International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 06 Issue: 04 | Apr 2019 www.irjet.net p-ISSN: 2395-0072

Water Purifier using Peltier Module

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Abstract - *Present paper gives a picture of a conceptual design of smart water purification system using peltier module to achieve desired filtration of water. As energy demand increasing rapidly everyone necessitates appliances that use less amount of energy. Proposed model is based on peltier effect and uses peltier module (TEC1-12710) which exhibit heating on one side and cooling on other side plate depending upon supply voltage biasing. At heating side water will get heated up to necessity temperature so that all bacteria gets removed and after heating, at another side plate of peltier it will get cooled as per requirement by using less amount of energy which brings simplicity in the construction.*

***Key Words*:- Peltier module, Peltier effect, Heating, Cooling, etc.**

1. INTRODUCTION

The current scenario of power generation is inadequate as compared to demand. The consumption of power at domestic level mainly depends on heating and cooling appliances. So to overcome this problem, we have proposed and developed a model featuring both cooling and heating system with less power consumption. We know that semiconductor devices are more efficient in terms of power consumption. Peltier Module is the component which works on Peltier Effect. At and electrified junction of two different types of materials which act as pure conductor, then presence of heating and cooling is called Peltier Effect. Then one end of a metal bar becomes hotter or colder than the other, when supplied EMF between the two ends." In the market various processes and filters are available for filtering of water but by using these filters the required minerals in the water also gets removed which is harmful for body and health. By using this peltier heating we can heat the water so that the bacteria and germs present in the water gets removed and required minerals stays in the water.

Heat sink is used in both the compartments, so that the heating effect and cooling effect remains for longer time and do not neutralize each other. Peltier modules have specifications in terms of geometry, number of thermocouples, power rating, maximum voltage, current, maximum temperature difference. Many studies for improvement of module carried out are discussed in the section below and in future the limitations would get reduced, so making water filter based on Peltier module would surely contribute towards society growth.

2. BLOCK DIAGRAM & DESCRIPTION

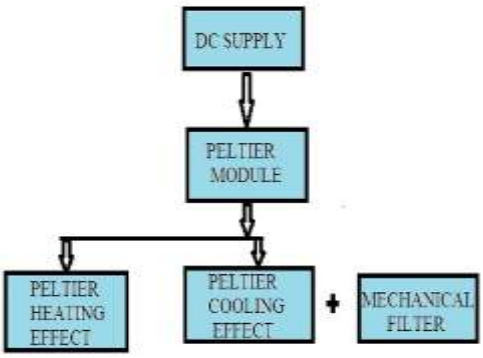

Fig.1 Block Diagram of model

A simple block diagram has been shown in Fig.1 which explains basic principle and working structure of whole model. A 12 V DC supply is fed to peltier module (TECI-12710) which exhibit two kind of temperature variation i.e. hot and cold.

2.1 Peltier Module

Both heating and cooling module could be generated through same peltier module which was used for actual modeling of circuit. Peltier module is a thermoelectric semiconductor device which works on the Peltier Effect.

According to this effect "If DC voltage is supplied to the junction of two different types of semiconductor material, then due to movement of positive and negative charge carriers' heat is transferred from one side to other side of module and because of this one side of module gets heated and other side gets cold.

In this model (TECI-12710) Peltier module has been used, it'screatedof2 semiconductors: Bismuth(Bi) and Tin(Sn), once DC voltage is applied across the junction of these semiconductors then few amount of heat is generated at the junction and this heat is known as Peltier heat and is also called Heat generated per unit time(H).

Two main factors on which heating and cooling effects depend and these are:-

1. Thermoelectric material
2. Point of contacts

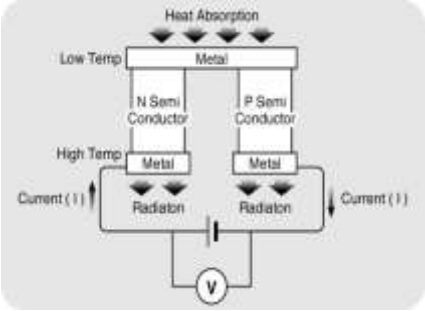

Fig.2 working principle of Peltier Module

Copper is used in this module because of its good conduction of heat. Heating and cooling in peltier is produces due to built in electrical contact, recombination of charge in space charge region & valence process.

Principle used to increase the heating efficiency of this model is given as follows:-

Peltier Heating Effect- Heat sink and exhaust fans are used to absorb the heat of peltier module and thermal paste is applied between heat sink and Peltier module for effective transfer of heat from Peltier module to heat sink. This heat is then dissipated into heating compartment for heating water.

3. EXPERIMENTAL SETUP AND OBSERVATIONS

Fig.3 Experimental setup for heating and cooling of water

Above fig. shows the setup of working module in which peltier module is mounted on heat sink. Heat sink is required for effective cooling; otherwise if heat is not removed simultaneously from module it will not produce willing output. As a part of heat extraction, 12 Volt DC operated fan is used.

The Peltier module used in this experiment has power ratings and efficiency of heating and cooling as mentioned below:-

Table-1 PELTIER MODULE SPECIFICATION

Module Used	TEC-12710
Input Voltage	12V, 2A DC
Heating Power	93^0C
Cooling Power	11^0C
Input Load	85 W

3.1 Experiment Result

Following graphs of heating and cooling shows the performance of TEC-12710 which shows the power consumed by this Peltier Module.

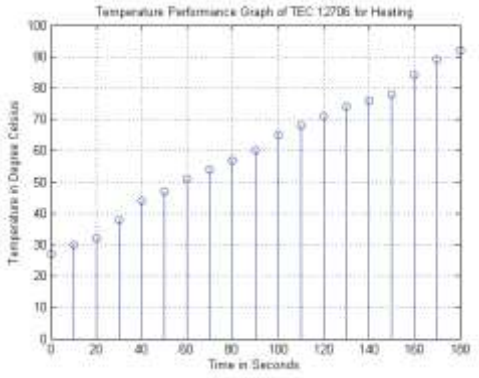

Fig.4 Performance graph of TEC-12710 for heating

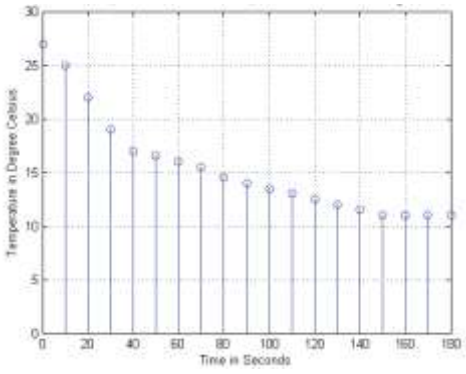

Fig.5 Performance graph of TEC-12710 for cooling

4. CONCLUSION

This paper explains the domestic application of Peltier effect which is used to reduce the power consumption for heating and cooling purpose in the water filtering. In this the Peltier module has been used and when we supply 12 V, 2A DC supply experimentally verifies the temperature performance according to the time. The peltier module is very good electronic component for power saving. It has very low power and high output. So In general life we can

use this device for water filtration because it is eco-friendly as it does not release any harmful gases like chlorofluorocarbon (CFC) as in conventional methods and removes only bacteria by keeping required minerals in the water itself.

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