ATICO®

FLUIDIZED BED DRYER

MODEL NO - AEC327

Instruction Manual

ATICO EXPORT.

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Foreword

Welcome to a value-conscious company, “**ATICO**”. We are proud of the advanced engineering and quality construction of our each equipment.

This manual explains the working of equipment. Please read it thoroughly and have all the occupants follow the instructions carefully. Doing so will help you enjoy many years of safe and trouble free operation.

When it comes to service remember that “**ATICO**” knows your equipment best and is interested in your complete satisfaction. We will provide the quality maintenance and any other assistance you may require.

All the information and specifications in this manual are current at the time of printing.

However, Because of “**ATICO**” policy of continual product improvement we reserve the right to make changes at any time without notice.

Please note that this manual explains all about the equipment including options. Therefore you may find some explanations for options not installed on your equipment.

You must follow the instructions and maintenance instructions given in the manual carefully to avoid possible injury or damage. Proper maintenance will help ensure maximum performance, greater reliability and longer life for the product.

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Contents

FLUIDIZED BED DRYER

OBJECTIVE:

- To study the fluidized bed dryer apparatus.

AIM:

- To study the drying characteristics of a given material in a fluidized bed dryer.

INTRODUCTION:

Fluidized bed technology is based on the fluid-like behavior of a bed of solid particles when subjected to the buoyant forces exerted by a gas or liquid. Though composed of an inhomogeneous mixture of fluid and solids, the bed – fluidized by the gas or liquid – behaves like a fluid (i.e., exhibiting hydrostatic surface properties and an effective bulk density lower than the original solids). The outcrop of this behavior is a host of attractive benefits including enhancement of heat and mass transport, high contacting efficiency for reactants, and improved flow and transport options for the solids. Understanding the behavior of fluidized beds is important to realizing these and other benefits. This behavior can be seen in the short video captured in Figure 1, where a bed of small glass beads moves from the slumped condition through bubbling fluidization and back again as the air flow rate is first increased then decreased.

THEORY:

The term drying usually infer removal of relatively small amounts of water from solid or nearly solid material. The water is usually removed by circulation of air or some other gas gives the material in order to carry away the water vapor. There are many types of equipment used in industries for drying operation. The most recent method is fluidized bed drying, which could be operated batch-wise as well as continuously. Drying is a process of simultaneous heat and mass transfer. The heat transfer rate is between five to twenty five times that for the gas alone. Because of rapid equalization of temperature in fluidized bed, temperature control can be accomplished.

Fluidized bed units for drying solids, particularly coal, cement, fertilizers, limestone etc are in general acceptance. One of the major advantages of this type of dryer is the close control of conditions so that a predetermined amount of free moisture may be left with the solids to prevent dusting of the product during subsequent material handling. In order to set up drying schedules and to determine the size of the equipment, it is necessary to know the time which will be required to dry a substance from one moisture content to another under specified conditions. Our knowledge of the mechanism of drying is so incomplete that it is necessary with few exceptions to rely upon at-least some experimental measurements for this purpose.

DESCRIPTION:

This is a dryer in which moisture removal takes place by fluidization of solids particles by hot air. The set-up fitted with a specially designed, vertical Glass Column. The lower portion of the column is filled with fluidizing material. The material is supported on the screen mesh held between two flanges. Air from a compressor is heated in the heater box and passed through the column. Flow control and by-pass valve are fitted to regulate the airflow. At the top outlet of column a cyclone is provided to collect any solid particles taken out by the air stream.

UTILITIES REQUIRED:

- Electricity Supply: 1 Phase, 220V A.C,.5kW
- Wet Solid Saw Dust,
- Floor area 1m × 2m

EXPERIMENTAL PROCEDURE:

- Prepare a feed of a solid material (saw dust) to be dried in dryer.
- Measure its dry weight.
- Take a small container, then fill it with dry saw dust.
- Measure its weight and note down it.
- Add known amount of water in the saw dust (feed) and mix it properly.
- Then again fill the container with wet feed sample and weight it.
- Calculate the initial moisture content.
- Turn on the blower and heater and set the required temperature and air flow rate.
- After achieving the required temperature fill the glass column with the wet feed and note down the height of the feed filled.
- Note down the initial temperature reading.
- After 10 minute take out a sample of feed and fill the container with it then weight the container.
- Repeat this procedure and continue to take sample at every 10 minute and weight it until feed is completely dried and steady state achieved.
- Calculate the moisture content for each reading.
- Repeat the experiment for different air flow rates, drying temperature.

OBSERVATION & CALCULATION:

DATA:

Dia. of Column, D = `0.08 m

Height of the glass column (h) = 0.5 m

Dia. Of Pipe, d_p = 0.042 m

Dia. of Orifice, d_o = 0.021 m

Coefficient of discharge (C_d) = 0.64

Drying temperature = ……….^{o}C

Surface area of the material (A) = 2×3.14×r×h

OBSERVATION :

Weight of initial Dry Sample, S_i = _________gm (neglect the weight of the container)

Weight of initial wet Sample, Wi = _________ gm

Weight of water in initial sample = -------gm

Initial Moisture content present in sample feed material, $X = \dfrac{W_i - S_i}{S_i}$

OBSERVATION TABLE:

S.No.	Time	Air Inlet		Air Outlet		Air Flow		Sample Weight
	t, min	DBT, ^{o}C	WBT, ^{o}C	DBT, ^{o}C	WBT, ^{o}C	h_1, cm	h_2, cm	W_s
1.								
2.								
3.								
4.								

CALCULATIONS:

$$\text{Head in term of air } (\Delta H) = \left(\frac{h_1 - h_2}{100}\right)\left(\frac{\rho_w}{\rho_a} - 1\right) \text{m of air}$$

$$\text{Flow rate of air } (Q_a) = \frac{a_o \times a_p}{\sqrt{a_p^2 - a_o^2}} C_d \times \sqrt{2g\Delta H} - - - - - - - - \text{m}^3/\text{sec}$$

Moisture content present in sample, $X = \dfrac{Ws - S_d}{S_d}$ gm water/gm of dry solid.

Now plot a X V/s t on X-Y scale.

From this plot we calculate the slope = - dx/dt.

Now we have the drying rate as

$N = -S \dfrac{dX}{dt}\dfrac{1}{A}$, kg/m^2-s

CALCULATION TABLE:

S.No.	Time t, min	Weight gm	Moisture content present in solid, X	Slope = -dx/dt	N(Drying rate) Kg/m^2-sec
1.					
2.					
3.					
4.					

Plot the graph between X & N.

NOMENCLATURE:

A	=	Dying surface area, m^2
N	=	drying rate, kg/m^2-s
S_i	=	Initial weight of dry feed, kg
W_i	=	Initial weight of the wet feed, kg
X	=	moisture content of solid (kg of water/kg of dry solid)
t	=	time, min.
P	=	density, kg/m^3
P_m	=	density of manometric fluid, kg/m^3
P_a	=	density of air, kg/m^3
ΔH	=	Head in term of air, m
h_1,h_2	=	Manometer readings, cm
g	=	Acceleration due to gravity, m/sec^2
C_d	=	Coefficient of discharge
a_p	=	Area of pipe, m^2
a_o	=	Area of orifice, m^2
Q_a	=	flow rate of air, m^3/sec
Wp	=	weight of present sample, kg
Sd	=	weight of dry feed of the sample.kg

PRECAUTIONS & MAINTENANCE INSTRUCTIONS:

- Measure the exact volume of water and weigh the material properly.
- Always use clean water and good quality chemicals and standard solution.
- Use electronic balance for weighing of chemicals.
- Flow should not be disturbed during the experiments.
- Handle the chemicals carefully.

TROUBLESHOOTING:

- ❖ If D.T.C display ‘1’ on display board it means sensor connection is not OK tight that.
- ❖ If switch ON the heater but temperature can’t rise but panel LED is ON it means there is any fault in panel ask electrician or us.