# HARDNESS REDUCTION OF SEA WATER

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*Abstract :* As the world's population continues to grow, existing water supplies will become increasingly insufficient. As more and more water is required to meet mankind's needs, desalination of sea water will become an increasingly important source of useable water. Any comprehensive plan addressing mankind's energy usage or ecologic impact must account for the effect of desalination; responsible development requires attention to the most energy-efficient methods of purifying water. Proposed project involves hardness reduction of sea water using thermal distillation method with the help of peltier module for thermoelectric heating and cooling purpose. The software and hardware required to implement the hardness reduction unit are explained and its operation is described. Hardness reduction of sea water thus helps us to reduce the hardness of sea water and convert it into desalinated water with lesser consumption of power.

***IndexTerms – Peltier Module, SMPS, TDS-EC Meter, pH Meter.***

## I. INTRODUCTION

Many innovative technologies of desalination are working to reach the need of water of growing population. But to make it available in low price and less energy is a challenge. The fuel burning and petroleum spreads due to existing technologies and the effect of it on environment can't be neglected.

So to overcome this problem, we have proposed and developed a model featuring both cooling and heating system with less power consumption. Also the system is environment friendly. In this model we have used peltier module which is based on inverse of Seeback effect.

The objective of this paper is to present a model which helps us to fulfill the basic necessities of cooling and heating at domestic as well as industrial level by using peltier module for hardness reduction of sea-water.

The specific objectives that have to achieve that are as follows:

1. To develop a system for hardness reduction of sea-water.
2. To design system to avoid unnecessary power consumption.
3. To increase efficiency of the system.

## II. LITERATURE SURVEY

[1] Refrence1 explains the use of peltier module for heating and cooling purpose at domestical level. The module designed requires less amount of energy and hence can be used in areas with electricity scarcity. It is environment friendly, as it does'nt use fossil fuels or non-renewable energy resources and it does not release any harmful gases like chlorofluorocarbon (CFC) as in conventional methods.

[2] Refrence 2 explains that the water heater by magnetic induction is environment friendly,reliable and effective with innovative design. The heater's advantages and strengths that can be mentioned are: competitive and innovative design, water and electric energy saving system, it can be used in houses or hotels, generating comfort and benefits for the user. Its installation is relatively simple compared with its competence that works with gas, electricity or solar energy.

[3] Refrence3 Seawater desalination is becoming an attractive source of drinking water in coastal states as the costs for desalination declines. A prime consideration for seawater desalination is a source of feedwater that is reliable and consistent to sustain operations and produce potable water effectively and efficiently.

## III. PROBLEM STATEMENT:

To fulfill increasing water demand innovative technologies of desalination are taken place but despite this the energy requirements are still tremendous. The energy required can very significantly based on the type of desalination used as well as the initial salt content of the seawater. The amount of energy required for desalination depends on the initial salt content of the water. The cost need for the plant is also very high.

## IV. HARDWARE AND SOFTWARE DESCRIPTION:-

**1.Peltier device:-**


Thermoelectric cooling uses the Peltier effect to create a heat flux between the junction of two different types of materials. A Peltier cooler, heater, or thermoelectric heat pump is a solid-state active heat pump which transfers heat from one side of the device to the other, with consumption of electrical energy, depending on the direction of the current. Such an instrument is also called a Peltier device, Peltier heat pump, solid state refrigerator, or thermoelectric cooler (TEC).

**POWER RATING OF A PELTIER MODULE:-**

POWER = VOLTAGE X CURENT
= 12V * 6A

= 12V * 6A * 2 (Considering two Peltier's are been used one for heating and one for cooling chamber each)

= 144 WATT

- POWER= VOLTAGE X CURENT = 12V * 6A= 72 WATTS (for one peltier module)
  =72 WATTS X 24 HOURS

=1.728 Kwatt/hour x 30 days

= 51.84 Kwatt / month

**Cost of electricity per kWh. = 51.84 X 5/- = 259.2 /-**

**2. Switch Mode Power Supply:-**


SMPS is used to provide a constant supply voltage and current to both units i.e heating unit and cooling unit. The type of SMPS we are using gives 12V 10A that means the current rating and votage rating is 12V and 10A respectively. The peltier module requires constant power supply 12V 6A which is provided through SMPS.

**3.TDS METER,ELECTRICAL CONDUCTIVITY AND pH METER:-**


A TDS meter indicates the total dissolved solids (TDS) of a solution, i.e. the concentration of dissolved solid particles. Since dissolved ionized solids, such as salts and minerals, increase the conductivity of a solution, a **TDS meter measures** the conductivity of the solution and estimates the **TDS** from that reading.Dissolved ionized solids, such as salts and minerals, increase the electrical conductivity (EC) of a solution.The EC meter checks the electrical conductivity of the meter.

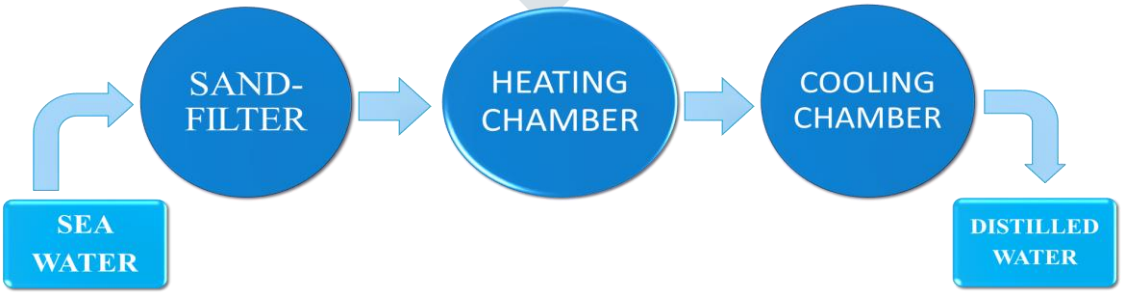
**Level of TDS parts per million (ppm) Rating**

- Between 50 – 150 Excellent (For everyone)
- 150 – 250 Good (for athletes)
- 250 – 300 Fair (Might be bad for kidneys)
- 300 – 500 Poor (Might be very bad for kidneys)
- Above 1,200 Unacceptable

A pH meter is a scientific instrument that measures the hydrogen-ion activity in water-based solutions, indicating its acidity or alkalinity expressed as Ph. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter".

**V. Methodology**

The basic structure of model contain 3 main units: sand filter, heating chamber and cooling chamber. While actual implementation of this model seawater is taken as input through pump and for large scale purposetwo more units are added named as screening, coagulation and flocculation. Screening can remove large particles like dead trees and coagulation and flocculation will help to remove small particles.




Sand filter-

We have implemented sand filter using 7 filter layers. The layers contain course sand, fine sand, pebbles, coal, alum, filter paper, cotton. Water pass through these 7 layers and we get clean water but as per our readings the salt content in the water remain same.

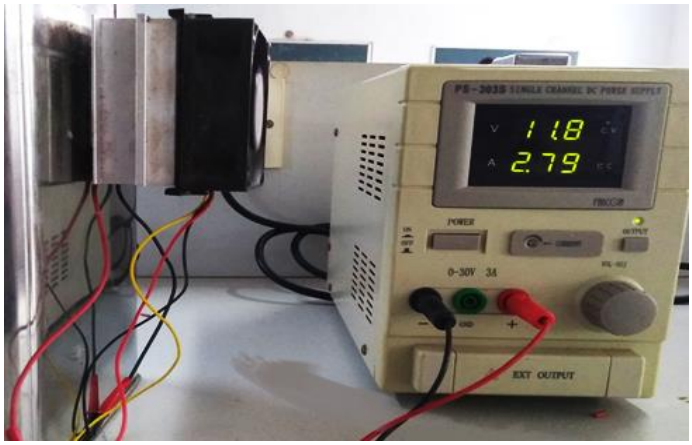
| | EC (CONDUCTIVITY) | HARDNESS ppm | pH |
|---|---|---|---|
| Sea water before filtration | 858 | 5429 | 7.8 |
| Sea water after filtration through sand filter | 858 | 5429 | 7.8 |

Heating chamber-

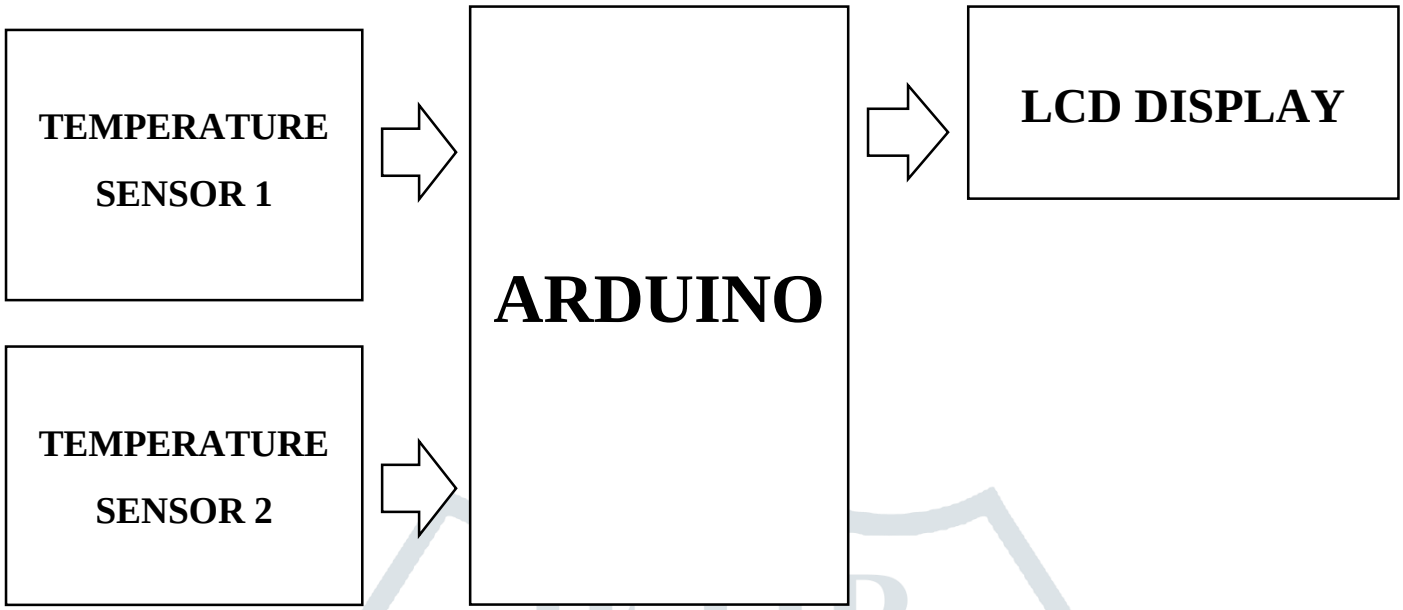
We have connected the peltier module at the base of the heating chamber. Container is made up of copper as copper spreads heat faster as compare to other metals. There should not be any insulation between metal surface and peltier module, so we have used strong adhesive which can withstand with heat. The power supply to the peltier module is given by SMPS. The proper arrangement is done to collect the water vapors via glass connector. Fitting of glass connector to chamber should be proper.After giving power supply water starts boiling in about 1 hour. Water vapors are travels through glass connector this glass connector is connected to cooling chamber by pipe.


Cooling chamber-

For cooling purpose we have to use heat sink. Hot side of peltier is connected to heat sink by same adhesive to prevent the module from damage. Cool side of unit is connected to cooling unit. Power supply to the peltier is given through the same SMPS. Water vapors traveling through the pipe gel cool in cooling chamber so as we gel distilled water as output.



**VI. SYSTEM OVERVIEW:-**




**VII. CONCLUSION**

This project work is an attempt to design an implement the hardness reduction of sea water using peltier module. As the world's population continues to grow, existing water supplies will become increasingly insufficient. As more and more water is required to meet mankind's needs, desalination of sea water will become an increasingly important source of useable water. Any comprehensive plan responsible for development of hardness reduction unit requires attention to the most energy-efficient method of purifying water. Benefits of this project are reduction of power and usability of it in any extreme environments or remote locations. This project also facilitates to monitor the electrical conductivity, total dissolved salts and ph of water.

**VIII. REFERENCES**

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