



Portable Solar Based Water Purifier with Heating and Cooling effect

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ABSTRACT

In India there is a big problem of getting pure water. Our project is basically to purify water for drinking purpose which is based on ultrafiltration method along with cooling and heating effect based on Thermoelectric Peltier effect using Solar panel. In Peltier effect, a temperature difference created by applying a voltage between two electrodes which is connected to a plate of semiconductor material.

We have used Ultrafiltration (UF) method to purify water which is the most useful technique for water purification. In this method variety of membrane filtration is used which forces like pressure gradients that lead to a separation through a semipermeable membrane, for heating and cooling effect, we have used Peltier thermoelectric principle with a solar panel.

Our system is run by SolarSystem. As we have known that solar energy is a renewable source of energy and It does not affect the environment.

Keyword- Solar water purifier, Peltier effect, Ultrafiltration, Semipermeable membrane

INTRODUCTION

As we all known that water, basically pure water is an important thing for human life. By utilizing impure water there are various type of water-oriented dieses like diarrhoeapneumonia etc. happen to human, so it is right of every human to get pure water. There are various reason that a person can't get the pure water, like either purification cost is high, either lack of electricity, or geographical condition.

In spite of all the thing, we have made water purifier which initial cost is low to moderate but no running cost utilized, as there is very less moving part in the system. We are using solar energy to power up our water purifier. There are three stage purification method are using, categorized in two part as primary and secondary filter. As impure water having high number of TDS in value, which is not considerable for good human health, hence we achieved our required value of TDS by using this purifier, which is good for human health.

We are not just providing purified water but also, we added heating and cooling effect, which heat and cool pure water simultaneously as according to environmental condition or as our requirement. For doing this purpose we are using Peltier Module, which have certain properties who fulfills our requirement, and this property is also known as Peltier Effect. Peltier Module follows on Peltier thermoelectric Principal.



METHODOLOGY

To get the pure water firstly the water goes through primary filter, then goes through the secondary filter, and pure water collected to the reservoir, which go further for heating and cooling process.

Water Purification Method

There are three filter are using for purifying the water, Sediment filter, Activated Carbon Filter and Ultrafiltration (UF). Sediment filter removes the clay (sediment) and then this water from sediment filter goes to activated carbon filter, and the organic compound and chlorine ion get removed by activated carbon filter. Again, water enters to UF and it removes high molecular-weight substances, colloidal materials, and organic and inorganic polymeric molecules. Low molecular-weight organics and ions such as sodium, calcium, magnesium chloride, and sulphate are not removed. After circulating all the stages eventually, we get the pure water.

Pure water is collected in a reservoir which further sent for the heating and cooling process.

Heating and Cooling method

Peltier module is used for heating and cooling purpose. It is made of by jointing two conductors in between an array of semiconductor material are sandwiched. When we put the Peltier module in forward biased i.e. positive side are connected through p-junction, while negative side are connected through n-junction, then the flow of electrons occurs in upward direction. Hence at upper surface heat will be rejected due to electron concentration, (i.e. heating effect) and at lower surface heat will be absorbed from heat sink.

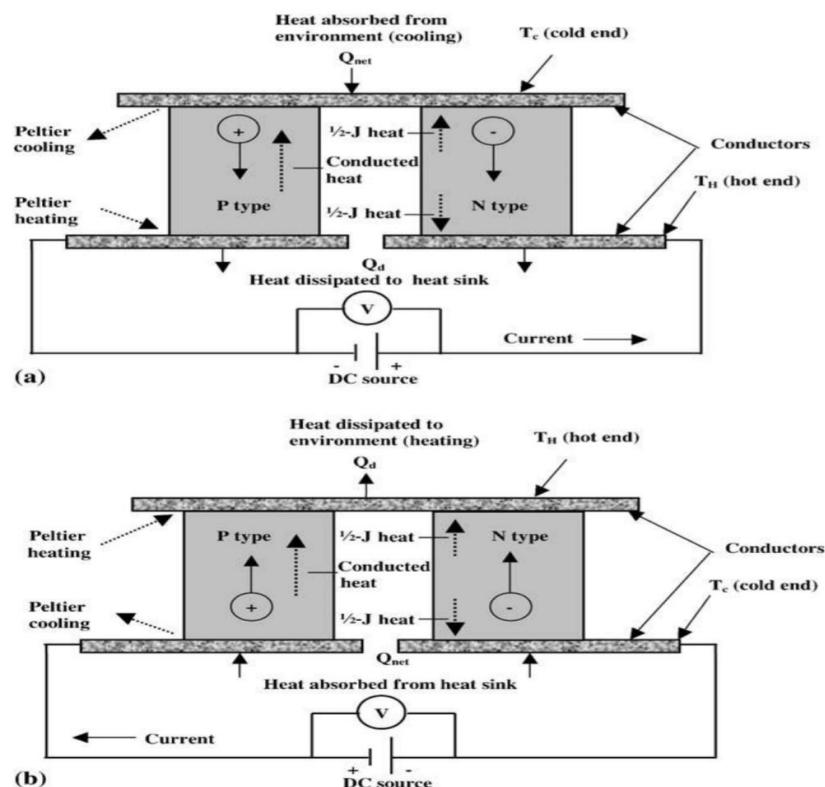


Fig. Schematic of thermoelectric module operation (a) cooling mode (b) heating mode



The Peltier module will be powered up by Solar panel, hence there will be no need of electricity.

EXPERIMENTAL SETUP

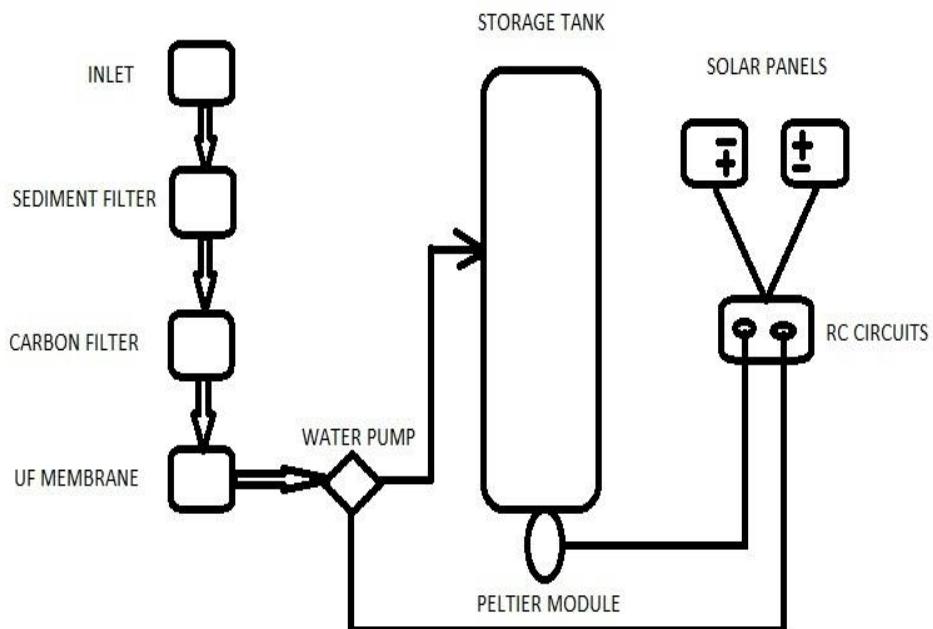


Figure- Line diagram of Solar based Water Purifier

This water purifier comprises two type of filter, namely

- 1- Primary filter
- 2- Secondary filter

In primary filter sediment filter are uses as a main filter. It is connected through in-late. Water firstly passes through sediment filter and lose large clay particle or sediment at outlet of primary filter. It does not remove organic, inorganic substances, and viruses, hence we need further purification.

Again, water goes through secondary filter, after passing through it we get the pure water at the reservoir. In secondary filter there are two filter we've utilized, activated carbon filter and ultrafiltration. Activated carbon filter removes chlorine and organic substances, while UF removes inorganic and organic both substances, as well as colloidal material.

After filtration we send the pure water for heating and cooling process, with the help of water pump. This will be done by Peltier module, both water pump and Peltier work with the help of solar energy and battery. RC circuit is used for controlling and regulating the components.



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ANALYSIS

Purification of Water

Water Used	Quantity (litter)	Time Required (minutes)	TDS value from primary filter		TDS value from secondary filter
			Before	After	
Normal Water	1	25	214	185	149
Colour Water	1	45	225	196	173
Mixing Water	1	35	450	399	215

1 Cooling

Water Supplied	Water Temperature °c(before cooling)	Temperature (°c) at different time interval		
		T= 15 min	T= 30 min	T= 45 min
1 lit.	32.8	31.2	29.7	25.3
2 lit.	34.3	31.4	28.1	26.2

2 Heating

Water Supplied	Water Temperature °c(before heating)	Temperature (°c) at different time interval		
		T= 15 min	T= 30 min	T= 45 min
1 lit.	32.7	35.7	36.9	38.4

CONCLUSION

Now a days, due to enhancement in technology various types of water purifier are available, some of them having low cost, some having high as well as involves running cost. So overall cost of a purifier during its whole life span becomes higher. The beautiful thing about this purifier that during the whole life span it having very low running cost, which can be negligible. This thing made this purifier more economical.

We achieved heating and cooling process at very low cost, comparatively other existing technology and also it is eco-friendly. Although Peltier have short life time hence somehow other heating and cooling devices dominated over it, but after analysing its power consuming capacity and other factors it will found that it is convenient for any heating and cooling process.



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