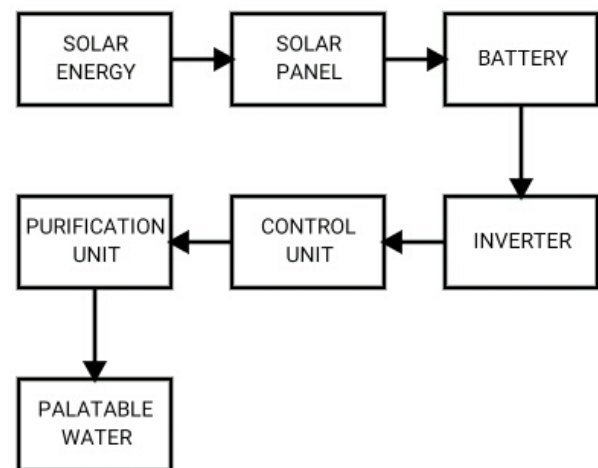
**Keywords:** Microcontroller 8051, UV sterilizer, Ion Exchange Resin, Silver Ceramic Filter, Solar Panel, Solar Energy, Battery, Inverter.

## I. INTRODUCTION

Water is a necessity of human along with food and air. Fresh water resources usually available are river, lake and underground water reservoirs. About 71% of earth is covered with water. Despite of all of that 96.5% of total earth's water found in oceans which is not drinkable .Less than 1% of fresh water is in river, lakes and the atmosphere which is drinkable. The distribution of fresh water is becoming an increasingly important issue in many areas of the world. The availability of fresh water in many areas of the country is brackish, saline or impure. The establishment of human habitat in these areas strongly depend on how such water can be made available. There are many methods available for purifying the drinking water such as chlorination of wells, chlorine tablet, and pot, slow and rapid sand filter.

To study the process of purification of water we are making a water purifier which works on solar energy which is excessive in nature and cheap. The sunlight is one of the several forms of heat energy that can be used to power that process. In case of power failure,

this purifier will continue to work on supply from the grid. Here we use microcontroller 8051 to check the water level and prevent it from overflow. This purifier can be use in remote areas and rural areas where there is no electricity. And also it can be use in places affected by natural calamities. It provides pollution free operation.



**Figure 1.** Block Diagram of Solar Operated Water Purifier

## II. MATERIALS

### A. Electrical Energy

**Electrical energy** is the greatest invention in history because it opened up to a entire new world. Without power, the world would never be able to innovate.

Electrical energy to this day is the most important innovation because it serves as the base line for all invention to.

Electrical energy occupies the top grade in the energy grade system. It finds uncountable uses in home, industry, agriculture and even in transport.

The annual per capita consumption of electrical energy in few countries is

**Table 1**

USA	14240 kWh
Canada	18400 kWh
Japan	8460 kWh
UK	675 kWh
USSR	6420 kWh
India	664.8 kWh

From above table it is shown that per capita consumption in India is laughably low as compared to that in developed country.

The reason behind this installation of transmission lines in remote areas, rural areas and the cost of electricity. Considering this reasons we have switch another source of energy.

There are many methods available for producing electricity, among that only few are greater generation of electricity.

It can be obtained from natural sources like

- Tidal Energy
- Wind Energy
- Solar Energy

Out of these sources of energy solar energy is widely used for generation of electricity.

Here we replace electricity with solar energy because for generation of electricity lots of water is used from many years. In these process most of the water is waste. To save this water and reduce the cost of electricity we have used solar energy.

Solar energy captured energy from the sunlight. It reduces the electricity bills. And have low maintenance cost.

### B. Solar Energy

Here we replace electricity with solar energy, because for generation of electricity lots of water is used from many years. To save this water and reduce the cost of electricity we have used solar energy.

Solar panel captured energy from the sunlight.

It is present in larger quantity in nature. It is essential to used as the solar panel can installed anywhere like home, industry, agriculture. There are few advantages of solar energy over electricity.

It reduces the electricity bills. And have low maintenance cost and easy to use.

### C. Solar panel

The solar panel is firstly introduced by the "EDEMAND BACGERAL" in 1839 at Age of 19. The solar panel are made up of semiconductor that is pure silicon.

#### Types of Solar Panels

The different types of solar panel are as follows;

1. Crystalline Silicon
  - a) Mono crystalline solar panel
  - b) Poly crystalline solar panel
2. String Ribbon Solar Cells
3. Thin Film Solar Panel
4. Building Integrated Photo voltaic

**Table 2**

Types	Efficiency	Life time
1. Crystalline Mono crystalline Polycrystalline	19-22% 14-16%	30-35 year 25-30 year
2. String Ribbon Solar Cells	7-8 %	-
3.Thin Film Solar Panel	10- 12 %	-
4.Building Integrated Photo voltaic	14- 16%	-

Mostly we use the mono crystalline Solar Panel because; it has high efficiency i.e. 19-22% to consume the Energy.

The Mono crystalline solar panel is made up of from pure silicon i.e. it is 90-99% of pure. Therefore its life time is also more than others solar panels. The life time of mono crystalline solar panel is 30-35 years. It is also used in winter season because, it has high efficiency.

The range of solar panel is depending on the amount of energy we use for purification unit. E.g. For finding the rating of solar panel we use the simple formula,

Suppose the rating of battery is 150AH  
Then,

$$150 \times 2 = 300W$$

Then, we use the rating of 300W for solar panel.

To charge the battery of 150AH out of 15%

Then,

$$15 \div 100 \times 1500AH = 22.5A$$

15% electric current is sufficient to charge the battery. Therefore, the 300W of solar panel is sufficient to charge the battery of 150AH.

#### D. Control Unit

The control unit consists of sensors, microcontroller 8051 and algorithm. Basically this microcontroller 8051 is used to sense the water level in tank. This system monitors the water level of the tank and automatically switches on the system whenever the tank is empty.

#### Sensors:

A device which detects physical property and records indicates, or otherwise response to it is called as sensors. We use water level sensor here. Level sensor is used to detect the level of substance that can flow. Level measurement can be done inside the container. Such measurement can be used to determine the amount of material within a closed container.

#### Microcontroller 8051:

8051 microcontroller is designed by Intel in 1981. It is an 8-bit microcontroller. It is built with 40 pins DIP (dual inline package), 4kb of ROM storage and 128 bytes of RAM storage, 2-16 bit timers. It consists of are four parallel 8-bit ports, which are programmable as well as addressable as per the requirement. An on-chip crystal oscillator is integrated in the microcontroller having crystal frequency of 12 MHz.

A Microcontroller has all the necessary components which a microprocessor possesses and invariably it poses ROM, RAM, Serial Port, timers, interrupts Input Output ports, and clock circuit. The microcontroller always focus on the chip facility and it is more prominent in the case of serial ports, analog-to-digital converters, timers, counters, read only memory, parallel input, interrupt control, random access memory and output ports. The concept of the 8051 microcontroller arises from here and here we will discuss in depth about the various aspects, uses, programming and other features of the 8051 microcontroller.

## E. Purification Unit

### Stage 1- Ion exchange resin:

High calcium and magnesium percentage decreases which present in hard water. The supply ability is 1000 Cubic Meter/Cubic Meters per Month. It uses in the desalination of potable water. The purity is 100%

### Stage 2 – Silver ceramic filter:

Bacteria protozoa and microbial cysts are removed. However, filter is typically not effective against viruses since they are small enough to pass through the clean side of filter. Silver helps to kill or incapacitated bacteria and prevent the growth of mould and algae in the body of the filter. The supply ability is 10000 Piece/Pieces per Month thermocouple protection tube. It contains 99% of Alumina. The temperature is 1700 C

### Stage 3- UV Sterilizer:

It will kill all the biological impurities inside the water. The use is to control the infection by stopping the spread of microorganisms. The supply ability is 20000 Set/Sets per Month Top aqua UV sterilizer. The input voltage required is 110/220V 50Hz. The UV sterilizer working pressure is 8 bars.

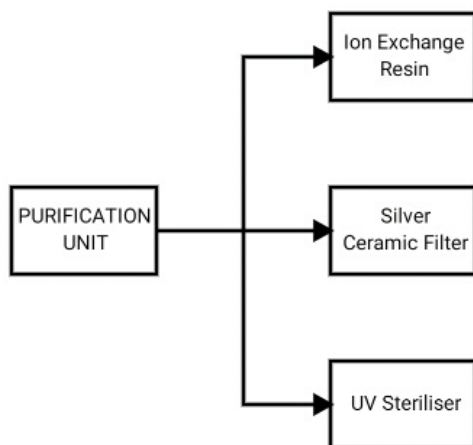


Figure 2. Purification Unit



Figure 3. Hardware Kit of Water Purification System

## III. CONCLUSION

Solar energy is used for purification of water. Pure and safe drinking water is the basic need of all the living beings. The contaminated water is the major problem of health hazards, to overcome this we can use the purifier which is solar operated as well as portable. Hence we end with the smart approach to get the drinking water with the optimum use of the renewable energy.

## IV. REFERENCES

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