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STUDY OF RELATIONSHIP BETWEEN POWER INPUTS AND SURFACE TEMPRATURE IN NATURAL CONVECTION IN HEAT TRANSFER

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Abstract - *It is very important to study the relationship between power and the temperature in free convection, because it is very important for any process chemical engineer to learn the basics & fundamentals of heat transfer. The purpose of this research is to know the effect of power input on energy molecules, relationship between power and surface temperature. This is because; in Chemical industries we have to deal with heat addition/rejection in many processes. For example in refineries, heat exchangers and reactors are used. Free convection apparatus is used for performing the experiment at laboratory to study the relationship between power input and surface temperature. In order to obtain good results of the experiment, external forces were removed. For example ceiling Fans were also switched off. Errors were also minimized. In this paper, numerical investigations were also made for the enclosure of Natural or free convection.*

The purpose of this research paper is not only to study the relationship between power and temperature but also to find the methods of enhancing the heat transfer via convection.

Keywords: Convection, Power input, Energy Molecules, Natural Convection Apparatus.

1 Introduction

Convection is a mode of heat transfer. This is such type of mode in which molecules are used to transfer heat. Due to the motion of molecules in fluid, energy is transferred from one molecule to another. The energy which is transferred between molecules is called thermal energy.

Free convection is the transfer of heat without any external force. When cold water is allowed to heat from its surrounding heat, the hot water will rise and cold water will replace it, this is because hot water is less dense. And This process continuo.

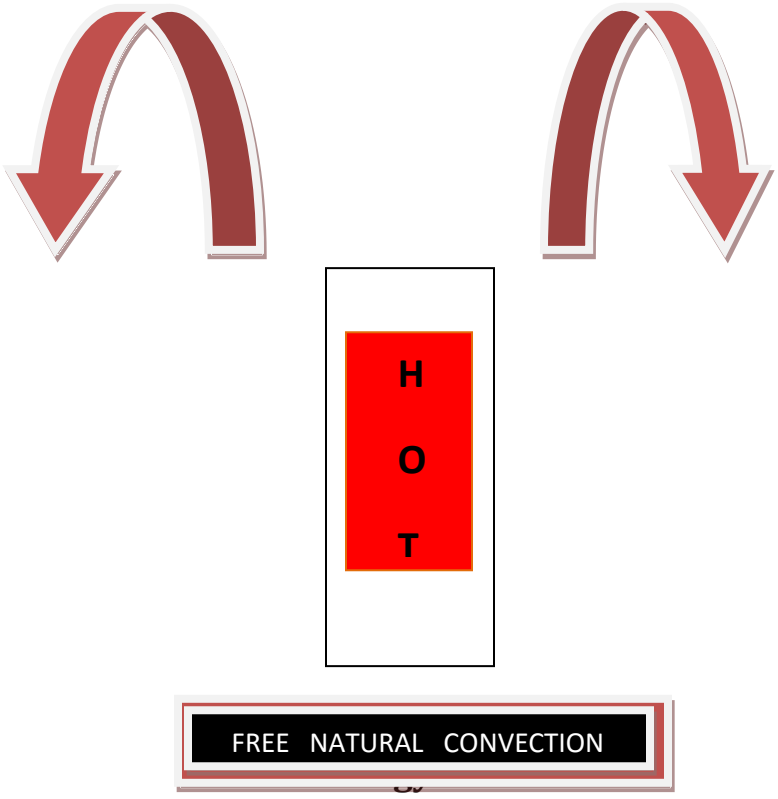
Reasons Behind free convection,

- Free convection occurs due to differences in densities.

  Nu= f(Gr,Pr) ….. 1

- Free convection occurs due to Newton's Law **2** of cooling.

$$Q=hA(Tw-T\infty)$$



Tinned heat exchanger was placed in heat duct. After that, the normal air temperature was recorded. Power input used was 20 watts. The apparatus was allowed to achieve steady state. When steady state conditions were achieved, the temperature of plate was noted.

3 Calculations:

Ts = 52.6°C

Ta = 33.2 °C

Ts –Ta = 19.4°C

Q =hA(Ts – Ta)

Where h is the heat transfer coefficient.

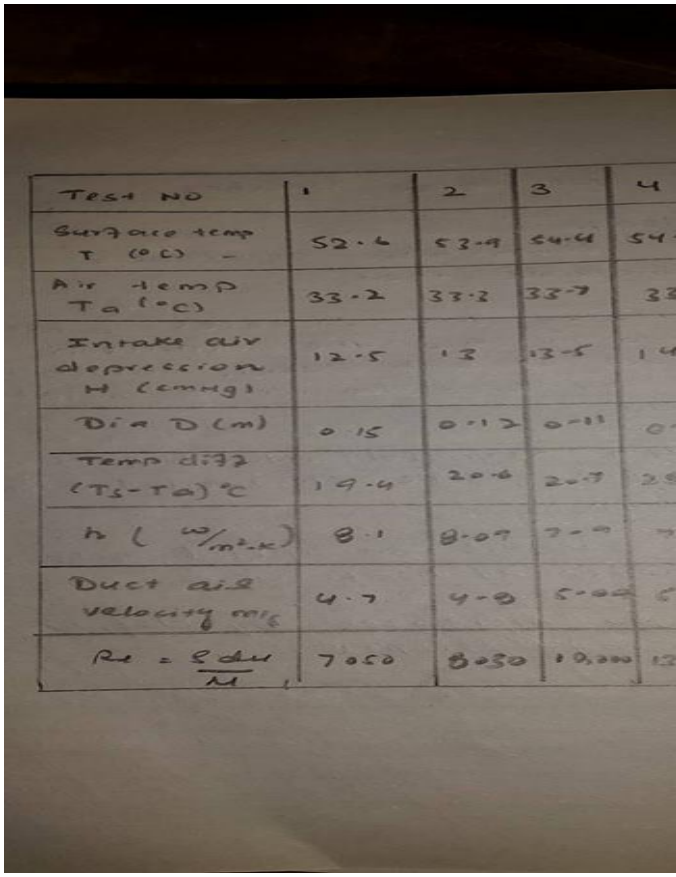
$$h = Cp(Ts - Ta)/(\pi/4D^2)(Ts-Ta)$$

$$= 4.18(52.6-33.2) \ / \ (3.14/4(0.13)^2(19.4)$$

$$= 8.1 \ W/m^2.K$$

For velocity,

u = 4.7 m/s

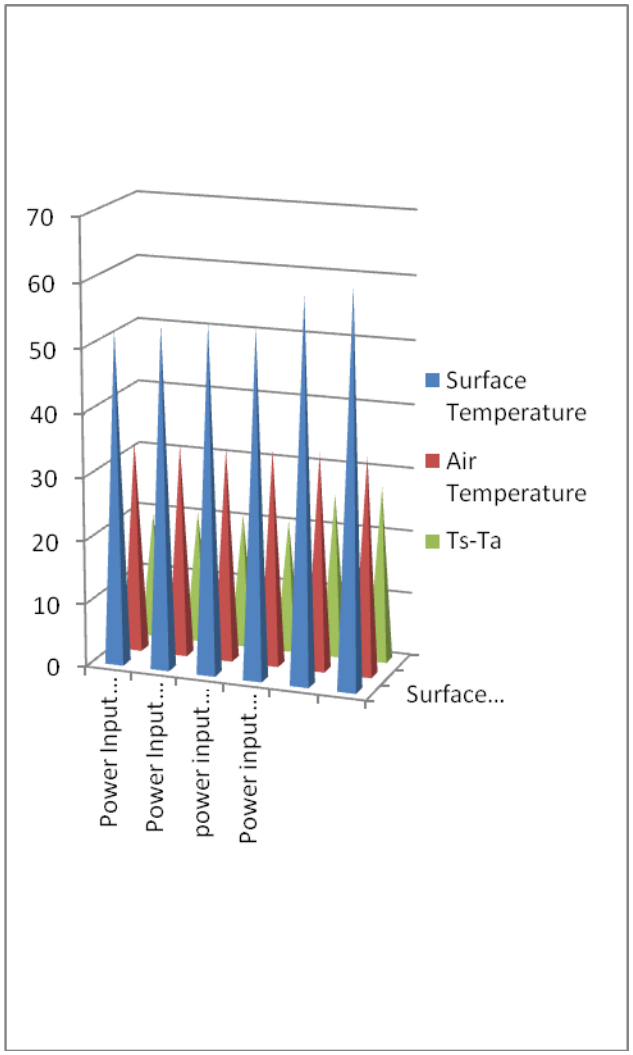


4 Tables

Surface Temp. °C	52.6	53.9	54.4	54.6	60	62
Air temp. Ta °C	33.2	33.3	33.4	33.9	34.2	34.4
Intake Air depression	12	12.5	13	13.5	14	14.5
Diameter	0.15	0.12	0.11	0.10	0.08	0.06
Ts-Ta	19.6	20.6	21	20.7	25.8	27.6
H (W/m^2)	8.1	8.09	7.9	7.9	7.9	7
Duct AIR velocity	4.7	4.8	5	5.1	5.3	4.8
Re=pdu/μ	7050	8030	10000	13070	13070	15180

These readings were performed various times at different power inputs i-e 40, 60, & 80 Watts.

5 Chart Representations



6 Conclusions

It was noted that by increasing the power input the temperature of heated plate was increased. Similarly, by increasing the power input, with increment in temperature of plate, however, the energy of molecules was also increased. When the molecular energy was studied on microscopic level, it was noticed that molecules enhanced their motion.

7 Acknowledgements

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8 References

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9 Biographies

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