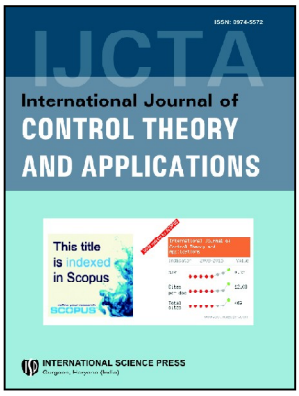

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Optimization of Materials and Refrigerants for Fin Tube Air Cooled Condenser Used in Ac

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Abstract: **Background:** The main objective is to design and implement the high-efficient warm change in an AC condenser. In systems involving warm exchange, a condenser is a system or unit used to reduce a material from its gaseous to its fluid condition, generally by chilling it. The hidden warm is given up by the material, and will exchange to the condenser coolant. **Methodology:** This document provides the growth and development of warmth exchange that happens in the condenser by modifying the coils material and also forecasts the heat efficiency of the condenser. Aluminium is selected as our content due to cheap, deterioration proof and good mach inability. Use of low cost Aluminium content coils will increase the efficiency of the condenser due to aspects such as the specific warm at continuous stress (Cp), overall warm exchange coefficient (U). **Findings:** Air cooled off condensers are used in little models like household appliances, deep freezers, standard water chillers, window air-conditioners, divided air-conditioners, little packed air-conditioners etc. These are used in vegetation where the chilling fill is little and the total volume of the refrigerant in the fridge pattern is little. Airs cooled off condensers are also called coils condensers as they are usually made of birdwatcher or Aluminium coils. Air cooled off condensers take up a larger space than standard water cooled off condensers. **Improvements:** In this papers warm exchange by convection in AC by different the chemicals are driven by CFD and heat research. The evaluation is out on an air-cooled pipe condenser of a fumes pressure pattern for air conditioner system. The materials considered for pipes are Copper and Aluminium materials 1060 and 1100. The chemicals different will be R 12, R 134 and R407C. CFD research is done to determine heat range submission and warm exchange rates by different the chemicals. Heat exchange research is done on the condenser to look at the better material.3D acting is done in Pro/Engineer and research is done in Analysis.

Key Words: Heat Transfer, Condenser, Copper, Aluminium Alloy, Refrigerant, Heat Flux, Condenser Design, Cost, Overall Heat Transfer Coefficient.

I. INTRODUCTION TO AIR CONDITIONER

An **air conditioner** (often referred to as **AC**) is a home appliance, system, or mechanism designed to dehumidify and extract heat from an area. The cooling is done using a simple refrigeration cycle. In construction, a complete system of heating, ventilation and air conditioning is referred to as "HVAC". Its purpose, in a building or an automobile, is to provide comfort during either hot or cold weather.

Air Conditioning System Basics and Theories

Refrigeration Cycle

In the refrigeration cycle, a heat pump transfers heat from a lower-temperature heat source into a higher-temperature heat sink. Heat would naturally flow in the opposite direction. This is the most common type of air conditioning. A refrigerator works in much the same way, as it pumps the heat out of the interior and into the room in which it stands.

Evaporative Coolers: In very dry climates, evaporative coolers, sometimes referred to as swamp coolers or desert coolers, are popular for improving comfort during hot weather. This type of cooler is the dominant cooler used in Iran, which has the largest number of these units of any country in the world, causing some to refer to these units as "Persian coolers." An evaporative cooler is a device that draws outside air through a wet pad, such as a large sponge soaked with water. The sensible heat of the incoming air, as measured by a dry bulb thermometer, is reduced. The total heat (sensible heat plus latent heat) of the entering air is unchanged. Some of the sensible heat of the entering air is converted to latent heat by the evaporation of water in the wet cooler pads. If the entering air is dry enough, the results can be quite comfortable; evaporative coolers tend to feel as if they are not working during times of high humidity, when there is not much dry air with which the coolers can work to make the air as cool as possible for dwelling occupants. Unlike air conditioners, evaporative coolers rely on the outside air to be channeled through cooler pads that cool the air before it reaches the inside of a house through its air duct system; this cooled outside air must be allowed to push the warmer air within the house out through an exhaust.

Introduction to Condenser A Condenser or evaporator is a heat exchanger, allowing condensation, by means of giving off, or taking in heat respectively.

The construction principle Refrigerant and air will be physically separated, at air conditioner condenser, and evaporator. Therefore, heat transfer occurs by means of conduction.

We would like the heat exchanger that enables these processes, to have,

- High conductivity– this property will ensure that the low temperature difference between the outside wall, and inside wall.
- High contact factor– this property ensures the passing air mass, will come in contact with the tubes, as much as possible

Conductivity in Air Conditioner Condenser and Evaporator

We have to understand the factors that affect conduction of a material. Let's assume a condition where the refrigerant is within the tube of an air conditioner condenser. The tube will have a circular wall.

Fourier 'slaw has stated that the rate of conduction heat transfer is proportional to,

- the thermal conductivity of the wall k W/m^2,
- the **mean** surface area, A m^2
- the **inverse** of the wall's thickness L in metres
- and the temperature difference between the inside wall, and the outside wall

Selection of the tube for the condenser and evaporator has to meet few other criteria as well. It has to be durable, difficult to oxidise, easy to join with other lengths of similar tube, good strength and cheap.

Water Cooled Condenser: Standard water is used to awesome down condensers. One technique is to awesome down condensers with water from the city the water and then fatigue water into the sewage after it has been used to awesome down the refrigerant. This technique can be expensive and, in some instances, is not permitted by law. When there is a sewage problem, a limited sewage treatment plant capacity, or famine, it is incorrect to use this chilling technique. The use of recirculation to awesome down water for recycling is more practical. However, in recirculation, the power required to function water to the chilling location is part of the price of working the unit. There are three kinds of water-cooled condensers.

They are:

- The double tube
- The spend and coil
- The spend and pipe types

II. LITERATURE REVIEW

Balaji N *et al*. [1] The majority of the study focused large fridges. But in this paper talks about the single divided air conditioner program using instead of air chilling using liquid centered chilling. The coolant used in the heat exchanger genuine ethylene glycerin. Compare the trial results value of current program with new customized program. The air compressor operating here we are at the genuine ethylene glycerin centered air conditioner product is less than the current program. The compressor's operating time is reduced from 44 moments 30 a few moments to 33 moments and 4 a few moments. The required indoor temperature of 18°C is reached in 11 moments 26seconds earlier. It is evident that plenty of your time taken for chilling by the customized product is 25.69% less than that of the current divided air condition program. Timetaken for chilling reduces instantly improve the efficiency of the air conditioner program.

III. 3D MODELING OF CONDENSER

The model is designed from based on journal of plate-fin-and-tube condenser performance and design for refrigerant r-410a air-conditioner shown in following figure s with feasible conditions.

CFD ANALYSIS FOR CONDENSER

Save Creo Model as .iges format

→ Analysis → Workbench → Select analysis system → Fluid Flow (Fluent) → double click

→ → Select geometry → right click → import geometry → select browse → open part → ok

→ → Select mesh on work bench → right click → edit

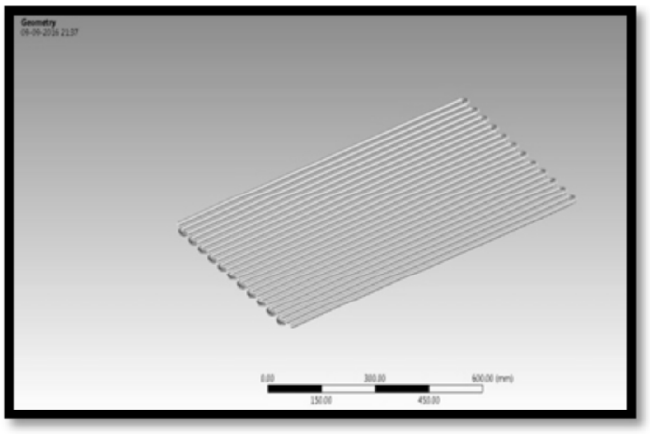
Select mesh on left side part tree → right click → generate mesh →

IV. THERMAL ANALYSIS

Note: Input for thermal analysis are taken from above CFD results

Material – Aluminium 1060 Fluid - R12 Open work bench 14.5>select **steady state thermal** in analysis systems>select geometry>right click on the geometry>import geometry>select **IGES** file>open

Imported model



Aluminium 1060 Material Properties

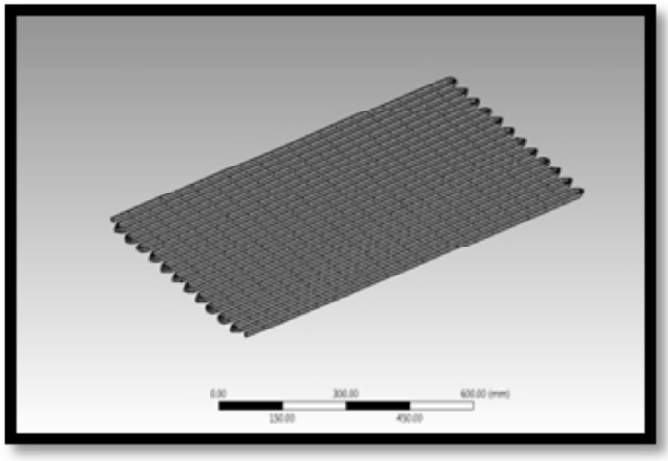
Thermal conductivity of Aluminium = 15.1W/mk

Specific heat =356J/Kg K

Density = 0.00000412 Kg/mm^3

Model >right click>edit>select generate mesh

Meshed model



Boundary conditions

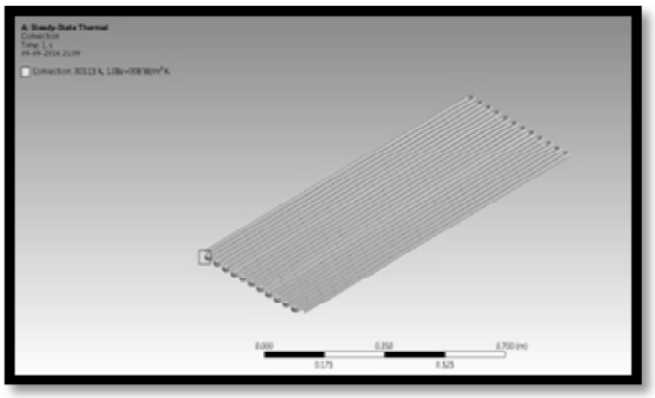
Select steady state thermal >right click>insert>

Select steady state thermal >right click>insert>select heat flux

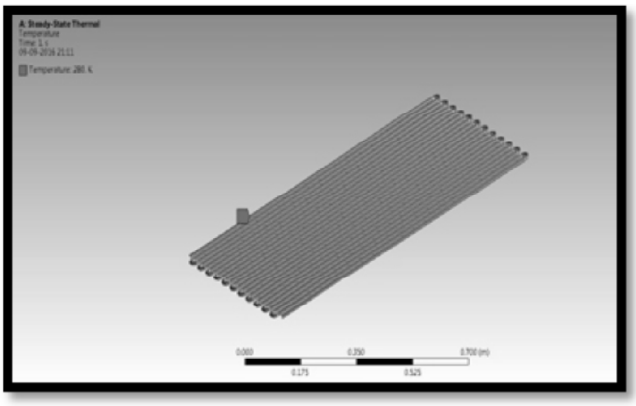
Select steady state thermal >right click>solve

Solution>right click on solution>insert>select temperature

Convection



Temperature



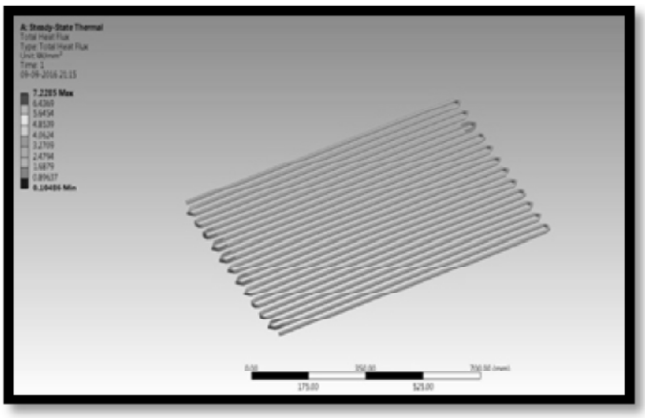
Material –Aluminium 1100 Fluid - R12

Thermal conductivity of Aluminium = 59.1W/mK

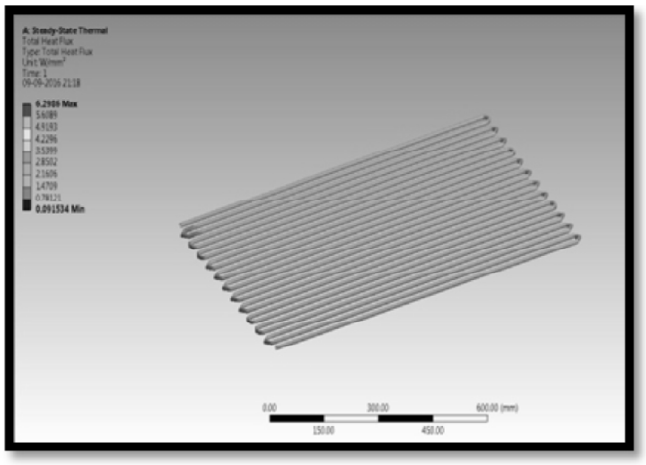
Specific heat =421 J/Kg K

Density = 0.00000771Kg/mm^3

Heat flux

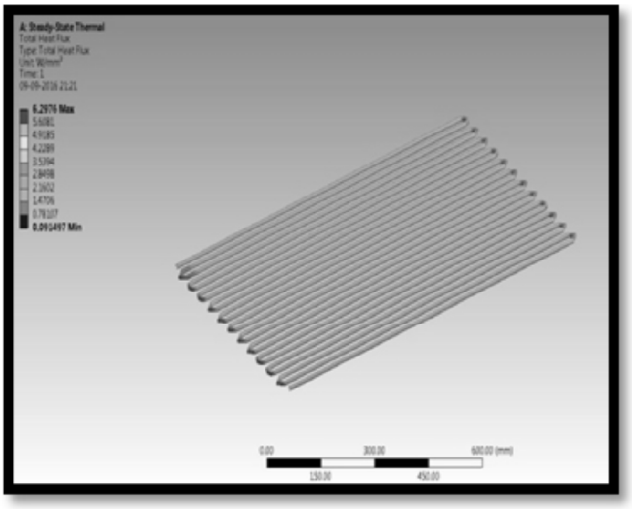


Fluid - R134A Heat flux



Fluid - R407c

Heat flux



V. RESULTS AND DISCUSSION

Air cooled off standard water Refrigerator analyze is carried out to find out the condenser efficiency factors by changing condenser coil content Cu to Al. The research is carried out on two models of condenser of Cu and Al pipe condenser at same input factors to analyze the difference in the performance parameters.

Figure 8 reveals the difference in condenser air outlet temperature. When the refrigerant moves through the circuit and the ventilation over the pipe, then warm is moved from refrigerant to air, eventually the air warm range improves. The warm exchange amount from refrigerant to air is same for both condensers. It seems that, air store warm range of birdwatcher as well as Aluminium pipe condenser is same.

Figure 9 demonstrates the overall warm exchange coefficient of the Aluminium pipe condenser is less than birdwatcher pipe condenser which is approximately regarded as same. Therefore for same potential of condenser, area need for both bird watcher as well as aluminium pipe condenser is same.

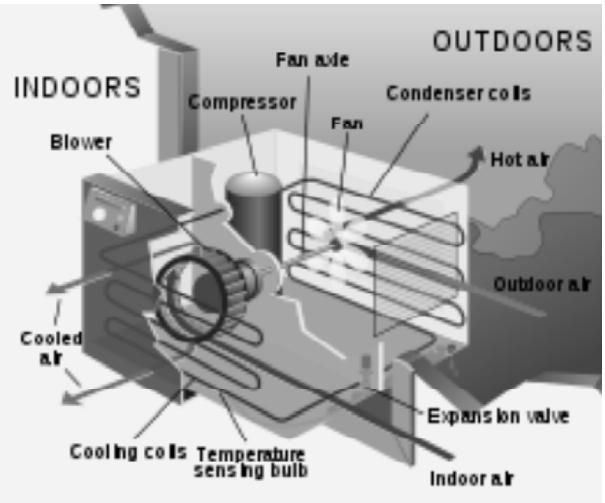


Figure 1: A typical home air conditioning unit

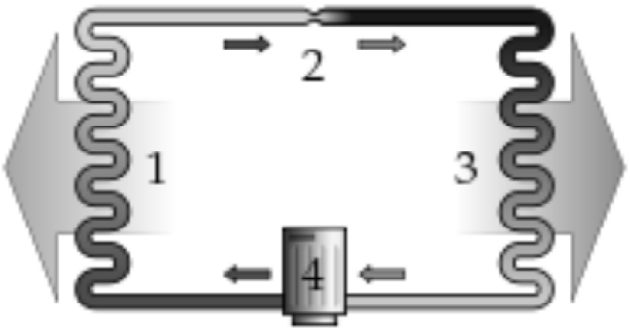


Figure 2: A simple stylized diagram of the refrigeration cycle: 1) condensing coil, 2) expansion valve, 3) evaporator coil, 4) compressor

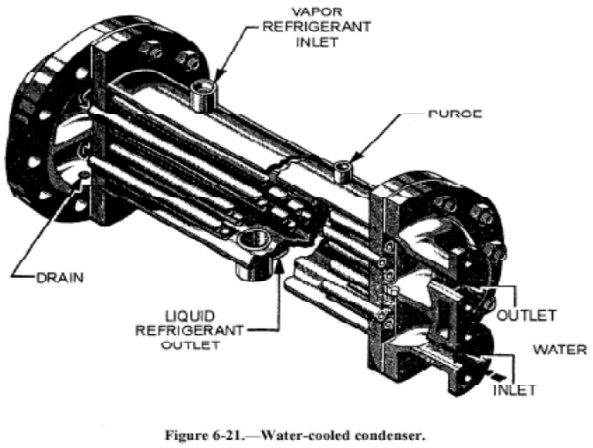


Figure 3: Design of water cooled refrigerant work

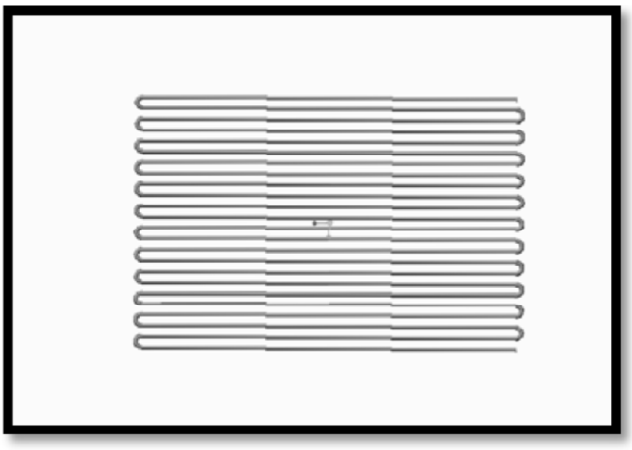


Figure 4: 3D Model

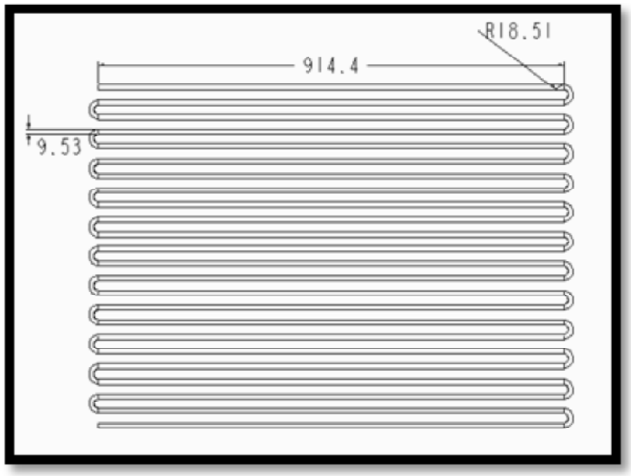


Figure 5: 2D Drafting

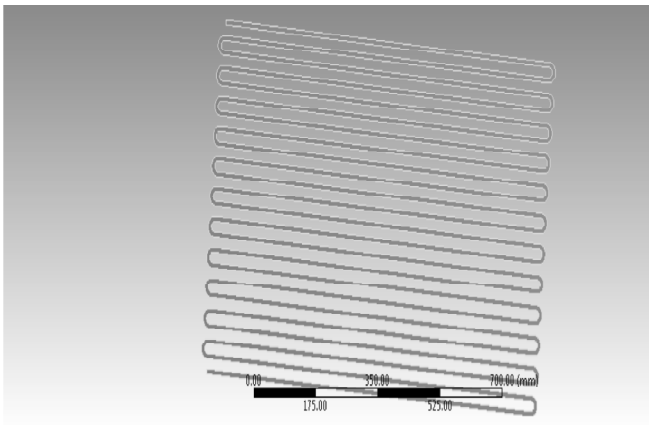


Figure 6: Imported model from Creo 2.0

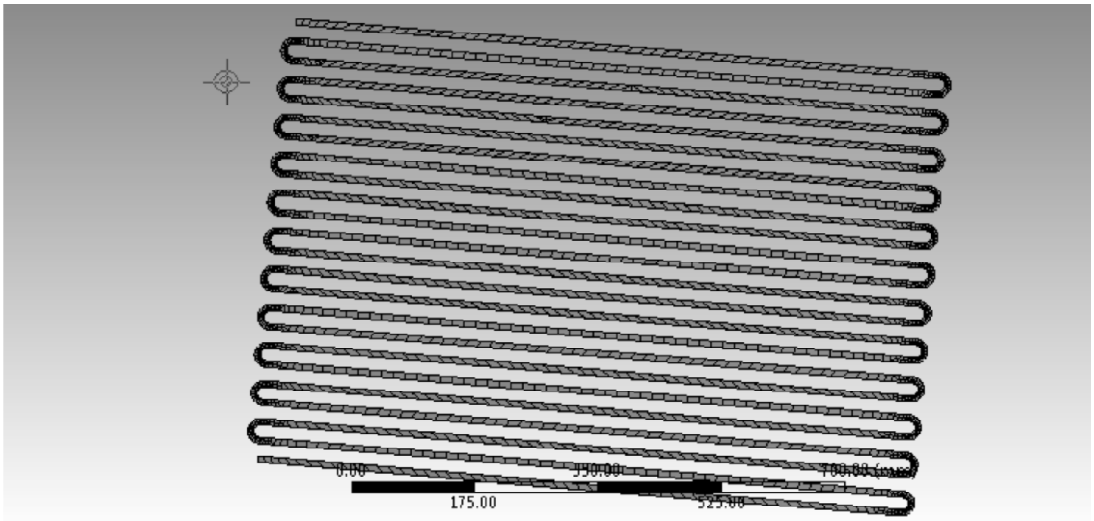


Figure 7: Meshed Model

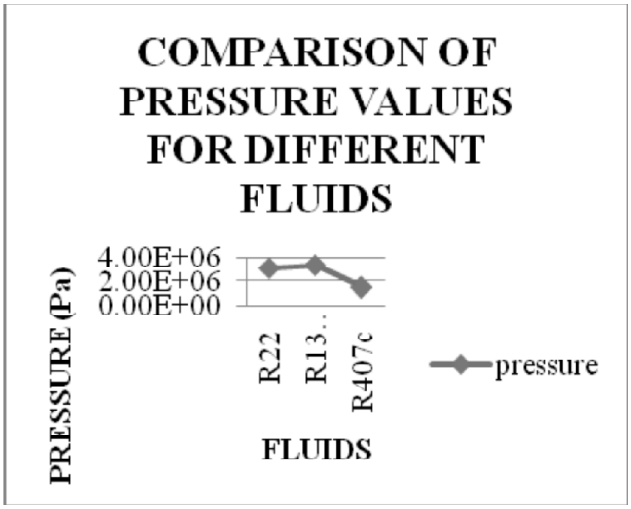


Figure 8: Outlier of condenser with respect to pressure

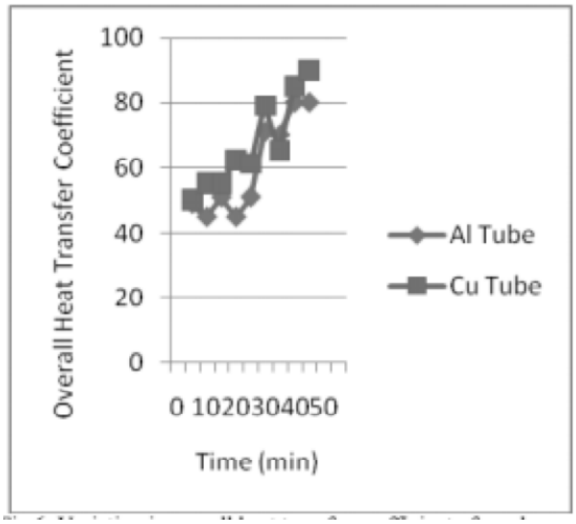


Figure 9: Variation in overall heat transfer coefficient of condensers

As the time increases the air store warm range reduces because the load (water temperature) on the program decreases. By paying attention to regarding the problem of price of condenser and efficiency evaluation of Cu and Al tube condenser, the price of birdwatcher is three periods more than the Aluminium. So at same C.O.P. it is possible to restore the Cu to Al pipes. By this pipe alternative, the sum complete of condenser is reduced.

VI. CONCLUSION

In this paper warm exchange by convection in AC by different the chemicals are determined by CFD and heat research. The assessment is out on an air-cooled tube condenser of a fumes compression cycle for air conditioning system. The materials considered for tubes are Birdwatcher and Aluminium materials 1060 and 1100. The chemicals varied will be R 12, R 134 and R407C. CFD research is done to determine temperature distribution and also warm exchange rates by different the chemicals. Heat exchange research is done on the condenser to evaluate the better content. By monitoring CFD research outcomes, warm exchange coefficient is more when

R134A is used and also warm exchange rates are more when R12 is used than other fluids. By monitoring heat research outcomes, warm flux is more when R12 is used and when content Birdwatcher is used. (i.e) the warm exchange rates are more when fluid R134A and content Birdwatcher is used.

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