Eng. Arwa

The University of Jordan

School of Engineering

Chemical Engineering Department

Chemical Engineering Laboratory (II) 0915461

Experiment Number (5)

Fluidized Bed Heat Transfer Unit

Type of the report: short report

Instructor: prof. Motasem Saidan

Performing Date: 30-11-2022

Submission Date :14-12-2022

80/100

Name	Id Number
Laila Alameri	
Noor Ghassan	
Saja AlQaisi	
Sara Albanna	
Taleen Alhawarneh	

Abstract

A glass cylinder through which air may be passed and two stream meters are used to make up the experimental setup. The goal of the analysis is to determine how fluid velocity affects pressure drop through the fluidized bed. One of the flow meters has a scope that is roughly equivalent to one tenth that of the other. It was found that the incremental of fluid velocity leads to increase the pressure drop along the bed.

Table of content

Table of tables

Table of figures

Results

Table (1): Effect of the variation in flow rate on the pressure drop (for low flow rate).

Flow rate(low)	T3 (°C) Air Temp	ΔP (cm H2O)	Actual flow rate	Observation
2	23.2	5.5	4.2	Static
4	25.6	6	6	slightly static
6	26.3	6.5	7.6	Start moving
8	27.3	6.7	10	moving
10	28.1	7	12.3	Bubbling
12	28.5	7.4	14	More bubbling
14	29	7.6	16	More bubbling
16	29.4	7.8	16.4	More bubbling
18	29.9	8	20	More bubbling
20	30	8.4	23	More bubbling
22	30.1	8.7	24.6	More bubbling
24	30.1	9	27.5	More bubbling
26	30.1	9.4	30	More bubbling

Table (2): Effect of the variation in flow rate on the pressure drop (for high flow rate).

Flow rate(high)	T3 (°C) Air Temp	ΔP (cm H2O)	Actual flow rate	Observation
3	30.8	9.6	40	More bubbling
5	31	11.4	50	More bubbling
7	31.2	13.2	60	More bubbling
9	32	15.4	75	More bubbling
11	32.3	17.5	90	More bubbling

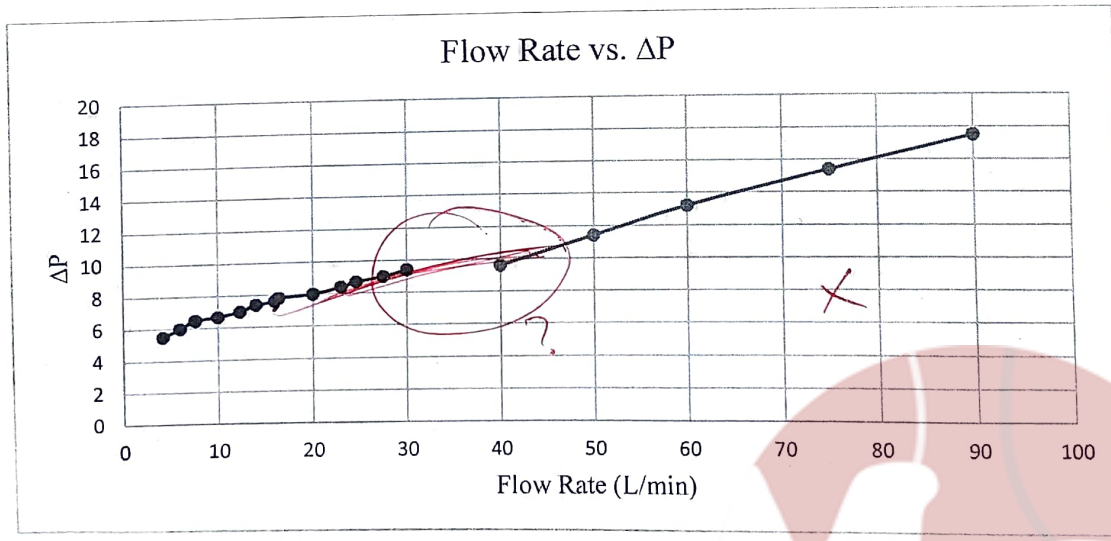

Figure (1): The relation between pressure drop variation with increasing flow rate along the bed.

Discussion

The change in pressure drop inside the bed is impacted by the air flow's speed. As seen. By referring to Table (1) and Table (2) it is clear that the air temperature is proportional to the air flow. Figure (1) shows the variation of incremental flow rate on the pressure drop, when the air flow was increased, little bubbles at initially appeared on the material's surface inside the bed, these bubbles traveled from the bottom to the top of the material. Large air bubbles begin to emerge when the air flow speed is elevated to a high degree. These air bubbles can delve deeper into the bed and work to mix the material there. As expected, the pressure drop increases with the increase of flow rate; this is because the bed pressure is proportional to the centrifugal weight of the bed. As a result of experimental limitation (not covering full range of flow rate) the optimum value of pressure drop is not clear.

Conclusion

- The bed gets increasingly porous as the fluid flow rate rises (void).
- The term "boiling beds" refers to those where bubbles form more quickly.
- As the flow rate rises, pressure drops rise.
- High flow rates produce moving particles, whereas low flow rates produce stationary beds.

References

♦The Engineering Toolbox (2022). Water - Specific Heat vs. Temperature. Retrieved November 4,2022, from

https://www.engineeringtoolbox.com/specific-heat-capacity-water-d_660.html

♦The Engineering Toolbox (2022). Water - Heat of Vaporization vs. Temperature. Retrieved November 4,2022, from

https://www.engineeringtoolbox.com/water-properties-d_1573.html

Appendix

Sample of calculations:

Using the below calibration curve, taking the first raw of each table,

For Table (1): At flowrate (scale) = 2, reading the cross value with the low flow rate curve = 4.2

Then the actual flow rate = 4.2 (L/min).

For Table (2): At flowrate (scale)= 3, reading the cross value with the high flow rate curve = 40

Then the actual flow rate= 40 (L/min).

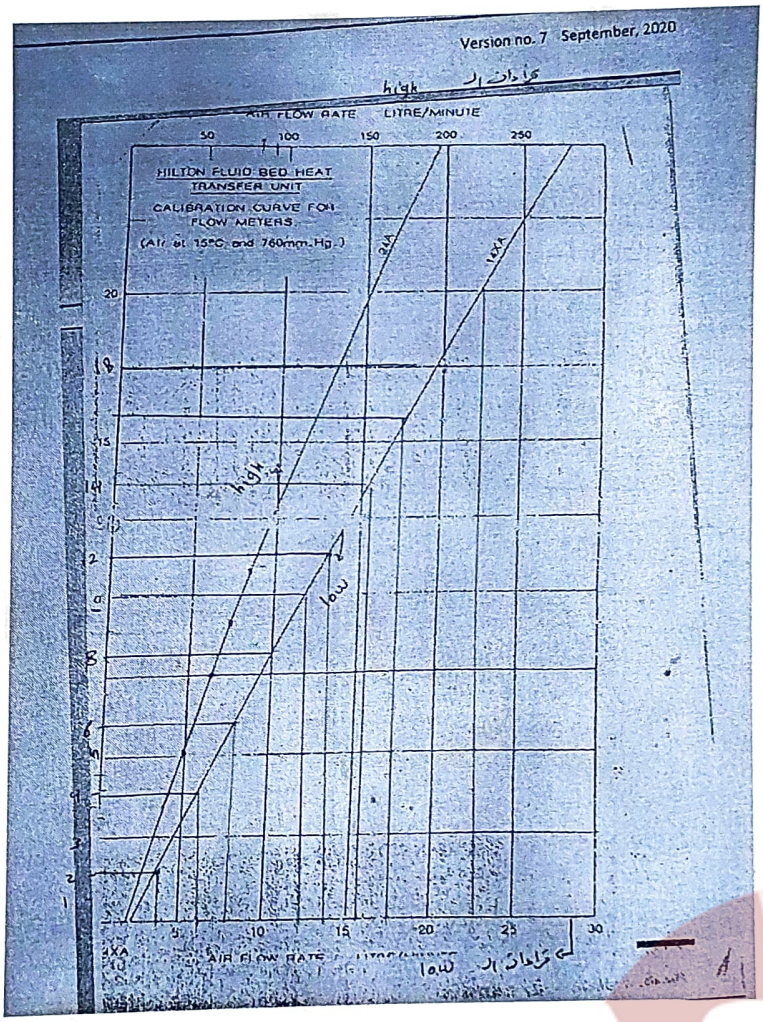

Figure (2): Calibration curve for flow meters for fluid bed heat transfer unit. (Manual of Chemical Engineering laboratory (II), pp. 30)

Fluidized Bed Heat Transfer Unit Data Sheet

Flow rate	T_1 (°C) Bed Temp.	T_2 (°C) Heater Temp.	T_3 (°C) Air Temp.	Voltage (V)	Current (A)	$\Delta P(cmH_2O)$	Observation
2						5.5	
4						6.0	
6						6.5	
8						6.7	
10						7.0	
12						7.4	
14						7.6	
16						7.8	
18						8.0	
20						8.4	
22						8.7	
24						9.0	
26						9.4	
3						9.6	
5						11.4	
7						13.2	
9						15.4	
11						17.5	

Instructor signature:

Date: 30/11/2022