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Pneumatic Conveying Study of Rice Husk Based on Laboratory Trails and its Assessment

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ABSTRACT

A conveying system of any kind is used to transport a material from one source place to destination or receiving place. For the chosen method of pneumatic conveying, air is used as the transport medium. It is applicable to most fine powder to granular materials, be they in that form naturally or have to be pulverised or crushed. In this system, energy is needed to accelerate the material from rest, to lift it as required and to overcome the losses due to friction. Rice husk is by-product which results from paddy, the husk is removed by friction as the paddy grains pass between two abrasive surfaces that move at different speeds. It has been used as building material, fertilizer, insulation material, or fuel. Combustion of rice hulls produces rice husk ash (RHA) which is a potential source of amorphous reactive silica. Most of the ash is used in the production of Portland cement. The ash is a very good thermal insulation material. Rice husk though been not easily transportable material, however, certain operational sequences, precautions at feeding zone and with sufficient motive force (flow and pressure) rice husk can be transported which was resulted in Conveying Flow lab tests. Rise husk has high silica content and is abrasive, the conveying velocities are keen to investigate. This paper explains the setup used for this trials, characterization of material used as feed, conveying parameters achieved.

Key words: Conveying Systems, Rice Husk Lean phase Danse phase trial

Problem statement -

To identify the root cause and appropriate type of pneumatic system for low density material & impact of moisture in rice husk in lean phase.

Pneumatics conveying is often the perfect solution for the conveyance of dry powder form materials: overpressure and under pressure create a fast air flow inside the pipelines, which transports the material directly to the desired location. Safe, simple and cost-efficient. This makes pneumatic conveying the optimal bulk material transport.

There are two types of conveying system.

Dilute Phase In dilute-phase conveying, particles are fully suspended in the conveying air and transported at low pressure and high velocity. Dilute-phase pressure conveying is one of the most common conveying methods for powders or granules. It's most often used with non abrasive, nonfragile materials that have a light bulk density.

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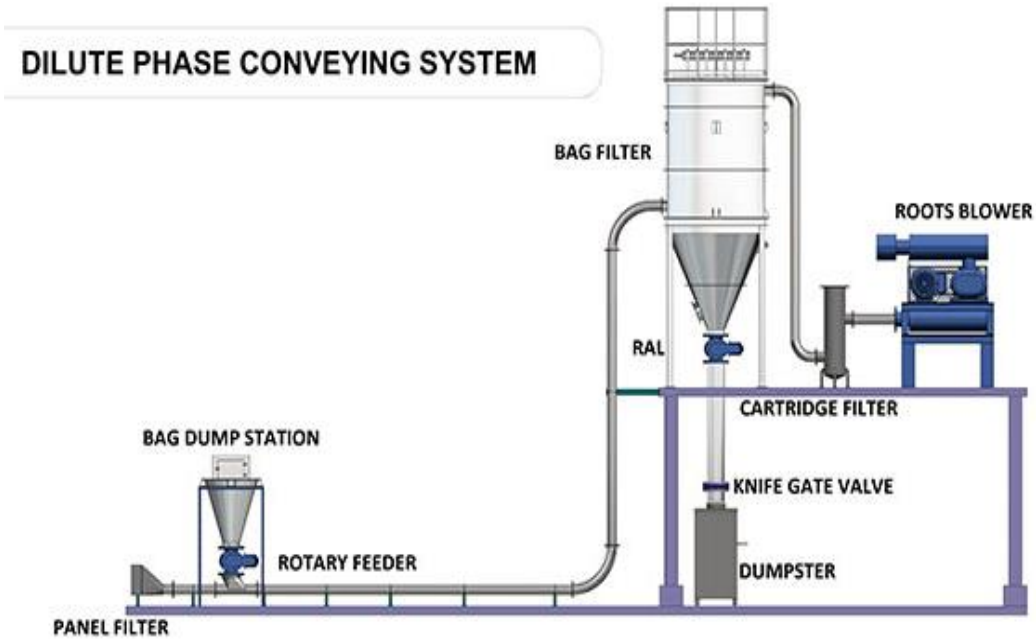
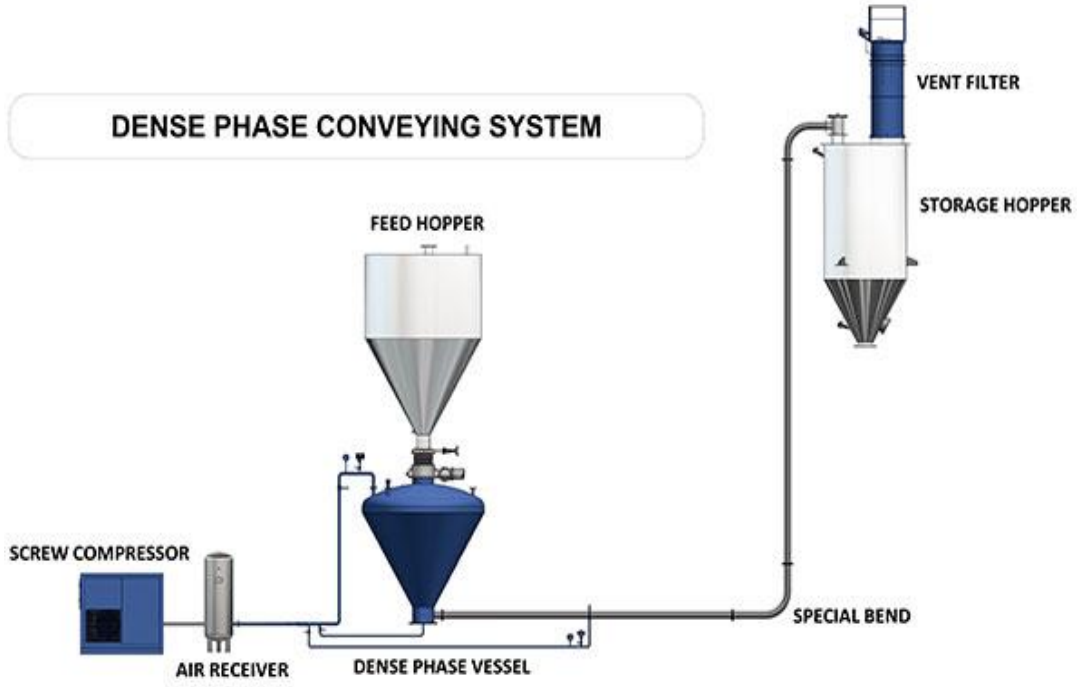


Pic 1a: Lean Phase System

Dense phase Dense phase conveying systems are a type of the pneumatic conveying system, which is using air to transport bulk solids / powder in pipes. Dense phase conveying differs from the other main technology of pneumatic conveying, dilute phase, by the fact to use only a small weight of air compared to the weight of product being transported. It means that dense phase systems operate at a high solids load ratio and at low air velocity.



Pic 1b: Dense Phase System

Test Trail setup:

Rice husk conveying tests been conducted on the existing setup at Conveying Flow Lab. The feed station having opening for bags discharging, fed the rice husk as received and discharge via rotor valve. The negative pressure (Vacuum conveying) conveying been setup for this application.

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Pic2: Feed station **Pic3: Collection filter**

At first, fed the material in feed station through batch wise as can see in fig 2. The bin mounted vent filter which filters lighter density material and heavy density material after feeding all the material int the hopper. Material discharges to the conveying line via RAL. With provided vacuum to convey material system, pipe size that was used for experiment as 80NB and the total conveying length is about 60 meters. Material that used was Rice husk which has moisture of appx 30%. Viewing from sight glass to see the conveying material to observe flow patterns can be observed via sight glass and conveyed fines material were at collecting filter and then collected at collecting hopper. As there is 30% moisture in rice husk, initially fed the material dumped, simulating the site conditions where usually by means loaders will dumped the rice husk for transportation. While doing so, observed the material sticking inside the rotary air lock and jamming occurred. This lead to conduct the flowability test to record the flow properties of rice husk

Challenges

In Dilute phase pressure conveying material might stuck in flanges or in gasket. There are chances of leakages in this type of systems. Trial which we did on Rice Husk. moisture is present in it because of that we face issues/challenges in pending/Turing areas material is sticking in these areas. These are some challenges we face. Material properties are mentioned below. When the material is conveying material

Trial Material properties

Name- Rice Husk
Bulk density – Loose = **79** kg/m^3 , Tapped- **98** kg/m^3
Moisture content- _____
Angle of repose- 45 DEG

Trial Conducted

We use Dilute phase conveying for Rice husk trail
Qty of Feed Material Received = 8.5 kg
Qty of Feed Material Conveyed = 8.5 kg

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Particle size - (+5 MESH= 19%), (+ MESH= 26%), (+10 MESH=35%), (+20 MESH=76%)
Initial Pressure/ Vacuum (MMHG) – 120 bar
Capacity that we achieve- 8.5Kg
Ambient temperature – 30 C
Total Covarying length- 60 m



Pic: 4: Feed material **Pic 5: Choked material** **Pic 6: Repose check**

RESULT

Rice husk which is having many usages as mentioned earlier, to convey material through dilute phase system one should design the hopper discharge system with valve size relatively bigger so it will discharge smoothly. The Vacuum conveying method gives better results due to silica issues in the feed material rather than pressure and any other mode.

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