ISSN : 2455-9679
Impact Factor : 3.805

IJRTSM

INTERNATIONAL JOURNAL OF RECENT TECHNOLOGY SCIENCE & MANAGEMENT

"A CASH STUDY ON EARTH-TO-AIR HEAT EXCHANGER FOR AIR COOLING IN BUILDING"

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ABSTRACT

This CFD survey tests the performance of the world tube device with and while not fin for various material .After going CFD analysis through the comparison charts shown within the above, we will see that the results are quite encouraging. The impact of a fin wherever measured and ascertained in a very earth tube heat exchanger to have an effect on the warmth transfer and flow. supported the findings given, the subsequent conclusions will be drawn for the pipe of twelve m length and 0.15 m diameter, temperature price thought-about for recess is 293K; pipe material metal with fin is effective as cherish different ones. Tube length doesn't play rather more important role in terms of warmth transfer rate. Therefore, thought of fins helps America to extend the warmth transfer rate.

Key Words: *CFD , transfer rate, tube, heat exchanger, flow, temperature*

I. INTRODUCTION

Energy is very important to the existence of our society, it is important and urgent to find alternative sources to replace conventional fuels or to reduce their continuous consumption due to their limited reservoirs and their negative impact on the environment, therefore it is necessary to look after to seek alternative sources of energy. This energy should be abundant on earth and it should be available everywhere on earth. Today, the use of air conditioning systems in both commercial and residential buildings is increasing. To achieve this, vapor compression machines are used. Machines are the source of chlorofluorocarbons (CFCs), which are harmful to the depletion of the ozone layer and also contribute to global warming. Air conditioning systems are used extensively around the world and consume a large proportion of electrical energy. The power consumption reaches its peak. in summer, which requires new power plants to generate electrical energy and makes electricity peaks more expensive. The whole world is also concerned about climate change and is trying to find alternative sources of clean and green energy.In fact, among the various energy sources, electricity is characterized by the fact that it has the highest GHG emission factor. Many alternative techniques are used to reduce the high quality energy consumption. One of these methods is the ground-air heat exchanger.

The energy utilization for cooling and warming of structures is probably the most issue in right now, so utilize environmentally friendly power. Geothermal energy is one of the types of sustainable power which can be utilized in a wide scope of uses like age of power, space warming, cooling, and warming and cooling water. The dirt temperature at a specific profundity (3-4 m) starting from the earliest stage is generally steady, and is lower than the external air temperature in summer and higher in winter.

1. From this solidness of soil temperature, we can rely upon the earth as a warmth source in winter and warmth sink in summer for space warming and cooling in private and business structures, and this can be refined by utilizing the earth-to-air heat exchanger (EAHE), likewise called the ground heat exchanger.

The EAHE ordinarily comprises of line or multiplies covered in the ground on a level plane or in an upward direction. One finish of the line is associated with the conveyance end of the blower and the opposite end is available to the

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climate. At the point when wind currents through the covered lines, the warmth is moved from air to the encompassing soil throughout the late spring season and the other way around in winter. There are two kinds of EAHEs, the open-circle framework and the shut circle framework. In the open circle, the air is provided straightforwardly and this framework gives the ventilation, while the shut circle courses the inside air and is more proficient than the open one. In recent years, geothermal heat pump systems for use in residential and commercial buildings have become increasingly popular. These systems include several different variants, all of which dissipate heat and / or extract heat from the ground:

(1) Ground-coupled heat pumps (GCHP) systems;
(2) Surface Water Heat Pump Systems (SWHP);
(3) Groundwater heat pumps (GWHP) systems:

a. Vertical Column Well Systems (SCW); born open circuit groundwater systems.

This technology is not recommended for cooling in humid climates as moisture reaches the sprayer and often remains in the pipes. However, in the coastal regions of southern Europe such as Greece, where the climate remains dry and hot. Results.

1.2 FUNCTIONAL PRINCIPLE OF THE NATURAL AIR HEAT EXCHANGER

The geothermal air heat exchanger exchanges heat between the air and the ground by convection and transfers heat to the pipe wall by conduction.

SUMMER CONDITIONS

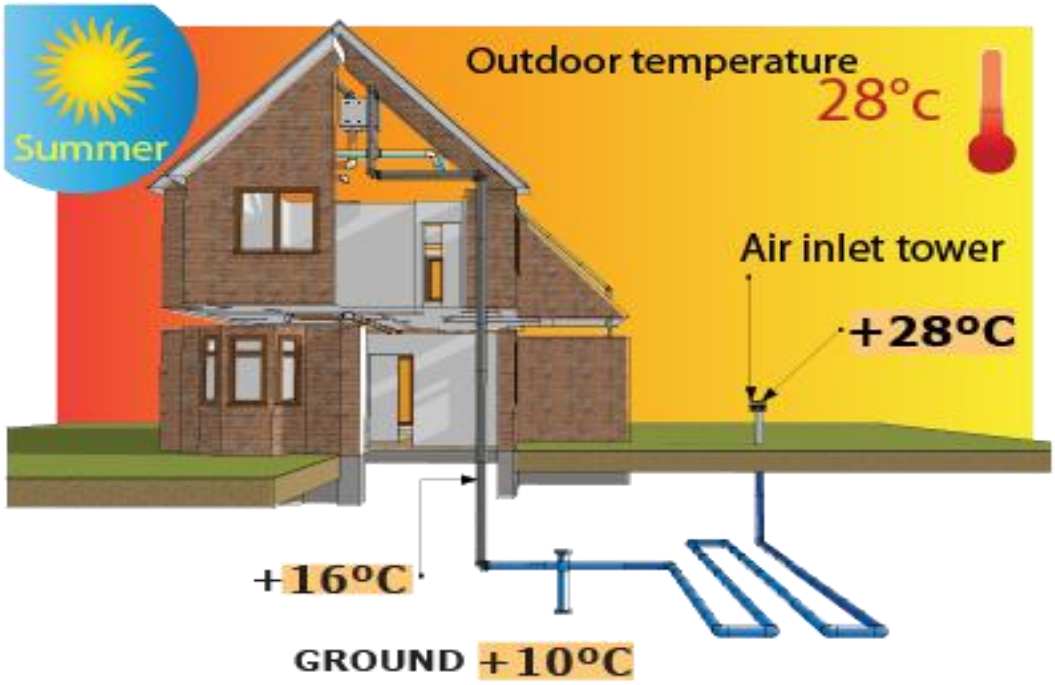

Figure 1.1 Working of EAHE in summer condition

- Hot air enters into the tube
- Air loses heat to the ground
- Cool air enters into the house

WINTER CONDITIONS

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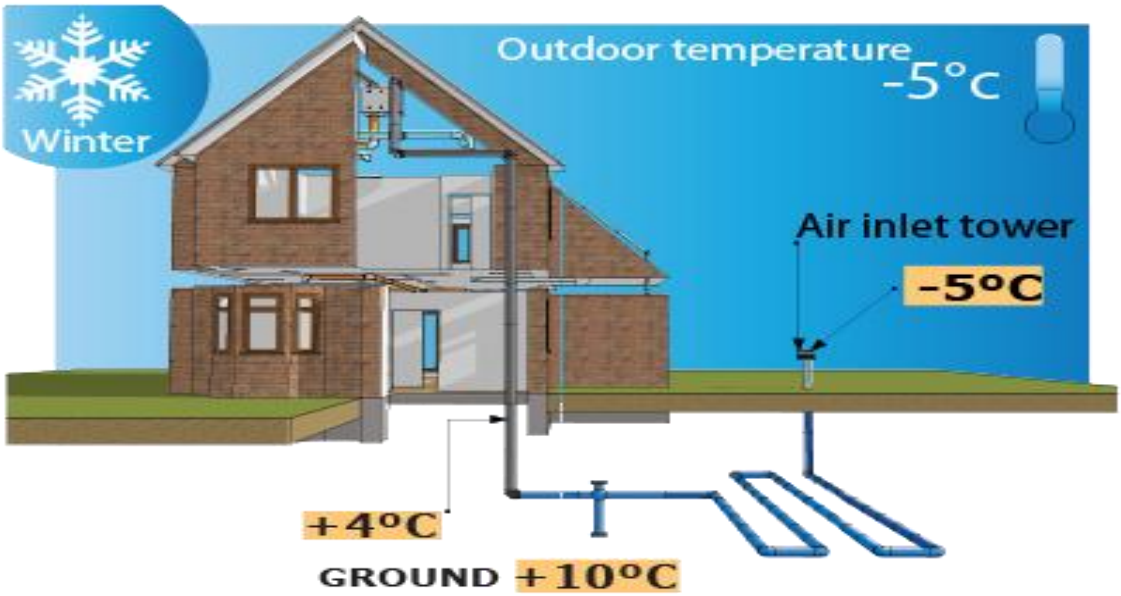

Figure 1.2 Working of EAHE in winter condition

- Cool air enters into the tube
- Air gains heat from the ground
- Hot air enters into the house

II. BOUNDARY CONDITIONS

Here in the analysis the boundary condition is same for both the materials for with fin and without fin as considered by **Shreekant Kumar et al. [2017]** during the work. Some of the conditions are shown in the Table.5.5.

Table 5.5: Boundary condition of different parameters

Name	Velocity(m/s)	Temperature(K)
Fluid inlet i.e. Air	3	293

III. MODELING

The math of earth tube heat exchanger for playing out the recreation study is taken from the one of the exploration researcher's Shreekant et al. (2017) with definite measurements and after than we supplant the model by giving a cylinder length of 12 m when contrasted with of 30 m. As we realize that the dirt temperature underneath 3m of ground surface kept up with at 25.4 ^{0} C consistently and normal winter temperature lies between 16-18^{0} C so the cylinder length doesn't assume substantially more fundamental part as far as warmth move rate. Consequently, idea of blades assists us with expanding the warmth move rate. The piece of the model planned in ANSYS (familiar) workbench programming.

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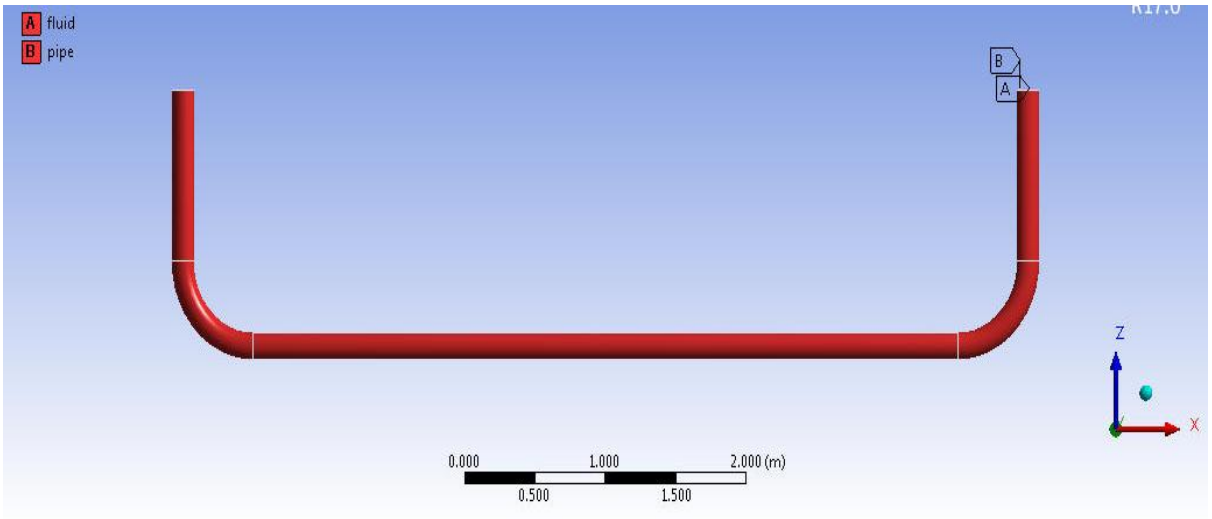

Fig.ure 3.1. Name Selection for fluid flow and pipe of earth air heat exchanger system

The temperature on the outside of line (divider) was uniform in hub bearing and was characterized as equivalent to earth's undisturbed temperature at Bhopal city (25.4°C). No slip condition with smooth divider was accepted at the internal surface of the line. Number of cycle =60.After putting the limit conditions, the arrangement is instated and afterward emphasis is applied with the goal that the upsides, everything being equal, can be found in a bend line diagram. After the cycle gets finished outcome could be seen.

IV. RESULTS AND DISCUSSIONS

Heat transfer through earth air heat exchanger depends on the velocity and temperature of fluid flowing inside the heat exchanger. In current velocity of 3m/s have been considered. To analyze the cumulative effect of material and fins on the heat exchanger rate, the CFD model of heat exchanger has been developed .

Figure 4.1 Temperature contour of earth air heat exchanger system without fin for pipe material Aluminium.

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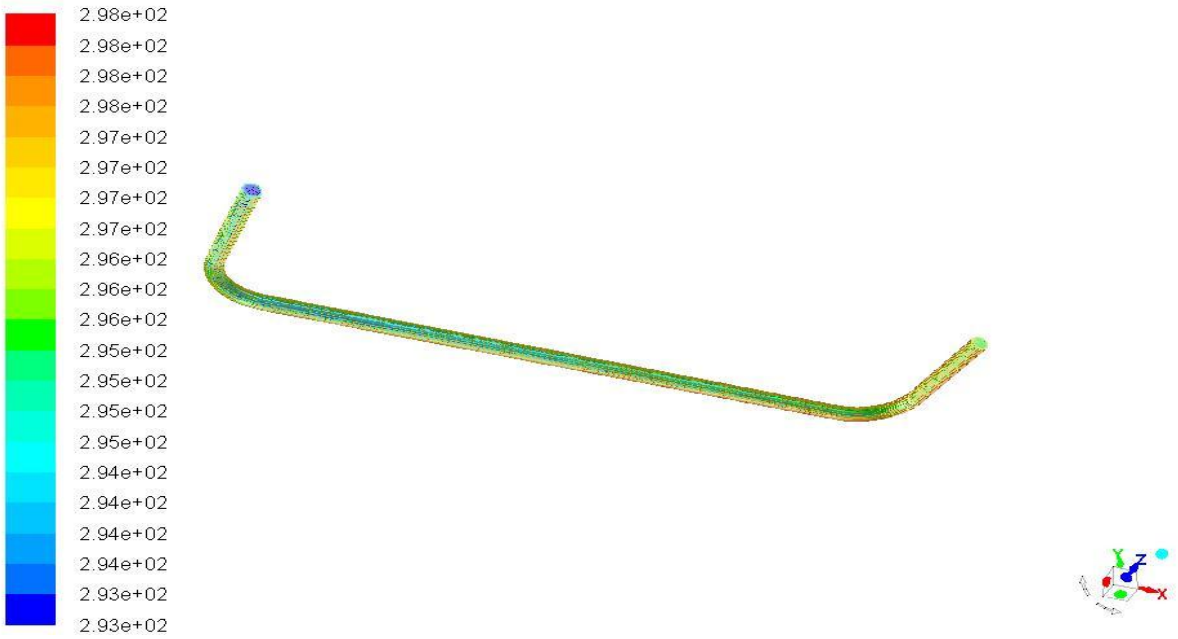

Figure 4.2 Temperature contour of earth air heat exchanger system without fin for pipe material PVC

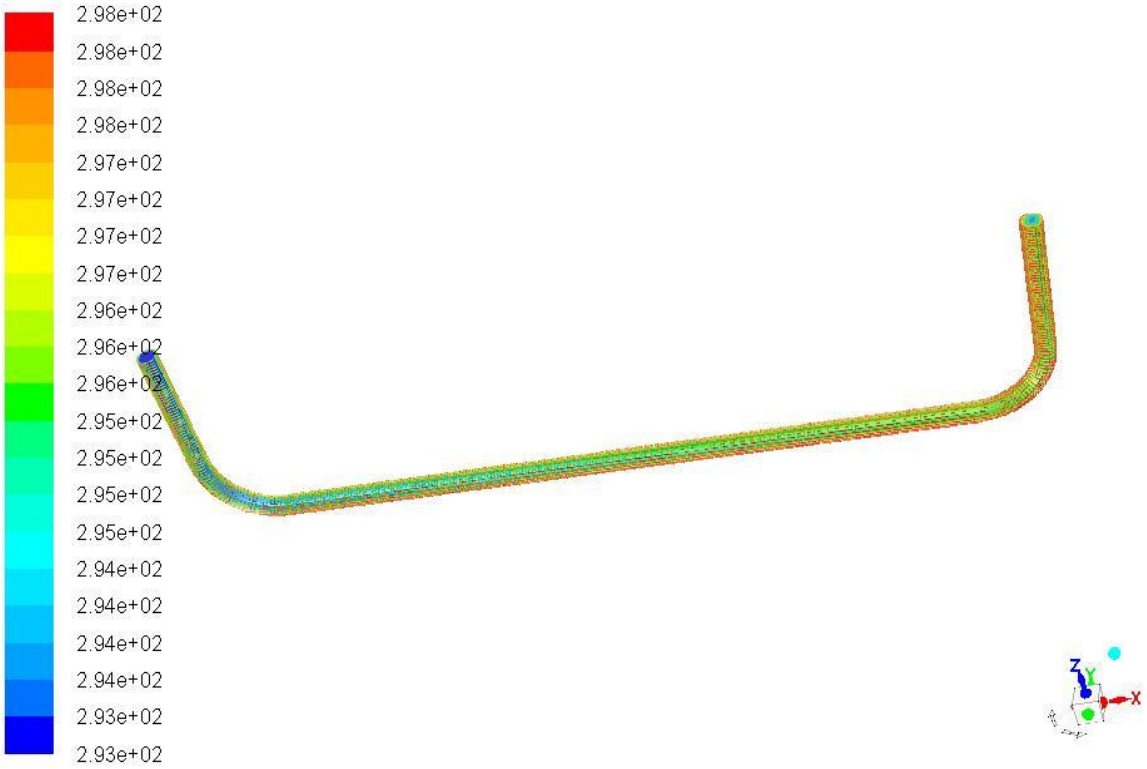

Figure 4.3. Temperature contour of earth air heat exchanger system with fin for pipe material Aluminium.

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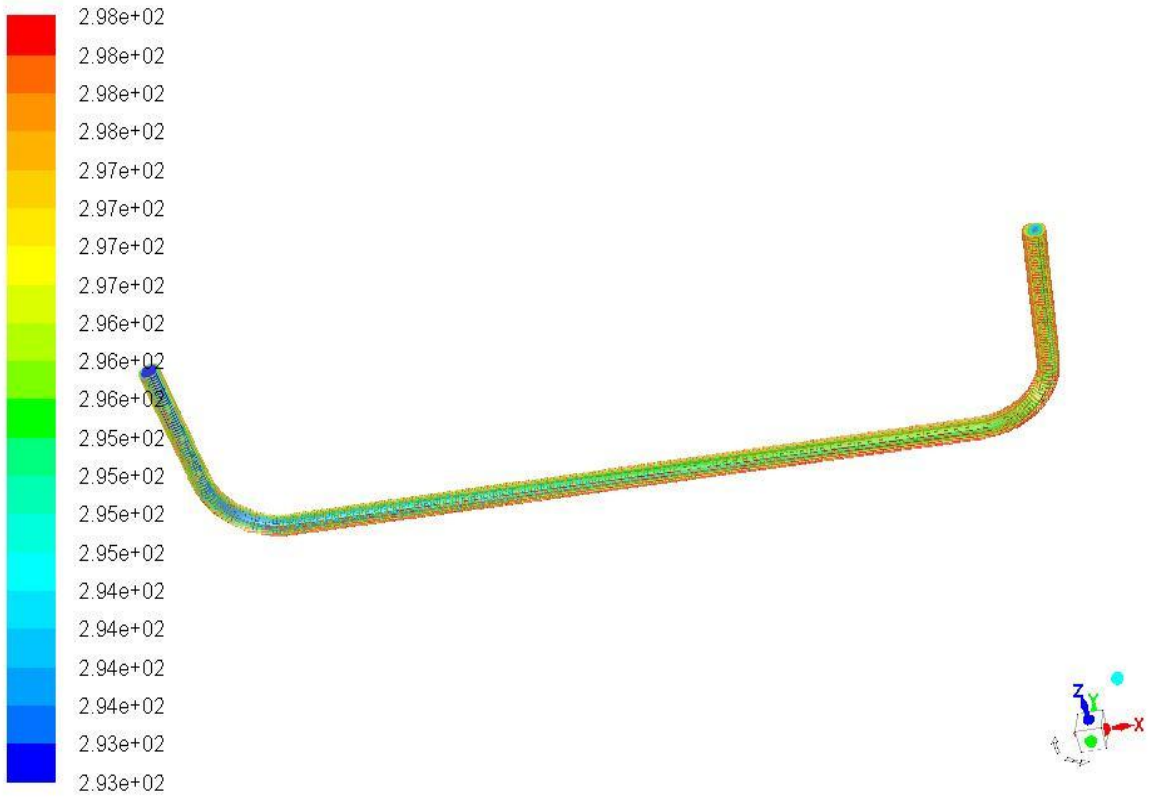

Figure 4.4. Temperature contour of earth air heat exchanger system with fin for pipe material PVC.

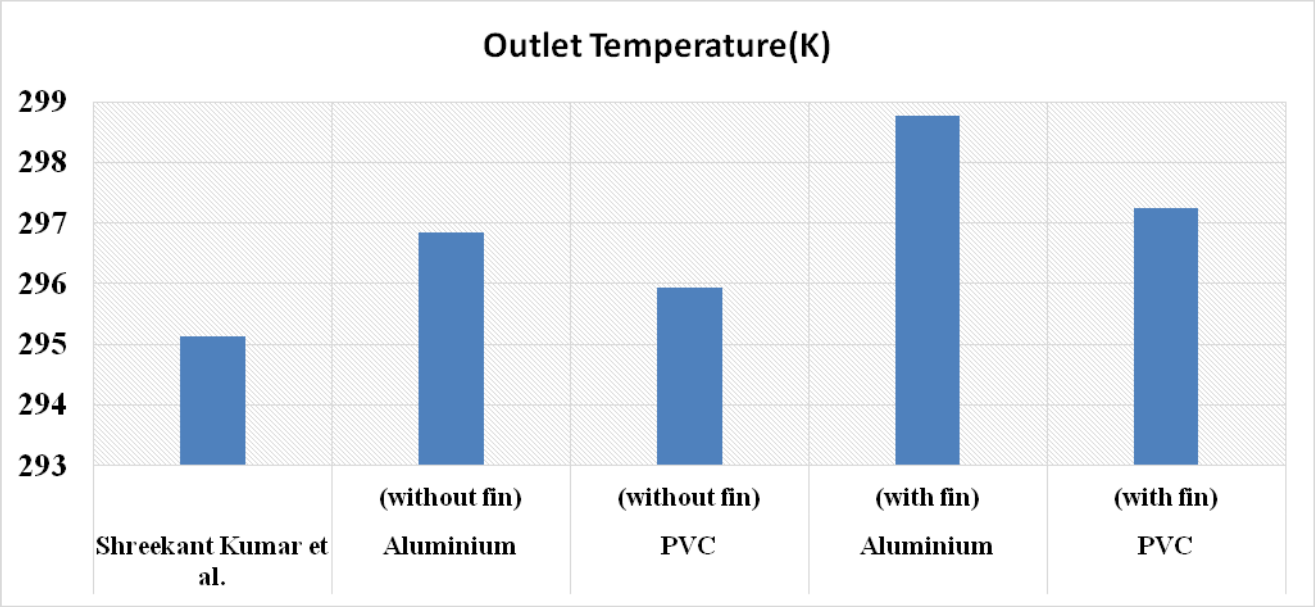

Figure 4.5. Outlet temperature values of earth tube heat exchanger determined from CFD models opposed to the values derived from **Shreekant Kumar et al. (2017).**

V. CONCLUSION

This CFD survey tests the performance of the world tube device with and while not fin for various material .After going CFD analysis through the comparison charts shown within the above, we will see that the results are quite encouraging. The impact of a fin wherever measured and ascertained in a very earth tube heat exchanger to have an effect on the warmth transfer and flow. supported the findings given, the subsequent conclusions will be drawn:

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• The outlet temperature of metal pipe with fin is 298.76 K.
• Performance is effective with fin.
• Outlet most temperature is 298.76 K for metal with fin and therefore the minimum temperature is 295.12 for the results derived from Shreekant Kumar et al. (2017).
• Thermal purpose of read metal pipe material is more practical than compared to PVC and. One doable justification for the development of this methodology is that the mean heat transfer constant increases, additionally to the influence of a fin, owing to the increase within the temperature differential between the soil temperature and therefore the airflow. The thermal resistance is additionally lower since the extent and warmth transfer coefficient are reciprocally proportional.

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