CHALLENGES FACED INPNEUMATICCONVEYING SYSTEMS

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ABSTRACT

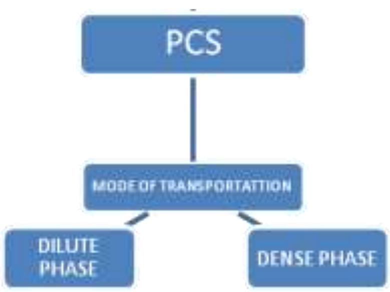
This gives a complete information on the current trends & challenges in pneumatic conveying system (pns). The challenges which are very general in day today conveying industries and even the solution which can minimize the losses like attrition, saltation, and insufficient capacity & pipeline wear. The paper clearly deals with the major threats and hazardous material which is got by the conveying industries all over the world. This paper clearly deals with the safety measures which can be taken for the above mentioned hazardous. The theories like early warming theory, basic safety theory & introduction of flameless venting is given in this paper.

***Keywords*: Challenges Faced, Hazardous Waste**

I. INTRODUCTION

The Pneumatic conveying systems are basically quite simple and are eminently suitable for the transport of powdered and granular materials in factory, site and plant situations. The system requirements are a source of compressed gas, usually air, a feed device, a conveying pipeline and a receiver to disengage the conveyed material and carrier gas. The system is totally enclosed, and if it is required, the system can operate entirely without moving parts coming into contact with the conveyed material. High, low or negative pressures can be used to convey materials. For hygroscopic materials dry air can be used, and for potentially explosive materials an inert gas such as nitrogen can be employed. A particular advantage is that materials can be fed into reception vessels maintained at a high pressure if required.

1.1 Types of Pneumatic Conveying SYSTEMS (Pcs)



1.1.1 Dilute Phase Conveying

- Object are suspended in the conveying air
- The transfer velocity is greater than the “saltation” velocity
- Low system pressures (< 14 psig)

- High air to solids loading ratios (> 2.25)
- High linear velocities (4,200 –6,500 ft/min)
- More destructive -mostly due to the high velocities
- Lower capital costs at start-up
- Lower cost equipment / not rated for pressure system[1]

1.1.2 Dense Phase Conveying

Dense phase conveying takes several different forms, which makes it difficult to define neatly. For plastics processing, think of it as a system that moves material – ideally plastic pellets – with low velocity and high pressure through the pipes, with the pellets settling and accumulating on the bottom of the horizontal conveying line. The pellets are dragged along, and may flow in intermittent surges. The typical velocity of dense phase systems is in the range of 400 ft./min. to 2,000 ft./min. As with dilute phase, there's a pick-up velocity and terminal velocity at the start and finish of the line, and acceleration throughout.[2]

1.2 Comparison

II. CHALLENGES FACED IN PNEUMATIC CONVEYOR SYSTEMS

2.1 Attrition

Attrition is one of the key issues and can lead to any of the following

- poor product performance
- environmental, health and safety issues
- changes in flow properties of material

polymeric components can be problematic due to the formation of either dust or flossThe key in these issues is velocity control. Typically attrition is a strong function of velocity. If the velocity in a dilute phase system can be reduced, this represents a legitimate option for reduction of attrition.

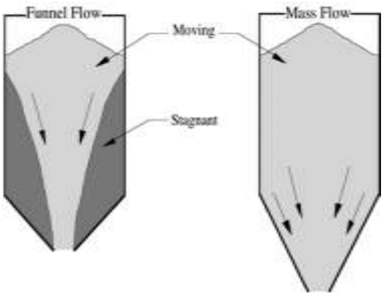
- Increasing conveying system throughput
- Line failure in dense phase system
- Plugging due to poor layout
- Pressure drop which is due to
- Solids friction
- Bends in the pipeline
- Lift
- Particle acceleration
- Air
- Dilute phase[2]

2.2 Saltation

When the gas velocity is slowly decreased during dilute phase conveying, material will begin to deposit or "salt out" at the bottom of the horizontal sections of the conveying system. Saltation is loading dependent – typically the higher the loading, the higher the saltation velocity. No single correlation predicts saltation across all gas and particle parameters.[3]

2.3 Insufficient Capacity

Possible causes of insufficient conveying capacity include: hopper and feeder problems; use of too much or too little conveying gas; line constrictions or poor line layout. Hopper flow obstructions. If the hopper cannot reliably discharge the bulk solids into the conveying line, then the transfer rate in the line will be reduced. Flow problems such as bridging and ratholing will lead to erratic solids discharge into the conveying line. A funnel-low discharge pattern, which occurs when flow through a hopper takes place only in a small flow channel, leaves large zones of stagnant material. Once the flow channel empties, a stable rathole can form and flow stops. Even if flow aids are employed (e.g. vibrators or air cannons), reliable discharge cannot be guaranteed with cohesive materials.[5]



overloaded conveyor belt from coal plant

2.4 Increasing the Solids Transfer Rate Mass Flow Hoppers

Modifying the hopper to promote a massflow discharge pattern,whereby all of the material is in motion during discharge, will produce a uniform discharge with a consistent bulk density. Mass flow can be achieved by changing the hopper geometry to give it a steeper angle, or by providing a smoother interior (i.e., with a lower coefficient of friction), or both. In addition, the hopper outlet must be large enough to prevent bridging.

2.5 F.Line Plugging and

Plugged pneumatic conveying lines can cause an entire process to shut down, and clearing these plug gages can be difficult, especially for cohesive materials. Possible causes of line plugging FOOD, POWDER, PNEUMATICS Figure 2.es include insufficient conveying velocity, too many bends, no acceleration zone, long plug length, upward sloping lines, and product build up in the line. Low gas velocity. If the pickup velocity is below the saltation velocity, the solids will not all be picked up by the air at the feed point, or some will fall out of suspension downstream, possibly causing a pluggage. If plugging occurs at or near the feed point, then either the gas mover is not providing sufficient air velocity or the pipeline is experiencing significant leakage. Too many bends or multiple bends in series.

2.6 Pipeline Wear

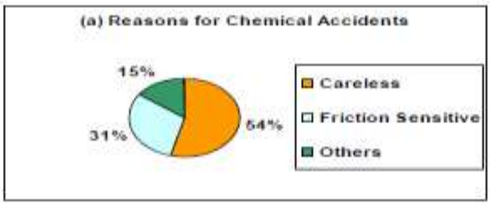
Bulk solids containing silica or oxides can quickly erode steel pipelines, especially with high gas velocities. Most pipeline wear occurs in the bends, and replacing bends can be costly and labour intensive. Causes of pipeline wear include high gas (and particle) velocity, soft pipeline surfaces, and bend layout. High gas velocity. The higher the gas velocity used to convey abrasive materials, the more the erosive wear. Many researchers have found this to be at least a geometric relationship, with wear proportional to gas velocity cubed, if not greater. Since the gas velocity always increases in a conveying line (due to the drop in pressure and density), the most severe wear occurs near the end of the pipeline. Figure 4 illustrates the effects of elbow wear (note the welded steel patch on the back of the elbow) in a long radius sweep, which is the most prone of all elbows to wear.[6]

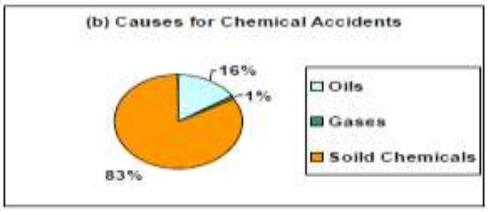
2.7 General Challenges Faced in Pneumatic Conveying Systems

The two main disadvantages of pneumatic conveyors are a relatively high initial installation cost and the amount of filtration required. The high cost is due to the need for an expensive blower or compressor, as well as larger diameter (up to 6 in.), pressure-tested pipe, supporting the larger pipes, and filtering the large volume of air used. As with vacuum conveyors, self-cleaning reverse-jet filters are a big help in reducing maintenance. Maintenance is needed to ensure these systems are leak-free for best efficiency and, above all, to avoid associated health and environmental issues leaks cause.[7]

III. STUDY OF HAZARDOUS CHEMICALS IN PNEUMATIC CONVEYING SYSTEMS

Hazards must be identified in engineering industries using chemicals in various forms like solid, liquid and gases to maintain safe working environment. The study of various accidents happened can be carried out for identifying the major hazards which creates accidents in engineering industries. Most of the chemical accidents in south India happen because of the careless mistakes and improper handling of materials. In this study, the safe handling methods of the various chemicals are explained. The preventive methods for chemicals from bad weather condition are studied in the last session and most of the safe handling techniques of engineering chemicals have been discussed.[8]





The preventive measures from the explosion requires at least to meet any one of the three conditions are;

- To avoid the development of explosible mixtures
- To replace the atmospheric oxygen with an inert gas, working in a vacuum
- By preventing the occurrence of effective ignition sources

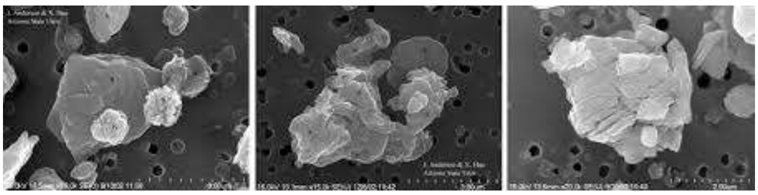
They react with water or moisture and produce dangerous and flammable gases and heat. In case of spillage, these chemicals should not be washed with water. If there is any fire while handling such chemicals, water should not be used for fire fighting. Only dry chemicals should be used to extinguish the fire. These chemicals should be stored in a water proof shed and handled in moisture free environment.

Nitrogen and carbon monoxide are the two industrial gases which may give harm to human life silently since these are not having any characteristic odour to give warning of their existence. Rigas et al stated that working with the organic material contents with nitration is a potentially dangerous process, because nitration performs exothermic reactions under suitable conditions with explosive substances. In gold and silver mine, the safety precautions are essential to maintain the working environment in a safe manner.

3.1 Dust as a Health Hazard

When suspended in air the smallest particle visible to the naked eye is about 50–100m in diameter, but it is the particles of 0.2–5m diameter that are most dangerous for the lungs, as mentioned above. Thus the existence of visible dust gives only indirect evidence of danger, as finer invisible particles will almost certainly be present as well. The fact that no dust can be seen is no reliable indication that dangerous dust may not be present in the air. The large visible particles in a dust cloud will quickly fall to the floor, but it will take many hours for the fine dangerous particles to reach the ground.[9]

Micro structures dust particles in coal conveying machines



3.2 Explosion Risks

When an exposable dust cloud is ignited in the open air there is a flash fire but little hazardous pressure develops. If the dust cloud is in a confined situation, however, such as a conveyor or storage vessel, then ignition of the cloud will lead to a build-up of pressure. The magnitude of this pressure depends upon the volume of the suspension, the nature of the material, and the rate of relief to atmosphere. Research has shown that the particle size must be below about 200_m for a hazard to exist.

At some point in a pneumatic conveying system, or time in the conveying cycle, whether dilute or dense phase, positive or negative pressure, the material will be dispersed as a suspension. A typical point is at discharge into a receiving vessel and a common time is during a transient operation such as start-up or shut-down. Consideration, therefore, must be given to the possibility of an explosion and its effects on the plant should a source of ignition be present.

Due to legal and Health and Safety Executive requirements it is advisable for specialist advice to be sought on dust explosion risks. Authoritative literature on the subject is widely available and there are many tests that can be carried out to determine the seriousness of the problem. It is strongly recommended that a specialist in this field is consulted if there is any doubt about the potential explosion risk connected with pneumatically conveying any material

Explosions Due to Human Error

Fire Accident in China

3.3 Grouping the Hazardous Materials

Group I: Very dangerous Expert advice should always be sought

- Beryllium: particularly as the oxide
- Silica (SiO2) which has been heated: in these circumstances silica undergoes modification into biologically active forms calcinedkieselguhr (diatomaceous earth) is dangerous on this account
- Crocidolite (blue asbestos): evidence associates this variety of asbestos with the development of malignant tumours of pleura and peritoneum

Group II: Dangerous

A visible haze of any of these dusts is intolerable and no possible source of such should be ignored whether or not there is a visible cloud.

- Asbestos, other than crocidolite: the two important varieties in commerce are amosite (brown asbestos) and chrysotile (white asbestos)
- Silica: (e.g.) as quartz, ganister, gritstone, etc.
- Mixed dusts: containing 20% or more of free silica, (e.g.) pottery dust, granite dust and foundry dust
- Fireclay dust: with a total silicate (as silica) content in excess of 60%

1) Group III: Moderate risk

Emission of any of these dusts to form a dense local cloud should cause concern

- Mixed dusts: containing some free silica but arbitrarily less than 20%. In this group are included the dusts of iron and nonferrous foundries
- Coal dust

- Kaolin (china clay, fullers earth)
- Non-crystalline silica: including unheated kieselguhr
- Carbides of some metals
- Cotton dust: and other dusts of vegetable origin
- Aluminous fireclay
- Synthetic silicas
- Graphite
- Talc
- Asbestine
- Mica

IV. CONCLUSION

This paper completely deals with the present trends & challenges. This paper gives the best practices involved in current industries that is Early-Warming, & safety theories.

The best suited safety method in chemical,cement,food and many conveying industries is the Flameless venting which proves to be non-hazardous and increase of efficiency by 80% of the conveyor systems.

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