



**Al-Mustaqbal University College**

**Chemical Engineering and Petroleum Industries**

**Unit Operations Lap**

**Experiment (5)**

**Plate & frame filter press**

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## INTRODUCTION

Pressure filters can apply a large pressure differential across the septum to give economically rapid filtration with viscous liquids or fine solids. The most common types of pressure filters are filter press. A filter press contains a set of plates designed to provide a series of chambers or compartments in which solids may collect. The plates are covered with a filter medium such as canvas cloth. Slurry is admitted to each compartment under pressure; liquor passes through the canvas cloth and out a discharge pipe, leaving a wet cake of solids behind. Plates and frames sit horizontally in a metal rack, with cloth covering the face of each plate, and are squeezed tightly together by a screw. Slurry enters at one end of the assembly of plates and frame. It passes through a channel running lengthwise through one corner of assembly. The set up consists of 7 plates and 6 frames. Frames are covered with filter cloth. Feed is fed by gear pump at the top and filtrate collected at the bottom from each plate by operating the cock. After removing Cake, washing and cleaning can be done by water provided by overhead tank . Inlet & outlet pressures are measured by pressure gauges. Rate of filtrate removals is measured by calibrated tank provided.



## **AIM**

- To determine the specific cake resistance( $\alpha$ )based on observed rate of filtration at constant pressure
- To determine the medium resistance (R)based on observed rate of filtration at constant pressure

## **EXPERIMENTATION:**

- To study the operation of filter press in the laboratory.
- To evaluate specific cake resistance and medium resistance.

## **UTILITIES REQUIRED:**

- Electric Supply: Single phase, 220 V AC, 1.5 kW.
- Water supply.
- Drain.
- Slurry required to performing experiment.

## **TECHNICAL DETAILS:**

- No. of frame : 6
- No. of Plates : 7
- Size: 200 mm x 200 mm.
- Material : Acrylic
- Screw Jack arrangement for tightening and removing of frames easily.
- Filter Medium : Filter Cloth
- Filtrate collection tray: Material Stainless Steel, Suitable size.
- Slurry Feed tank : Material Stainless Steel, Capacity 40 Ltrs.
- Slurry Tank Agitator : Stainless Steel Impeller with SS Shaft coupled to

- FHP Motor and Reduction Gear Box
- Slurry Feed Pump : Gear Pump with FHP motor.
- Piping system: GI and PVC.
- Filtration rate measurement: Using measuring tank. Material Stainless Steel Pressure Measurement: Bourdon type pressure gauge.
- Overhead water tank: Material Stainless Steel, Capacity 25 Ltrs.
- Control panel Comprises of Standard make On/Off switch, Mains Indicator etc.
- Instruction Manual : An ENGLISH instruction manual will be provided along with the Apparatus
- A good quality painted rigid MS Structure is provided to support all the parts

## **OBSERVATIONS & CALCULATIONS:**

$$P_i = 1.1 \text{ kg/cm}^2$$

$$P_o = 0.5 \text{ kg/cm}^2$$

$$M = 2 \text{ kg}$$

$$V = 20 \text{ L}$$

<b>Number of frame <math>N_f</math></b>	<b>6</b>
<b>Area of filtrate tank <math>A_c</math></b>	<b><math>0.0398 \text{ m}^2</math></b>
<b>Area of one frame <math>A_{f1}</math></b>	<b><math>0.04 \text{ m}^2</math></b>
<b>Viscosity of the filtrate <math>\mu</math> at <math>20^\circ \text{C}</math></b>	<b><math>000106 \text{ N.S/ m}^2</math></b>

$$v = A_c * h / 100$$

**Plot the graph of  $t/v$  vs.  $v$  and find a slope and intercept**

$$A = 2 * N_f * A_{fi}$$

$$\Delta p = p_i - p_o$$

$$C = m/V$$

$$\alpha = \frac{a * \Delta P * A^2}{\mu * C}$$

$$R = \frac{b * \Delta P * A}{\mu}$$

## **Discussion**

What are Plate & frame filter press do?

Where Plate & frame filter press used?

What are factors that affect the efficiency of a Plate & frame filter press?

## **Nomenclature:**

<b>Nom</b>	<b>Column Heading</b>
<b>A</b>	<b>Total Filtration area</b>
<b>A<sub>C</sub></b>	<b>Area of filtrate tank</b>
<b>A<sub>F1</sub></b>	<b>Area of one frame</b>
<b>a</b>	<b>Slop of the graph t/n vs. v</b>
<b>b</b>	<b>Intercept of the graph t/v vs. v</b>
<b>C</b>	<b>Concentration of the slurry</b>
<b>h</b>	<b>Height of filtrate collected in time t</b>
<b>M</b>	<b>Mass of caco3 in feed</b>
<b>N<sub>f</sub></b>	<b>Number of frame</b>
<b>ΔP</b>	<b>Pressure drop</b>
<b>P<sub>i</sub></b>	<b>Inlet Pressure</b>
<b>P<sub>O</sub></b>	<b>Outlet pressure</b>
<b>R</b>	<b>Medium resistance</b>
<b>t</b>	<b>Time to collect filtrate</b>
<b>v</b>	<b>Volume of Filtrate collected in time t</b>
<b>V</b>	<b>Volume liquid in feed</b>
<b>α</b>	<b>Specific cake resistance</b>
<b>μ</b>	<b>Viscosity of the filtrate</b>

<b>Result Of experiment Lap.</b>		
<b>N0.</b>	<b>Time (sec)</b>	<b>Height(cm)</b>
<b>1</b>	<b>30</b>	<b>7</b>
<b>2</b>	<b>60</b>	<b>11</b>
<b>3</b>	<b>90</b>	<b>15</b>
<b>4</b>	<b>120</b>	<b>18.5</b>
<b>5</b>	<b>150</b>	<b>21.5</b>
<b>6</b>	<b>180</b>	<b>25</b>
<b>7</b>	<b>210</b>	<b>28.5</b>