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Electrolysis Air Cooler

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***Abstract*: Air conditioning is a rightful solution for the increasing of atmospheric temperature, know a days it done successfully. But air conditioning is costly and it cannot be affordable for common man due to its high capital cost and running cost, but air conditioning is necessary for the comfort of living beings. For we find a solution for this cost effect problem of air conditioning. We are presenting an air cooling system that works under electrolysis. Electrolysis air cooling is a new age air cooling system that works purely by principle of water electrolysis. In electrolysis air cooling the main parts are blower, copper electrode (anode), galvanized iron sheet (cathode), 12v dc power supply, air pump. galvanized iron sheet is fabricated to a box shape and used as cathode and copper plate is used as anode. And water mixed up with any electrolyte (salt, acid or alkali). when a potential difference occurs in between this experimental setup electrolysis happened and water split up into hydrogen and oxygen, for this action an amount of heat is absorbed from the atmosphere this results a cooling effect inside the system, air inside system gets cooled. And this cooled air get pumped out from the system by means of a blower provided at the top of the apparatus. This induced the decrease in the atmospheric temperature and atmosphere get cooled, moreover it gives comfort to living beings.**

Keywords: **New Technology, Electrolysis Air Cooling System.**

1. INTRODUCTION

Atmospheric temperature of the earth is increases day by day. Due to ozone layer depletion and global warming makes the crust temperature of earth un-habitable. An optimum solution for this adverse effect is find a solution for the prevention of ozone layer depletion and global warming, but it is not possible that most of the world countries are under developing, hence prevention of such activities not possible. Part wise conditioning is only possible. Evaporative cooling is based on a physical phenomenon in which evaporation of a liquid into surrounding air cools an object or a liquid in contact with it. As the liquid turns to a gas, the phase change absorbs heat. Water is an excellent coolant because it is plentiful, non-toxic, and evaporates easily in most climates. The concept, was refined, became the evaporative coolers which will provide a low-cost, alternative to refrigerated air conditioning. Fresh outside air is pulled through moist pads where it is cooled by evaporation and circulated through a house or building by a large blower.

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2. ELECTROLYSIS AIR COOLING

Electrolysis is an electrochemical process in which electrical energy is the driving force of chemical reactions. Substances are decomposed, by passing a current through them. As mentioned before, water is decomposed to hydrogen and oxygen, by passing a current through it in the presence of suitable substances, called electrolytes. Electric current causes positively

charged hydrogen ions to migrate to the negatively charged cathode, where a reduction takes place in order to form hydrogen atoms. The atoms formed then combine to form gaseous hydrogen molecules (H2). On the other hand, oxygen is formed at the other electrode (the positively charged anode). Electrochemical processes are primarily utilized for chemical production (e.g., chlorine, aluminum, copper) and for electrical power generation (e.g., batteries and fuel cells). In addition, electrochemical systems have the potential of producing cooling effects in various ways, due to the strong coupling of electrochemical processes to pressure generation and thermal processes.

Electrochemical cooling systems could potentially be used in any area that utilizes cooling and also in refrigeration. Electrochemical reactions are a novel route to controlling the thermodynamic state of the working substance and could have several advantages over other cooling systems in current use or development, including vapor compression, absorption, thermoelectric, thermo acoustics, magnetic, or thermionic emission. One unique feature of electrochemical systems is the ability to operate with very few or no moving parts, a distinct advantage in electronics cooling. Electrochemical systems also have a different set of design constraints and therefore allow new physical configurations. For instance, the bulky compressor and evaporator compartments in refrigerators could be eliminated and replaced with thin reactors lining the walls or shelving.]

3. WORKING PRINCIPLE

Actually electrolysis air cooler works by the principle of splitting the H2O bond and during the time of this dissociation the energy given to the electrodes along with the energy from the atmosphere is used to break the bond of H2O. During the time it needs lots of energy to break the bond. This energy is supplied by the atmosphere and the 12 volt dc battery. Thus the process is enhanced and atmosphere or environment of the comes to a lower atmosphere. Electrolysis an endothermic reaction, Endothermic process describes a process or reaction in which the system absorbs energy from its surroundings. The intended sense is that of a reaction that depends on absorbing heat if it is to proceed.

The basic principle behind air cooling is described as below

Atom + Atom→ Molecule + Energy (Exothermic reaction)

Molecule $\xrightarrow{\text{energy}}$ Atom + Atom (Endothermic reaction)

This energy shown to dissociate this molecule will be the energy absorbed from the atmosphere and due to this process the atmosphere cools down. During electrolysis when direct current is applied to the electrodes the water molecules splits and hydrogen and oxygen are formed.

In a molecule of water (H2O), there are two hydrogen atom and one oxygen atom. When an electric current pass through the water the chemical bonds break the result is two positively charged hydrogen atom and one negatively charged oxygen atom.By using a copper anode and GI sheet cathode, and it is dip in a particular amount of water. DC voltage is applied to the water through the electrode. The positive terminal of the battery is connected to cu anode and negative terminal is connected to GI sheet cathode. The electrical resistance of pure water is very high. This resistance may be lowered chemically by adding either a salt (NaCl), an acid (HCl) or a base (KOH).

Direct current applied to water results in the following reaction:

$$2H_2O \longrightarrow 2H_2 + OH^-$$

Half as much oxygen as hydrogen is produced. Electrons are transfers from the anode to the cathode.

The reaction for alkaline electrolyte(KOH) at the anode is as follows.

$$4OH^- \longrightarrow O_2 + 2H_2O + 4e^-$$

The reaction at cathode is.

$$2H_2O + 4e^- \longrightarrow H2 + 2H_2O$$

The anode reaction is an oxidation reaction - free electrons are produced. The reaction at the cathode is a reduction reaction - free electrons are absorbed.

The reaction for an acid electrolyte such as hydrochloric acid (HCl) at the anode is given below.

$$2H_2O \longrightarrow O_2 + 4e^-$$

The reaction at cathode is.

$4H^+ + 4e^- \longrightarrow 2H_2^-$

An electrochemical reaction such as electrolysis of water is an endothermic reaction. An endothermic reaction is any chemical reaction that absorbs heat from its surroundings. Therefore in order to split water into hydrogen and oxygen, energy is required. This energy is absorbed by the system in the form of heat.

4. ENERGY CONSUMPTION FOR THE ELECTROLYSIS OF WATER

Electrolysis of water is defined as the chemical reaction, when electric power is given to the system through one positive and one negative electrode. The water is split into hydrogen and oxygen.

Enthalpy change (ΔH) of one mole of hydrogen at 25°C =**285.83** KJ/mole

1Mole of hydrogen = **18**gm water

For electrolysis of 1 g of water

Energy absorbed for complete dissociation of 1 gm of water = 285.83÷18 =**15.87944**KJ/g

15.87944 x 1000 = **15879.44**J/g

Energy absorbed for complete dissociation of water = **Energy From Electric Power +**

Energy From The Surrounding

By equation of power

P = E÷T = I×V

Where, t = 1 sec

I = input current in amperes

V = input voltage

Energy from electricity by using 12v 35 dc battery = 12V×35A= **420**J/s

Heat absorbed by 1 gm of water to reduce 1° C = **mCΔT**

Where m= mass of water

C = specific heat capacity of water.

ΔT = change in temperature.

Heat absorbed by 1 gm of water to reduce 1° C = **4.18 J**

Calculated time for 1gram of water to dissociate from electrical energy= **37.47** seconds.

From the above equations it is clear that in order to undergo electrolysis. The energy must be absorbed from the environment in the form of heat inorder to break the chemical bond of hydrogen atoms. The heat that is absorbed from the surroundings is actually absorbed from the hot air in the surroundings of the system. In this way the air in the surroundings will get cooled. By using this cooled air electrolysis air cooler is worked.

Since electrolysis is a endothermic reaction, endothermic process describes a process or reaction in which the system absorbs energy from its surroundings; usually, but not always, in the form of heat. The intended sense is that of a reaction that depends on absorbing heat if it is to proceed. The opposite of an endothermic process is an exothermic process, one that releases, "gives out" energy in the form of (usually, but not always) heat.The full energy analysis of a reaction is the Gibbs free energy(ΔG), which includes an entropy (ΔS) and temperature term in addition to the enthalpy. A reaction will be a spontaneous process at a certain temperature if the products have a lower Gibbs free energy (an exergonic reaction) even if the enthalpy of the products is higher

In addition, electrochemical systems might operate more efficiently and use less environmentally hazardous materials than conventional systems. The major objectives of this project are to investigate the use of existing electrochemical

theory for cooling process. This includes the conceptual development of possible techniques and initial modeling to assess their technical feasibility and performance. Some simple system were constructed and tested as proofs of concept.

5. DESIGN AND CONSTRUCTION

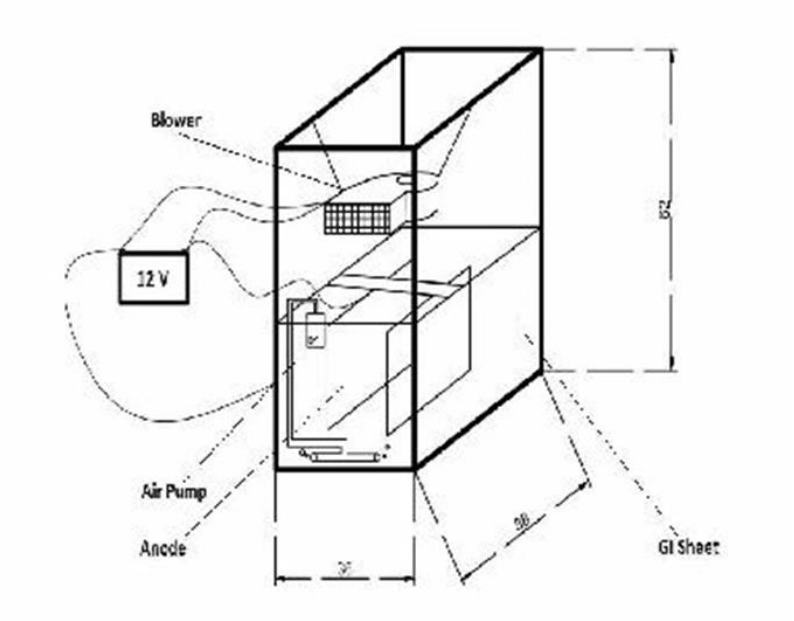

Fig 5.1 Schematic diagram of electrolysis air cooler

This is the schematic diagram showing electrolysis air cooler, constructional details of electrolysis air cooler is, it consist of exhaust skeleton fabricated of GI pipe square shape that gives provision for installing the experimental setup for the electrolysis. A GI sheet of 32x 34x 36 cm is fabricated as a square box, and a blower is fit in the top of the box with appropriate dimension that blower practically performed. Copper sheet used as anode where, GI as cathode. is installed in the GI box with correct dimension that required and one end is connected to the positive terminal of the battery 12v dc battery is used as the power source for the experimental setup. When we produced it commercially we can replaced it with appropriate power eliminator or using set down transformers and a extra device given to the experimental setup that an air pump which improve the cooling effect.

6. ASSEMBLY

All the parts required for assembling are moved to assembly unit on time, and an initial Cecking is done by the technical hand on charge of assembly unit. Assembling steps is as follows.

A: Make the skeleton by using GI pipe

B: Fix GI box at the bottom of the body.

C: Fix 2 copper plates at the center of this box.

D: Then a blower is arranged at the top of the body.

E: By using 12v battery is connected at the positive terminal of the blower and copper sheet.

F: Fix air pump at the bottom of the box

7. COST ANALYSIS

Costing is a system of accountings which accurately records expenditure in order to determine the cost of manufacturing a product. It is very much essential for efficient management of an enterprise. In order to compute the cost of each, the factors to be considered are. Material cost Direct and Indirect, Labor Cost, Direct and Indirect and Expenses. The product cost mainly depends upon the raw material cost. Estimating is done very carefully by considering all elements of production process.

TABLE 7.1: Cost Analysis

Sl No:	Materials	Required quantity		Total price (INR)
1	GALVANISED IRON AND COPPER SHEET SQUARTE PIPE FRAME	3/4 Sq. Ft		500/-
2	GI Pipe	4 Ft.		100/-
3	HYDRO CHLORIC ACID	50ml		80/-
4	BLOWER AND MOTOR	1		2000/-
5	BATTERY (35A ,12V)			1500/-
6	Welding and other works			1000/-
7	Transportation cost and others			900/-
	TOTAL			6080/-

8. RESULT AND ANALYSIS

Table 8.1analysis

Sl. No	Electrolyte used	Room temperature before cooling(^oC)	Cooling after 5 min (^oC)	Cooling after 10 min (^oC)	Cooling after 15 min (^oC)	Max cooling (^oC)
1	NACL	33.2 ^oC	29.9 ^oC	26.8 ^oC	25.3 ^oC	25 ^oC
2	KOH	33.2 ^oC	28.1 ^oC	26.3 ^oC	24 ^oC	24 ^oC
3	HCL	33.2 ^oC	28.3 ^oC	26.5^oC	24.3 ^oC	24.3 ^oC

Electrolysis of water by using 12V Dc battery and using copper electrode and GI electrode is done. For reducing the electrical resistance of the water various electrolytes are used. They are KOH, NaCl, HCL. By using these electrolytes electrolysis is performed on a particular amount of water and the cooling effect produced is analysed and it is tabulated as shown below.

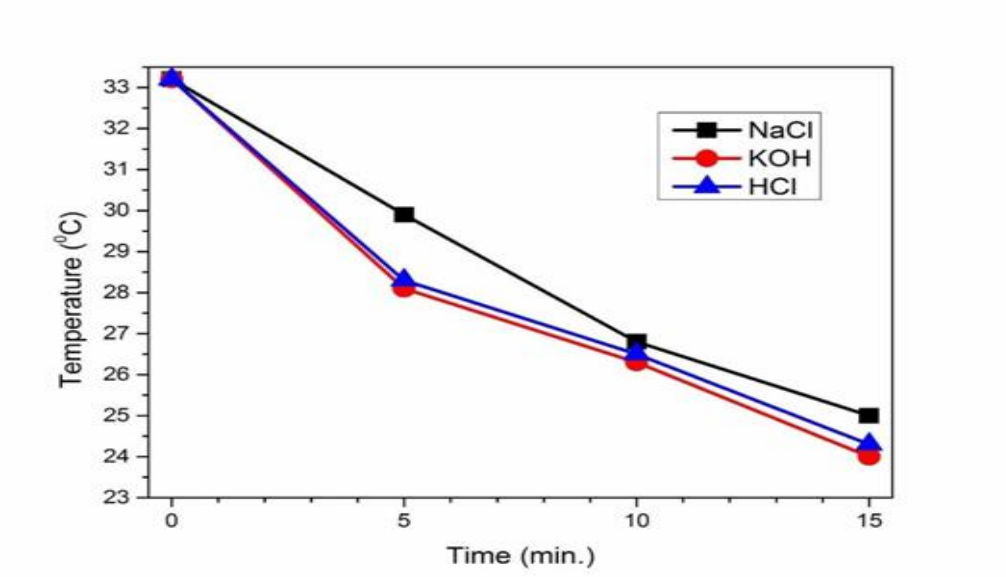

Fig 8.1 Graph between time and temperature

The graphical view of the cooling effect produced by using various electrolytes are shown in figure. The graph is plotted between temperature and time at X axis and Y axis respectively. The temperature before electrolysis is 33.2^{o}C. During electrolysis the temperature is reduced. Mainly three types of electrolytes are used for this experiment. These are KOH, NaCl, HCL. After electrolysis the temperature is reduced in 15 min. Comparing these these electrolytes KOH is the most efficient electrolyte. By using KOH maximum cooling effect will be obtained.

9. FUTURE SCOPE

Electrolysis air cooling is a latest technology of air cooling. During electrolysis of water energy is required for the dissociation of water into hydrogen and oxygen. Due to this some part of the energy is absorbed from the environment of the system, thus the surrounding air get cooled. This cooled air is drawn out through a blower to the required space. In evaporative air cooler when water is sprayed into the cooling pads. In order to the evaporation the water droplet latent heat of vapourization is given by the atmospheric air. In this way the atmospheric air gets cooled. In evaporative air cooler their is a pump which is used to spray water into the cooling pads. Blower is also used to circulating the air. Compare to electrolysis air cooling evaporative air cooling requires more moving parts and also as in case cooling by using electrolysis air cooler temperature can be reduced 6°C to 8°C from the room temperature. Electrochemical processes can be combined into thermodynamic cycles that can produce refrigeration. This method utilize the heat absorption and rejection associated with the entropy change of reaction that occurs as part of an electrically-driven chemical reaction. A fuel cell is a device which is used to produce electric current when hydrogen is given as a fuel. When hydrogen and the atmospheric air is combined in the presence of an electrolyte. Due to the flow of electrons current will produce. The reaction of hydrogen combines with oxygen is an exothermic reaction. Here energy is liberated from the system. This energy in the form of heat. There for when a fuel cell is working heat is liberated from the system. When both the electrolyser which produce cooling effect and the fuel cell which produce heating effect can be combined to produce a system which can be able to produce both cooling and heating effect and thus their is a scope to invent a new refrigeration system.

10. CONCLUSION

Electrolysis is a good cost effective air conditioning system that a common man can afford. Running and maintenance charge of the air cooler is less. Working of the air cooler is simpler that its energy comes from a 12 v dc supply and the base theory behind this air cooler is electrolysis. Because of these advantages we can conclude that electrolysis air cooler is good mean of cost effect air cooling system.

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