Pneumatic conveying of blended plastic pellets in dilute phase

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ABSTRACT

The pneumatic conveying of plastic pellets is a process widely used in the chemical industry. Different products can be transported using the same conveying system thanks to the great flexibility that this technology offers. However, there are also challenges due to the significant variation on pressure drop produced by different products. This has a direct impact on the conveying capacity due to the limited pressure that the air mover can provide. Among the different types of plastic pellets, it is known that products with a higher modulus of elasticity tend to produce higher pressure drop than harder materials.

The present work explores the effect of blending hard and soft pellets, on the pressure drop during dilute phase pneumatic conveying. With this purpose, a series of conveying tests were performed with blends of hard and soft pellets in different proportions. The component pellets had similar size, shape and density but different modulus of elasticity. The blends were conveyed through a 52mm diameter aluminum pipe and approximately 47 m in length. Each blend as well as the neat materials were conveyed at 23 m/s and 30 m/s with three repeats for each setting. The solids rate was controlled by a rotary valve, while the airflow was controlled to maintain a constant average gas velocity along the conveying system. Along the line, three pressure transmitters measured the pressure differential (ΔP) in horizontal and vertical direction as well as total pressure drop. The airflow was measured by a Vortex type flow meter located downstream the filter receiver. In each test, data from the pressure transmitters was recorded for two minutes during steady state condition. Due to segregation at the receiver, the blends were remixed after each trial so a homogeneous blend was assured for each trial.

Using the data form the pressure transmitters, the corresponding friction factors were calculated for each blend and for the neat materials. The results showed how the friction factors are affected by the composite elasticity of the blend, which in its turn is determined by the mixture ratio between the soft and the hard pellets. Additional tests (currently in progress) and analysis allowed the development of an experimental equation that defines the relation between friction factors of soft and hard materials as a function of the ratio of their elasticities.