MINOR TEST I I - BULK MATERIALS HANDLING ITL 752

Time Allowed : **One hour** **Max. Marks: 15**
Date: **04.10.2017**
Answer all questions

Q.1 Granulated sugar is off-loaded from a road tanker into a silo at a confectionary plant. The plant pipeline is 70 m long, 45m of this runs horizontally and 25 m is vertically up. The pipeline contains six 90^0 bends. Air is available at a pressure of 1.0 bar gauge. The tests were carried out with sugar in a 50 mm bore pipeline. The test line was 50 m long, entirely in the horizontal plane, and contained nine 90^0 bends. It was established that the sugar would have to be conveyed in dilute phase and that a conveying line inlet air velocity of 17 m/s should be used. Tests with the sugar showed that it could be conveyed at 3.7 tonnes/hr with a conveying line pressure drop of 0.9 bar and a conveying line inlet air velocity of 17 m/s.

(a) Using the model described below determine the product flow rate which could be achieved through the plant pipeline if it were 125 mm bore, and determine the phase density (solids loading ratio) at which the sugar is conveyed. (3)

(b) It is proposed to build another storage silo at the plant and this will involve conveying the sugar a further of 20 m. The extension will also be of 125 mm bore pipeline. It will all be in the horizontal plane and will include two additional 90^0 bends. Using the model described below determine the flow rate of sugar which can be achieved through this extended pipeline, with the same conveying line pressure drop, and determine the phase density at which the sugar will be conveyed. (3)

The basic features of the model are:

1. Differences and changes in the empty line pressure drop relationships can be neglected.
2. The loss associated with each bend, both on the test line and the plant line, can be taken to be equivalent to 10 m of horizontal pipeline.
3. The equivalent length of vertically up sections of pipeline is double that of horizontal sections of the pipeline.
4. A pressure drop of 0.1 bar must be allowed for across the feeding device.
5. Pressure losses in the air supply lines can be neglected
6. The presence of the sugar particles can be neglected for the purpose of evaluating air velocity
7. Take air and product temperatures to be 15 ^{0}C.
8. Take R for air to be 0.287 kJ/kg K.
9. Discharge is to atmospheric pressure at 1.0 bar absolute.

Q.2 (a) What are the major operational problems encountered in pneumatic conveying systems and what are their reasons. What precautions can be taken to minimize the effect of such problems. (3)

(b) Discuss the influence of impact angle and impact velocity on erosion. (2)

Q.3 Figs 1 and 2 show the conveying characteristics for Cryolite and Dicalcium Phosphate. Explain the difference in the conveying behavior of the two materials and explain the limitations on these conveying characteristics. (4)

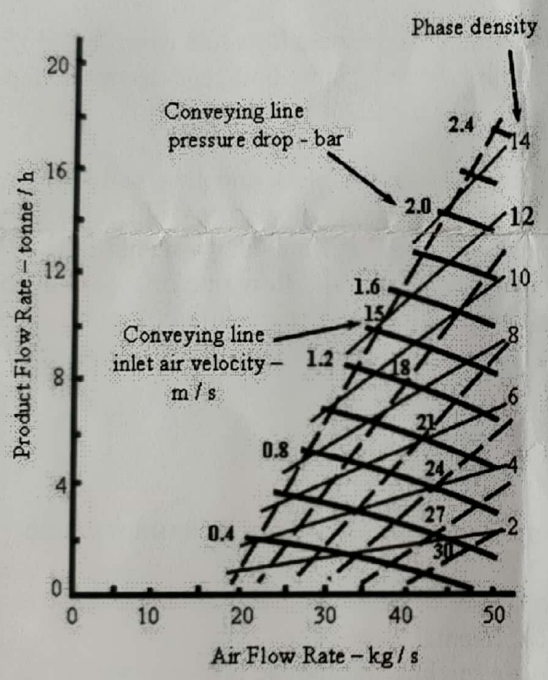

Figure 1: Conveying Characteristics with lines of Constant Conveying Air Velocity Added for Cryolite

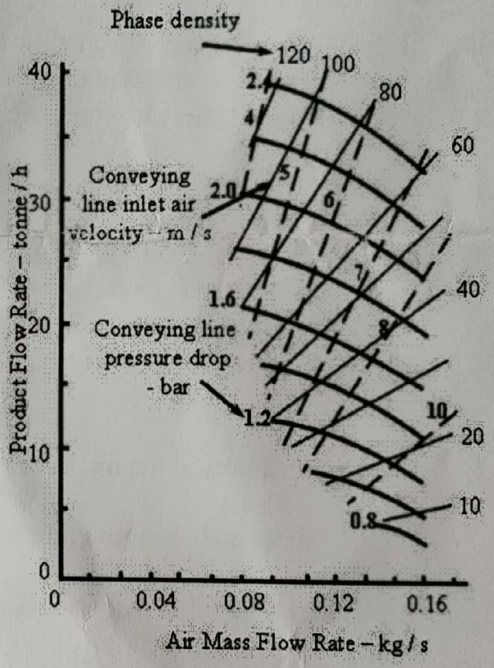

Figure 2: Conveying Characteristics with lines of Constant Conveying Air velocity added for Dicalcium Phosphate