Purification of Water By Cooling I.C. Engines Using Scrap Materials

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Abstract- *The availability of drinking water is essential for the survival all of mankind. Adequate amount of water resources are available on our planet but very few of them can be used for the purpose of drinking. A number of water purification methods have been put forth by researchers to purify brackish water and sea water. As water purification processes require some sort of energy source. The main aim of this project is to purify any kind of water into pure water and in turn cools the I.C. engine, due to this about 25% of engine heat will be reduced and about 25% of the inlet water will get purified into pure water. So here we are making an attachment which can be easily fixed to all type of engines such as cars, bikes, etc. The main advantage of our project is it doesn't requires any external source to run the equipment, it does not need mechanical energy, electrical energy, and some man power energy, it requires only the waste heat from the engine which is unusable for any circumstance. Initially while the engine run's the heat is produced, in air cooled engines this heat is reduced by using fins, so that the contaminated water from the tank is allowed to flow through the copper tubes which is kept in between the fins of the engine, here we have used copper pipes because it has good thermal properties and the heat gets transferred to the water through the copper pipes so that the water gets converted into vapour. Again the vapour is transferred to Condensing chamber where the vapour get cooled so that the vapour will be converted into pure water which is collected in a Container. Here we have used the scrap materials obtained from the house hold utensils to complete the project.*

I. INTRODUCTION

1.1 GENERAL

Water purification is a relatively simple treatment of brackish (i.e. contain dissolved salts) water or sea water in to fresh water. Distillation is one of many processes that can be used for water purification and can use any type of thermal energy. In this process, water is evaporated; using the heat energy then the vapour condenses as pure water leaving behind the dissolved salts and dirt sediments. The most important natural resource in the world is water and the safe drinking water availability is a high priority issue for quality of life and human existence. In developing countries water-borne disease leads to millions of deaths and billions of illnesses annually. As water purification processes require some sort of energy source, and with the advent of renewable sources of energy utilization in various fields.

1.2 Water Purification Methods Already Exists

- Reverse Osmosis (RO)
- Solar stills
- Humidification de humidification (HDH) desalination technology
- Desalination Process

II. DESIGN PROCESS

2.1 Schematic Layout

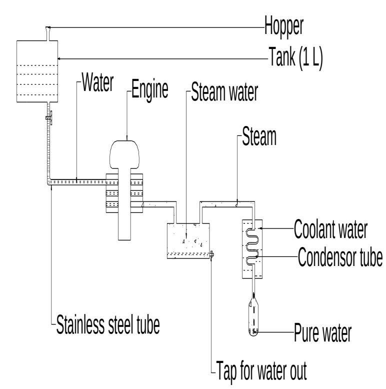

Fig 2.1: Schematic Sketch Of Water Purification System

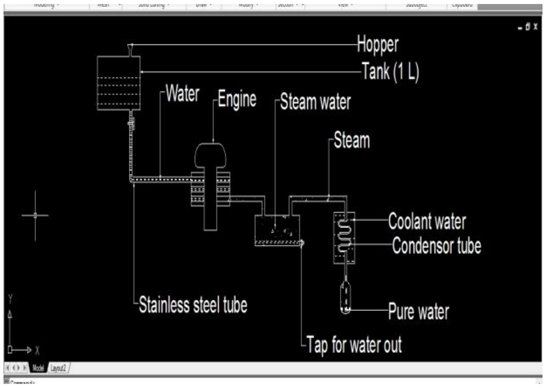

Fig 3.2: Schematic Sketch in AutoCAD 2010

2.2 Air-Cooling Effects of Fins on a Motorcycle Engine

Effects of the number of fins, fin pitch and wind velocity on air-cooling were investigated using experimental cylinders for an air-cooled engine of a motorcycle. Experimental cylinders that had a various number of fins and fin pitches were tested in a wind tunnel. Then the temperature inside of the cylinder, on the surface of the fins and in the space between the fins was measured. Results indicated that the heat release from the cylinder did not improve when the cylinder had more fins and too narrow a fin pitch at lower wind velocities, because it was difficult for the air to flow into the narrower space between the fins, so the temperature between them increased. We also obtained the expression of average fin surface heat transfer coefficient derived from the fin pitch and the wind velocity. This expression is useful for the fin design of an air-cooled cylinder.

The experimental equation for the fin surface heat transfer coefficient as follows:

$$\alpha=241.7\{0.024\,7-0.001\,48(h^{0.8}/p^{0.4})\}u^{0.73} \qquad (1)$$

where
α: Fin surface heat transfer coefficient [W/(m2·◦C)]
h: Fin length [mm]
p: Fin pitch [mm]
u: Wind velocity [km/h]
Equation (1) was developed using a copper cylinder at wind velocities from 32 to 97 km/h. However, it is not clear whether Eq. (1) can be applied with an aluminum cylinder at wind velocities of less than 32 km/h.
The experimental equation of the fin surface heat transfer coefficient as follows:

$$\alpha=2.11u^{0.71}\times s^{0.44}\times h^{-0.14} \qquad (2)$$

where
s: Fin separation at middle fin length [mm]

Equation (2) was developed using an aluminum cylinder at wind velocities from 7.2 to 72 km/h.

However, Equation (2) has less deviation with lower $u^{0.71}\times s^{0.44}\times h^{-0.14}$ but greater deviation with higher $u^{0.71}\times s^{0.44}\times h^{-0.14}$

2.2.1 Heat release from the cylinder

Cylinders a - m in Table 3.1 were used to measure heat release from the cylinder. Experiments were performed using the following steps. The experimental equipment in Fig. 3.3 was set and the cylinder was filled with 300 cm3 of heat storage liquid. The heat storage liquid was heated and the stirrer was operated. When the heat storage liquid reached a temperature of approximately 150◦C, the heater was turned off and removed. The temperature of the heat storage liquid decreased to 120ºC by cooling at room temperature. At 120◦C the wind tunnel was operated and the temperature was recorded. The temperature was recorded until it reached room temperature. Heat release from the cylinder was obtained by multiplying the mass and the heat capacity of the heat storage liquid by the difference between 120◦C and the temperature after 10 minutes from the start of recording, then dividing it by measurement time. The experiments were carried out at an ambient temperature of 13 ± 1◦C, because ambient temperature has a significant effect on temperature measurement of heat storage liquid. The wind velocity conditions were 0, 20, 40 and 60 km/h. The measured temperature was accurate to within ± 0.4◦C in this experiment. It is estimated that measured heat release was accurate to within ± 2%.

2.2.2 Heat transfer from the fins into the air

Cylinders n - q in Table 3.1 were used to measure heat transfer coefficient on the fin surface. In order to measure the temperature on the fin surface, junctions of K type thermocouple of 50 µm wire diameter were placed at distances of 5, 20 and 33mm from the fin root in radius and the windward angle of 0◦ (facing the oncoming air stream) to 180◦ with the

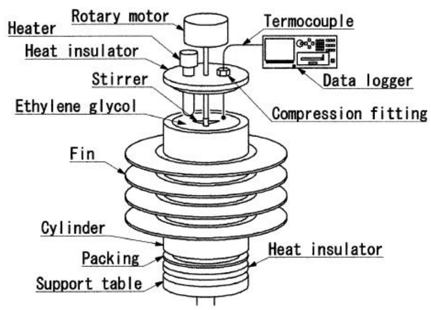

Fig 2.3: Measuring equipment for ethylene glycol temperature

Cylinder	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v
Pitch (mm)	/	/	7	10	15	20	7	10	15	20	7	10	15	7	10	15	20	7	8	10	15	20
Number of fins	0	1	2	2	2	2	6	6	6	6	16	11	7	3	3	3	3	9	8	7	5	4

Table 2.1: Specification of cylinders

equiangular spiral of 45◦ in circumference as shown in Fig. 3.4. In this case, the temperature on the fin surface was measured at fifteen positions on the center fin of three fins. Insulator covers were set not only at the top and bottom of the cylinder but also at a width of 30mm from both the top and bottom. A temperature controller was used to keep the heat storage liquid at a constant temperature. Experiments were carried out using the following

- The temperature of the heat storage liquid was maintained at 100◦C by the temperature controller, while the wind tunnel was operated.
- When the temperature on the fin surface became steady, it was recorded.

The local fin surface heat transfer coefficient was obtained by dividing the electric power supplied to the heater by the total surface area of the cylinder and the difference between the local temperature on the fin surface and the atmospheric temperature.

$$\alpha l = q/\{A(T1 - T2)\} \quad (3)$$

where,

αl: Local fin surface heat transfer coefficient [W/(m2 ·◦C)],

q: Electric power supplied to the heater [W],

A: Total surface area of cylinder [m2], $T1$: Local temperature on fin surface [◦C],

$T2$: Atmospheric temperature [◦C]

The loss of electric power supplied to the heater was examined in a preliminary experiment and it was compensated for when the local fin surface heat transfer coefficient was calculated. The experiments were carried out at wind velocities of 0, 20, 40 and 60 km/h. The measured temperature was accurate to within ±0.3◦C in this experiment. It is estimated that the local fin surface heat transfer coefficient was accurate to within ± 0.6% if the local heat flux was constant. However, we speculated that the local heat flux was not constant. Therefore, the local fin surface heat transfer coefficient became accurate to more than ±0.6%.

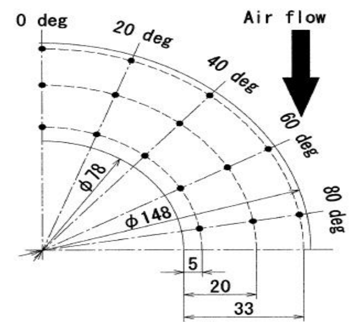

Fig 2.4: Thermocouple for measurement of temperature in space between fins

2.2.3 Temperature in the space between the fins

Figure 3.5 shows the temperature inside the cylinder and the average temperature between the fins for each fin pitch. The temperature inside the cylinder decreased with decreased fin pitch and increased number of fins for each wind velocity, except for the fin pitch of 7 mm. The temperature inside the cylinder with a fin pitch of 7mm is higher than that with a fin pitch of 8 mm. The temperature between the fins increased when the fin pitch decreased and the number of fins increased. The heat release from the cylinder increases because the fin surface area increases due to increasing the number of fins and decreasing the fin pitch from 20 to 8 mm. It appears that the heat release from the cylinder decreases because the temperature between the fins is even higher and the thermal boundary layers on the upper and lower fin surfaces overlap due to the increased number of fins, even with a decreased fin pitch from 8 to 7 mm.

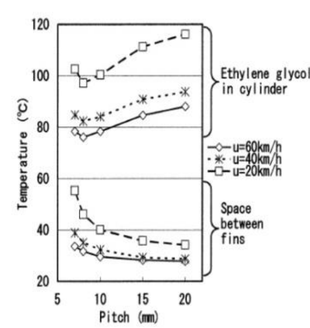

Fig 2.5: Effect of fin pitch on temperature of ethylene glycol in cylinder and space between fins

III. COMPONENTS USED

3.1 COPPER TUBE'S

Copper is a chemical element with symbol Cu (from Latin: *cuprum*) and atomic number 29. It is a soft, malleable, and ductile metal with very high thermal and electrical conductivity. A freshly exposed surface of pure copper has a reddish-orange color. Copper is used as a conductor of heat and electricity, as a building material, and as a constituent of various metal alloys, such as sterling silver used in jewelry, cupronickel used to make marine hardware and coins, and constantan used in strain gauges and thermocouples for temperature measurement.

3.1.1 Advantages of Copper Tube

Strong, long lasting, copper tube is the leading choice of modern contractors for plumbing, heating and cooling installations in all kinds of residential and commercial buildings. The primary reasons for this are:

- **Copper is economical.**

The combination of easy handling, forming and joining permits savings in installation time, material and overall costs. Long-term performance and reliability mean fewer callbacks, and that makes copper the ideal, cost-effective tubing material.

- **Copper is lightweight.**

Copper tube does not require the heavy thickness of ferrous or threaded pipe of the same internal diameter. This means copper costs less to transport, handles more easily and, when installed, takes less space.

- **Copper is formable.**

Because copper tube can be bent and formed, it is frequently possible to eliminate elbows and joints. Smooth bends permit the tube to follow contours and corners of almost any angle. With soft temper tube, particularly when used for renovation or modernization projects, much less wall and ceiling space is needed.

- **Copper is easy to join.**

Copper tube can be joined with capillary fittings. These fittings save material and make smooth, neat, strong and leak-proof joints. No extra thickness or weight is necessary to compensate for material removed by threading.

- **Copper is safe.**

Copper tube will not burn or support combustion or decompose to toxic gases. Therefore, it will not carry fire through floors, walls and ceilings. Volatile organic compounds are not required for installation.

- **Copper is dependable.**

Copper tube is manufactured to well-defined composition standards and marked with permanent identification so you know exactly what it is and who made it. It is accepted by virtually every plumbing code.

- **Copper is long-lasting.**

It has excellent resistance to corrosion and scaling, high mechanical strength, high-temperature resistance and lifetime resistance to UV degradation. Copper assures long, trouble-free service, which translates to satisfied customers and systems that last.

- **Copper is 100% recyclable.**

Copper stands alone as an engineering material that can be recycled over and over without degradation in content or properties. This combined with copper's proven durability means that no copper used in a building today needs to enter a landfill.

3.1.2 Fundamental Properties Of Copper

Atomic Number	29	Density @ 0 K	9021 kg/m^3
Atomic Weight	63.54	@ 0 °C	8934 kg/m^3
Isotopic Distribution	63 (69.09%)	Melting Point	1084.5 °C
	65 (30.91%)	Debye Temperature	
Atomic Diameter	2.551 x 10^{-10} m	@ 0 K	342 K
Electronic Structure	3d^{10} 4s	@ 0 °C	311 K
Valence States	2,1	Electrical Resistivity	(Ω·m)
Crystal Structure	Face-centered	@ 0 °C	1.545 x 10^{-8}
	cubic, Fm3m	Magnetic Susceptibility	(m^3/kg)
Lattice Spacing @ 0 K	3.6044 x 10^{-10} m	@ 4 K	-1.06 x 10^{-9}
@ 0°C	3.6149 x 10^{-10} m	@ 0 °C	-1.04 x 10^{-9}
Fermi Energy	7.0 eV	Elastic Constant	(Pa)
Fermi Surface	Spherical, with	@ 0 °C	
	necks at (111)	C^{11}	1.698 x 10^{11}
Open Orbits	(111) direction	C^{12}	1.224 x 10^{11}
Hall Coefficient	(m3/(A·s))	C^{44}	0.759 x 10^{11}
	-5.12 x 10^{-11}		

Table 3.1: Fundamental Properties Of Copper

3.2 CONDENSER

A condenser is a device or unit used to condense a substance from its gaseous to its liquid state, by cooling it. In so doing, the latent heat is given up by the substance and transferred to the surrounding environment. Condensers can be made according to numerous designs, and come in many sizes ranging from rather small (hand-held) to very large (industrial-scale units used in plant processes). For example, a refrigerator uses a condenser to get rid of heat extracted from the interior of the unit to the outside air. Condensers are used in air conditioning, industrial chemical processes such as distillation, steam power plants and other heat-exchange systems. Use of cooling water or surrounding air as the coolant is common in many condensers.

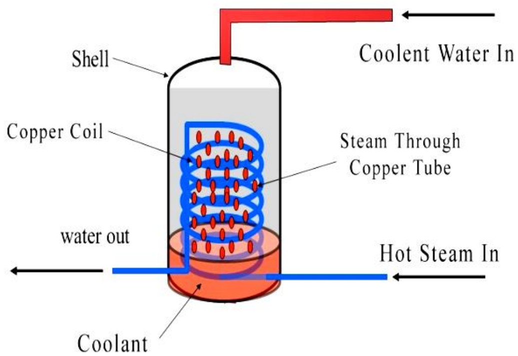

Fig 3.1 Working Of Condenser

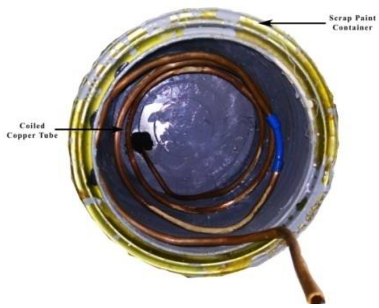

Fig 3.2: Fabricated Condenser Using Scrap

3.3 WATER BOTTLE

A water bottle is a container that is used to hold water, liquids or other beverages for consumption. A water bottle is usually made of plastic, glass, or metal. Water bottles are available in different shapes and colours. The Water bottle we used in our project as a storage tank for contaminated water is 1 Litre scrap bottle.

Fig 3.3: Water Bottle

3.4 DRIPS TUBE

It is a short, small plastic tube which has the fluid flow controller to control the flow of the fluid so that the flow of water from the bottle to the copper tubes will be adjusted and the required velocity of the flow is defined and used.

Fig 4.4: Drip Tube

3.5 STEAM CHAMBER

A Steam chamber is an enclosed space containing steam. It has an inlet port and outlet port for steam in and steam out. Here the steam can be stored so it's easy to transfer the steam from chamber to the condenser.

Fig 3.5: Fabricated Steam Chamber

3.6 ALUMINIUM FOIL SHEET

Aluminium foil (or aluminum foil), often referred to with the misnomer tin foil, is aluminium prepared in thin metal leaves with a thickness less than 0.2 mm (7.9 mils); thinner gauges down to 6 micrometres (0.24 mils) are also commonly used.[1] In the United States, foils are commonly gauged in thousandths of an inch or mils.

3.6.1 Properties

Aluminium foils thicker than 25 μm (1 mil) are impermeable to oxygen and water. Foils thinner than this become slightly permeable due to minute pinholes caused by the production process. Aluminium foil has a shiny side and a matte side. The shiny side is produced when the aluminium is rolled during the final pass. It is difficult to produce rollers with a gap fine

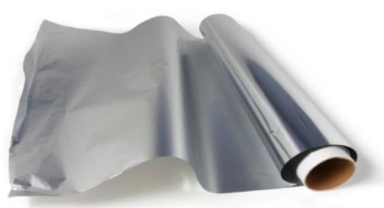

Fig 3.6 Aluminium Foil Sheet

enough to cope with the foil gauge, therefore, for the final pass, two sheets are rolled at the same time, doubling the thickness of the gauge at entry to the rollers. When the sheets are later separated, the inside surface is dull, and the outside surface is shiny. This difference in the finish has led to the perception that favouring a side has an effect when cooking. While many believe (wrongly) that the different properties keep heat out when wrapped with the shiny finish facing out, and keep heat in with the shiny finish facing inwards, the actual difference is imperceptible without instrumentation. Increased reflectivity decreases both absorption and emission of radiation. Foil may have a non-stick coating on only one side. The reflectivity of bright aluminium foil is 88% while dull embossed foil is about 80%.

3.7 VALVE

A valve is a device that regulates, directs or controls the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways. Valves are technically fittings, but are usually discussed as a separate category. Many valves are controlled manually with a handle attached to the stem. If the handle is turned ninety

Fig 3.7: Valve

valve. Valves are found in virtually every industrial process, including water and sewage processing, mining, power generation, processing of oil, gas and petroleum, food manufacturing, chemical and plastic manufacturing and many other fields.

IV. METHODOLOGY

4.1 THERMAL ANALYSIS OF SINGLE CYLINDER SI ENGINE

The energy transfer from the combustion chamber of an internal combustion engines are dissipate in three different ways. About 35 % of the fuel energy is converted into useful crankshaft work and about 30 % energy is expelled to the exhaust. About one third of the total heat generated during the combustion process must be transmitted from the combustion chamber through the cylinder walls and cylinder head to the atmosphere.

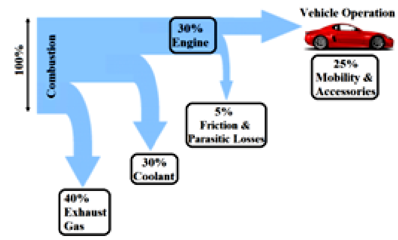

Fig 4.1: Typical energy path in internal combustion engine vehicle

4.1.1 Modes of Heat Transfer In IC engine

conduction: In this process heat is transferred by molecular motion through solids and through fluids at rest due to a temperature gradient. The heat transfer by conduction per unit area per unit time "q" in a steady situation is given by Fourier's law:

$$q = -K\nabla T$$

Heat transfer by convection in the inlet system is used to raise the temperature of the incoming charge. Heat is also transfer from the engine to the environment by convection process.

$$q = h_c (T - T_w)$$

The hypothesis of heat transfer due to radiation initiates from the concept of "black body". The heat flux from black body at temperature T1 to another at temperature T2 parallel to it across a space containing no absorbing material is given by:

$$q = \sigma (T_1^4 - T_2^4)$$

4.1.2 Heating the Manifolds

Intake manifold is the part of an IC engine that supplies the air-fuel mixture to the engine cylinder.

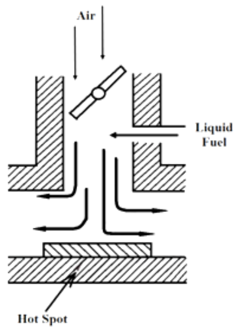

Fig 4.2: Air fuel intake system

Heat transfer by convection:

$$Q=hA(T_{wall}- T_{gas})$$

4.1.3 Heat Transfer in Combustion Chambers

During combustion process highest gas temperatures occur around the spark plug as shown in figure 5.3. During combustion process highest gas temperatures occur around the spark plug as shown in figure1.3 in this figure three hottest points identified the first one is exhaust valve, second is exhaust flow pipe and third is face of the piston which creates a critical heat transfer problem. The exhaust valve is very hot about 650 ºC because it is opening for hot exhaust gases, these hot gases liberated to atmosphere

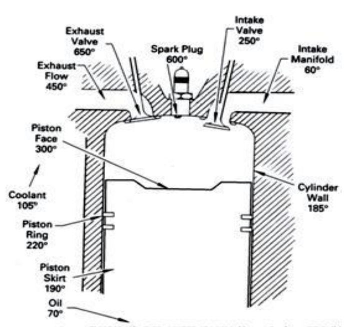

Fig 4.3: Temperature Distribution in Combustion Chambers

4.1.4 Temperature Distribution of Actual Engine Cylinder

Transient thermal analysis where performed on actual engine cylinder at 25^{o} C atmospheric temperature and result indicates the temperature distribution of actual engine cylinder the maximum temperature is 650^{o} C and minimum temperature is 92.091^{o} C.

Transient thermal analysis where performed for engine cylinder at the same atmospheric temperature as actual engine cylinder and the result indicates the Total Heat Flux the maximum value of total heat flux is 29.665 W/mm^2 and minimum total heat flux is 0.00353 W/mm^2

4.1.5 Mathematical Analysis

The purpose of fins in IC engine is to enhance convective heat transfer from engine. The primary purpose behind the operation of fins is to raise the effective heat transfer area from the surface. A balance of energy is performed on this element in which it is assumed that the element is at constant and uniform temperature of T.

Heat in to the left face = Heat out from the right face + Heat loss by convection

This yield

$$Q_x= Q_{x+\Delta x}+Q_{con}$$

After solving the above equation we got the general solution

$$\theta= C_1e^{-mx}+C_2e^{mx}$$

Where C1 and C2 are constant that can be determined from the boundary conditions.

Case I: The fin is very long and the temperature at the end of the fin is approach to the temperature of the surrounding $\boldsymbol{T_\infty}$.
Conductive heat transfer at the base of fin, according to Fourier's law

$$Q_{Fin} = kA\left(\frac{dT}{dx}\right)_{x=0}$$

$$Q_{Fin} = \sqrt{hpkA}\,(T_0 - T_\infty)$$

Case II: Fin Insulated at the tip

$$Q_{Fin} = \sqrt{hpkA}\,(T_0 - T_\infty)\tanh(ml)$$

Where $m= hPkA$

Case III: fin with heat losing at the tip/Heat losing from finite length of the fin

$$Q_{Fin} = \sqrt{hpkA}\,(T_0 - T_\infty)\left[\frac{\tanh(ml) + \dfrac{h}{km}}{1 + \dfrac{h}{km}\tanh(ml)}\right]$$

4.2 WATER TO STEAM FORMATION

Most mineral substances can exist in the three physical states (solid, liquid and vapor) which are referred to as phases. In the case of H2O (water), the terms ice, water and steam are used to denote the three phases respectively.

The specific combinations of atomic elements provide compound substances. One such compound is represented by the chemical formula H2O (water), having molecules made up of two atoms of Hydrogen and one atom of Oxygen.

4.2.1 Water

In the liquid phase, the molecules are free to move, but are still less than one molecular diameter apart due to mutual attraction and collisions occurring frequently. More heat increases molecular agitation and collision, raising the temperature of the liquid up to its boiling temperature.

Enthalpy of water = Water (liquid) enthalpy or sensible heat (normally denote as hf) of water.

This is the heat energy required to raise the temperature of water from a reference point of 0°C to its current temperature. At this reference of 0°C, the enthalpy of water has been arbitrarily set to zero. The enthalpy of all other states can then be identified, relative to this easily accessible reference state.

Sensible heat was the term once used, because the heat added to the water produced a change in temperature. This temperature could be sensed or measured, hence the term Sensible heat. However, the accepted terms these days are liquid enthalpy or enthalpy of water.

At atmospheric pressure (0 bar g), water boils at 100°C, and 100 kCal of energy are required to heat 1 kg of water from 0°C to its boiling temperature of 100°C. It is from these figures that the value for the specific heat capacity of water (cp) of 1.0 kCal/kg °C is derived for most calculations between 0°C and 100°C.

So the Specific Heat capacity of Water is the amount of energy/heat in Kilo calories, required to raise the temperature of One Kilogram of water by 1 Deg C.

4.2.2 Steam

As the temperature increases and the water approaches its boiling condition, some molecules attain enough kinetic energy to reach velocities that allow them to momentarily escape from the liquid into the space above the surface, before falling back into the liquid. Further heating causes greater excitation and the number of molecules with enough energy to leave the liquid increases. As the water is heated to its boiling point, bubbles of steam form within it and rise to break through the surface.

Considering the molecular arrangement of liquids and vapours, it is logical that the density of steam is much less than that of water, because the steam molecules are further apart from one another. The space immediately above the water surface thus becomes filled with less dense steam molecules.

When the number of molecules leaving the liquid surface is more than those re-entering, the water freely evaporates. At this point it has reached boiling point or its saturation temperature, as it is saturated with heat energy.

If the pressure remains constant, adding more heat does not cause the temperature to rise any further but causes the water to form saturated steam. The temperature of the boiling water and saturated steam within the same system is the same, but the heat energy per unit mass is much greater in the steam.

At atmospheric pressure the saturation temperature is 100°C. However, if the pressure is increased, this will allow the addition of more heat and an increase in temperature without a change of phase.

Therefore, increasing the pressure effectively increases both the enthalpy of water, and the saturation temperature. The relationship between the saturation temperature and the pressure is known as the steam saturation curve.

Water and Steam can co-exist at any pressure on this curve, both being at the saturation temperature. Steam at a condition above the saturation curve is known as superheated steam:

- Temperature above saturation temperature is called the degree of Superheat of the Steam.
- Water at a condition below the curve is called sub-saturated water.

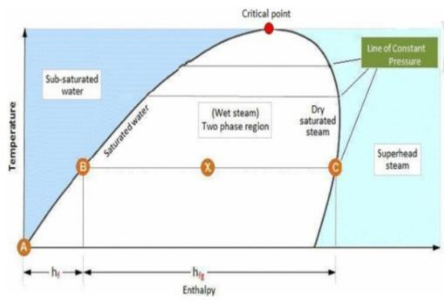

Fig 4.4: Steam Saturation Curve

If the steam is able to flow from the boiler at the same rate that it is produced, the addition of further heat simply increases the rate of production. If the steam is restrained from leaving the boiler, and the heat input rate is maintained, the energy flowing into the boiler will be greater than the energy flowing out. This excess energy raises the pressure, in turn allowing the saturation temperature to rise, as the temperature of saturated steam correlates to its pressure.

V. WORKING PROCEDURE

- Initially the uncontaminated a water is filled to the water storage tank which is provide by an outlet.
- The drip tube is connected to the outlet of the tank so that the water flow can be controlled.
- From the storage tank the water is allowed to flow through the copper tube which is fixed in between the fins of the engine.
- Thus the water inside the tube get heated and converted into water + vapour.
- The water + vapour is allowed to store in the storage tank from that tank has an vapour inlet and vapour outlet so that through the outlet port the vapour is allowed to flow through a condenser.
- Here the condenser we use is made up of scrap copper tube, the condenser is made by winding the copper tube into coil and kept inside a cylindrical paint box which is fully covered by the cold water.
- So that the vapour inside the condenser get condensed and converted into water.
- At last the water is collected in the fresh water storage tank.
- This process is repeated for many times to obtain 50% of fresh water from the inlet sea water.
- At last the remaining 25% of water is drained.
- So by using this method the engine can also be cooled.

This project can be used in all kind of engines and also it is applicable for compressor. In Thermal and Nuclear Power Plants the sea water is used for cooling the steam so there this filter can be used to purify the steam collected from the coolant that is sea water.

VI. RESULT AND DISCUSSION

6.1 WATER pH LEVEL

In general, a water with a pH < 7 is considered acidic and with a pH > 7 is considered basic. The normal range for pH in surface water systems is 6.5 to 8.5and for groundwater systems 6 to 8.5. Alkalinity is a measure of the capacity of the water to resists a change in pH that would tend to make the water more acidic.

Table 6.1: Water pH Level

0	7	14
Acidic	Neutral	Basic

6.1.1 pH of Common Liquids

Table 6.2: pH For Common Liquids

Vinegar	3.0
Wine	2.8 - 3.8
Beer	4 - 5
Milk	6.3 - 6.6
Seawater	8.3

This is important because the human body has a natural pH of 7.4. It needs this level to run efficiently and always seeks to return to this state, if it becomes overly acidic or alkaline, eating acidic foods can temporarily take the body out of balance.

6.2 WATER TEST RESULTS

6.2.1 Water Test Result For Sample 1

Table 6.3: Water Test result For Sample 1

	SL.NO.	BEFORE PURIFICATION (pH)	AFTER PURIFICATION (pH)
SAMPLE 1 (BORE WATER)	1	8.3	7.3
	2	8.3	7.25
	3	8.35	7.26
	AVERAGE	8.31	7.27

The pH level of the sample water before purification is 8.31 and after purification the pH value is reduced to 7.27.

6.2.2 Water Test Result For Sample 2

Table 6.4: Water Test result For Sample 2

	SL.NO.	BEFORE PURIFICATION (pH)	AFTER PURIFICATION (pH)
SAMPLE 2 (POND WATER)	1	7.9	7.17
	2	8	7.25
	3	7.95	7.36
	AVERAGE	7.95	7.26

The pH level of the sample water before purification is 7.95 and after purification the pH value is reduced to 7.26

VII. CONCLUSION

It is found that various methods are developed for distillation of water. These methods are subject to the demand of fresh water, quality of water source and the involved expense. Conventional Reverse Osmosis systems are currently prevalent domestically but at the cost of plenty of waste water. Non-conventional water purifiers like solar stills have unlimited potential but their usage is inadequate due to lesser output rate. So as a new innovation of our project the un contaminated water can be purified into pure water without any external source or supply at the same time the heat produced in the engine will also reduced due to the cooling effect of the water inside the copper tube. Here we have used copper tubes because copper is the only material with good thermal conductivity and corrosion resistance. Due to the corrosion resistant properties the tube won't get corroded by the salt or some other chemical content in the un contaminated water. As the project is fabricated and setuped in an Bajaj Discover 150 S and the results are tabulated above. The water obtained in this purifier is more purest and tested in lab for the pH value also the water is tasted by our teammates and confirmed that the water is pure. this method is very cheap and it's very easy to fit over the engines of all vehicles such as cars, bike, boats, etc.

VIII. FUTURE SCOPE

This Project Can be implemented in the following Place's

- Cars
- Air Compressors
- Boats
- Ships
- Thermal Power Plant
- Nuclear Power Plant

How it can be Implemented in the following place's?

Cars

In cars both the diesel and petrol engines have been used so during the combustion time the heat energy is produced so in cars for cooling the heat produced in the engine some cooling system is used. So that the coolant inside the system will get heated so to cool that coolant this system can be used which means the water can be purified.

Steam Power Plants

In steam power plants for cooling the steam sea water is used as the major source, so that during the cooling process the sea water get heated and small amount of water is converted into vapour so that vapour can be collected by an separate storage tank and by condensing the vapour its converted into fresh water.

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