بسم الله الرحمن الرحيم

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

بعض الوثائق
الأصلية تالفة

EXAMINERS

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CONTENTS

Summary

Many industries depend on the characteristics of the fluid flow through porous media, Such industries are Petroleum drilling, treatment of industrial waste water, etc. Increasing the flow rate of the fluid is important to decrease the cost and increase the production rate.

The present investigation is concerned with increasing of the flow rate of fluid and studying the behavior of the fluid through porous media, that study requires establishing two systems; a laboratory scale system and a packed bed system.

The laboratory scale system is used at the beginning of the study to study the effect of adding some agricultural wastes on the flow rate of fluid through porous cake. The agricultural wastes used are **Bagasse**, **Okra**, chopped **Straw**, **Potatoes** peel and **Jaw's Mallow** sticks. The effect of different parameters is studied. Such parametersare: pressure difference, slurry concentration and additives concentration.

Comparison between the data obtained from the study of the different parameter was made to determine the best type and concentration of the additive which gives the best flow rate of the filtrate.

This investigation is concerned also with obtaining an mathematical models for the best concentration of each type of the agricultural wastes used. These models relate the volume collected with time and are dependent on the pressure difference and slurry concentration. The deduced equations are as follows:

Chopped straw (5 gm/l)

$$V = \left(4.77548 * 10^{4}\right)\left(\Delta P\right)^{0.2314}\left(C\right)^{-0.6816}\left(1 - e^{\frac{-t}{25.8}}\right)$$

Jew's Mallow sticks (4 gm/l)

$$V = \left(3.5838 * 10^{3}\right)\left(\Delta P\right)^{0.2224}\left(C\right)^{-0.1199}\left(1 - e^{\frac{-t}{24}}\right)$$

Grinded *Okra (1 gm/l)*

$$V = \left(8.22577 * 10^{3}\right)\left(\Delta P\right)^{0.2859}\left(C\right)^{-0.3691}\left(1 - e^{\frac{-t}{20.3}}\right)$$

Okra pieces (2 gm/l)

$$V = \left(1.4031 * 10^{4}\right)\left(\Delta P\right)^{0.278}\left(C\right)^{-0.4688}\left(1 - e^{\frac{-t}{21.1}}\right)$$

Potatoes* peels pieces *(2 gm/l)

$$V = \left(4.5615 * 10^{4}\right)\left(\Delta P\right)^{0.2813}\left(C\right)^{-0.7713}\left(1 - e^{\frac{-t}{18.4}}\right)$$

Grinded *Potatoes* peels *(1 gm/l)*

$$V = \left(1.2679 * 10^{4}\right)\left(\Delta P\right)^{0.2812}\left(C\right)^{-0.4855}\left(1 - e^{\frac{-t}{17.6}}\right)$$

Grinded *Bagasse* pulp *(2 gm/l)*

$$V = \left(5.491 * 10^{3}\right)\left(\Delta P\right)^{0.2631}\left(C\right)^{-0.1821}\left(1 - e^{\frac{-t}{32.7}}\right)$$

where:

- *V* Collected volume of filtrate at time t, *(l)*
- *ΔP* pressure difference (***cm-Hg***).
- ***C*** slurry concentration (***gm/l***). and
- t Time (min.)

The packed bed system is used to study the Characteristics of the fluid flow through porous media. The parameters studied are: pressure difference, slurry concentration, particles size of the packing material, (sand), and porosity of the bed. Bagasse pulp, is added to the packing material with concentration of 1%, 3% and 5% to study the effect of the wastes concentration on the flow characteristics.

The deduced equations for the packed bed system without additives are as followa:

$$V = 51846(\Delta P)^{0.17}(C)^{-0.498}(d_p)^{0.054}(\varepsilon)^{4.1}\left(1 - e^{\frac{-t}{40.4}}\right) \quad \textit{at } (\Delta P \geq 1)$$

$$V = 8790(C)^{-0.218}(d_p)^{0.15}(\varepsilon)^{4.01}\left(1 - e^{\frac{-t}{24.5}}\right) \quad \textit{at } (\Delta P = 0.5)$$

when using **Bagasse pulp** as an additive the deduced equation is:

$$V = 7050(\Delta P)^{0..66}(C)^{-0.065}(d_p)^{0.12}(\varepsilon)^{2.52}\left(1 - e^{\frac{-t}{44}}\right)$$

The characteristics of the fluid flow through porous media is investigated by studying the relation between the Reynold's number and Friction factor. This study indicates that the fluid behaves as a Non-Newtonian fluid and that there are three regions of the flow: laminar, transient and turbulent regions.

From the present study it could be concluded that, some agricultural wastes can be used as filter aides, such as **Bagasse pulp** and **Jaw's Mallow** sticks, while other agricultural wastes can be used as filter resistant, i.e., **Okra** and **Potatoes** peel.

NOMENCLATURE

A	Dimensionless constant.
a	Specific surface of bed, cm^{-1}.
a_o	Specific surface of particles, cm^{-1}.
A_a	Cross sectional area, cm^2.
A_{vd}	Dynamic specific surface area, cm^{-1}.
A_{vs}	static specific surface area, cm^{-1}.
B	Dimensionless constant.
C'	Tortuosity factor.
C''	Constant.
C_D	Total drag coefficient.
C_{DF}	Friction drag coefficient.
C_{DP}	Pressure drag coefficient.
D	Column diameter, cm.
d_h	Mean diameter of sphere, cm.
D_p	Diameter of particles comprising the porous bed, cm.
d_P	Pacrticle volume to surface mean diameter.
f	Friction factor.
f^*	Friction factor for porous media.
f_m	Friction factor defined by equation (2-31).
f_{mod}	Friction factor defined by equation (2-30).
f_p	Friction factor defined by equation (2-29).
H	Consistency index, dyne.sec^n/cm^2 .
H_i	Consistency index, dyne.sec^n/cm^2 for equation (2-28).
I_2	Second invariant of rate of deformation tensor, s^{-2}.
k	Kozeny-Carman constant.
K	Permeability of porous medium, cm^2
L	Length of bed, cm.
L'	Length of the pore path, cm.
M_1	First momentum.
M_2	Second momentum.
n	Flow behaviour index.
n'	Power law index.
n_i	Power law model parameter.
ΔP	Pressure drop, kPa.
P'	Negative of the pressure gradient.
Q	Volumetric flow rate, c.c./s.
R	Sphere radius, cm.
Re'	Newtonian Reynold's number defined by equation (2-37).