



SODIUM CHLORIDE USED AS A PRIMARY COOLANT FOR AUTOMOBILE RADIATOR –A CASE STUDY

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Abstract: In water cooling system radiator is main part where the cooling of fluid takes place but in conventional cooling system radiator loses the heat by flowing through radiator hollow pipes and losing heat of coolant in atmosphere by convection and conduction. we know salt has a special quality to absorb large amount of heat. If we provide such an extra arrangement in which radiator heat is absorbed by radiator tank then we can use lower grade coolant and possibility of making it compact in size which allows us lesser compromising in design of vehicle with high efficient cooling system.,

Key words: - Radiator, coolant, sodium chloride, I c engine, Heat transfer enhancement

I. INTRODUCTION

In automobile engine the temperature of gases inside the engine cylinder may vary from 80 °C to 2300 °C during one cycle. If no external cooling is provided to engine and engine runs continuously at such a higher temperature than engine parts may get damaged due to expansion of parts due to heat. To avoid the damage of parts like piston, crankshaft, valve, piston ring etc. water cooling system is provided. In engine the cylinder wall and cylinder head are provided with the jackets through which the cooling liquid can circulate. The heat is transferred from cylinder walls to the liquid by convection and conduction. The liquid becomes heated a passage through the jacket and is itself controlled by the means of an air cooled radiator system. The heat from liquid in turn is transferred to the air.

Lossing of heat of coolant is done while coolant flowing through the hollow pipe from upper tank to lower tank. Now we are introducing radiator with sodium filled in both tanks for heat absorption of coolant. Sodium- air cooled radiator in which salt in upper tank and lower tank absorbs the some of degree Celsius heat of coolant in primary stage and the rest absorption of heat of coolant takes place same as in conventional a radiator. This extra arrangement in radiator increases the heat absorption capacity of radiator as heat is absorbed in tanks, also which is not happen in conventional radiator.

Salt has higher boiling point, it can absorb high quality heat to melt. The main purpose of using salt filled tank is to absorb heat of coolant from both tank and make it cooler during continuous operation of cooling.

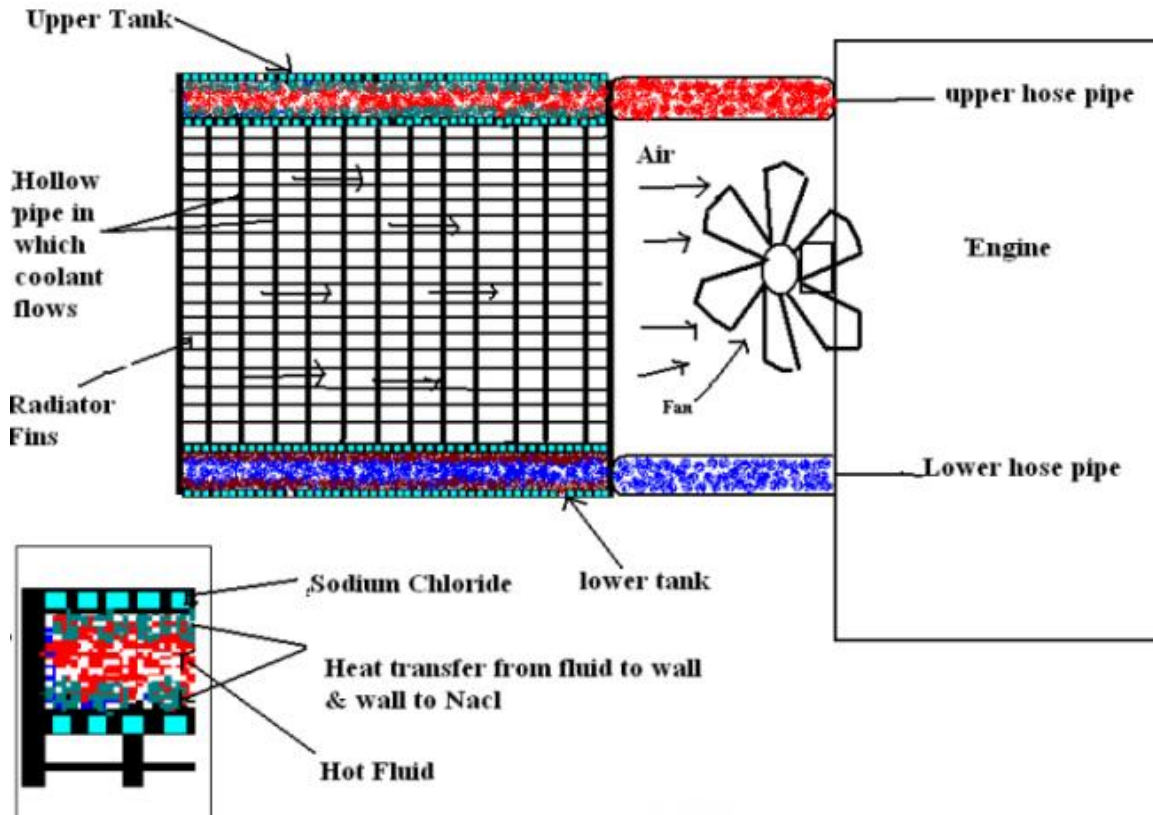
II. PHYSICAL PROPERTIES OF SALT

Sodium chloride is a crystal and it has high heat absorption quality because of its particular physical and chemical quality.

Salt has melting point about 750-800 °C at this temperature salt turns into liquid salt. And salt has higher boiling point near about 1400-1450 °C approx. at this temperature salt turns into a vapor as we can see salt can absorb tremendous amount of heat before it undergoes a phase change, turning from solid to liquid and liquid to vapor.

USE OF SODIUM: sodium is used as a heat exchanger in some of nuclear reactor and as a reagent in the chemical industry. But sodium salt has more uses.

III. EXPERIMENT SETUP



IV. HEAT TRANSFER AND TEMPERATURE DISTRIBUTION:

The transmission of heat per unit time from surface by convection is given by,

$$Q=hA(t_1-t_2) \quad (1)$$

Q=quantity of heat convective heat transferred

H=co-efficient of convective heat transfer

A=area of surface

(t_1-t_2) =temperature difference between the fluid and the surface.

The units of co-efficient of heat transfer are

$$h=Q/A (t_1-t_2) = w/m^2k \quad (2)$$

the co-efficient of convective heat transfer 'h' may be defined as the amount of heat transmitted for a unit temperature difference between the fluid and a unit area of surface in unit time. The value of 'h' depends on the types of fluid, their velocities and temperature, dimensions of the pipe. Since the 'h' depends upon several factors, it is difficult to frame a single equation to satisfy all the variations, however a dimensional analysis gives an equation for the purpose which is given as under

$$hD/k=c(\rho VD/\mu)^a (C_p\mu/k)^b (D/L)^c \quad (3)$$

$$Nu = Z (Re)^a (Pr)^b (D/L)^c \quad (4)$$

Nu=Nusselt number (hD/k)

Re=Reynold's number ($\rho V D/\mu$)

Pr=Prandtl number ($C_p \mu/k$)

(D/L)=Diameter to length ratio

C= a constant to be determined experimentally

C_p=Specific heat at constant pressure

K= Thermal Conductivity

P= Density

μ = Dynamic Viscosity

V= Velocity

V. RESULT AND DISCUSSION

In the conventional radiator both upper and lower tank is made of brass material. There is no cooling agent is provided in tanks. As the salt has special physical quality which is more heat absorption. We use salt in upper radiator tank and lower radiator tank while coolant comes to the upper tank by absorbing the heat of engine, heat transfer of coolant takes place by conduction and convection between the upper tank wall and coolant. Due to coolant heat, upper tank wall becomes hot and it transfer heat to salt and it reduces some of degree Celsius temperature of it. This same phenomenon happened in the lower tank of radiator. Sodium chloride has high heat absorbing quality we use it in radiator tank In this sodium air radiator and we provided two extra places where coolant loses heat than the normal radiator. Sodium air cooled radiator provided three ways cooling of coolant and make it to absorb more heat from engine. This provides more cooling effect to engine than the normal radiator does.

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