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Gentle and Energy-Efficient Pneumatic Conveying of Solids

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Abstract

Pneumatic conveying of powders is an engineering process used for conveying dry granulate or powder material. The aim of this paper is to present a modeling methodology to optimize energy efficiency of pneumatic conveying systems, considering the specific bulk characteristics of the product being conveyed. This work is based on engineering optimization of a workflow with data from an industrial operation commanded by a Programmable Logic Controller (PLC) with a control algorithm, performing logical, sequential, and timed tasks for plant control. The PLC communicates with a Human-Machine Interface and a Supervision and Control System, which are the means of interaction through a graphical environment interface with the process operator. By applying mathematics to introduce a systematic method to select the gas (air) pressure and flow necessary to operate a pneumatic conveying system in dense phase, it has been shown, on an industrial scale, the feasibility of controlling a conveying system by manipulating only two input parameters. This allows operation at pre-determined conveying rates with lower power requirements, resulting in a reduction of OPEX. Thus, this research focuses on optimizing energy efficiency to reduce Operational Expenditure (OPEX) through a systematic modeling approach. Because pneumatic conveyance is highly empirical, general models are difficult to establish. Due to these limitations, evaluating energy efficiency is usually limited to a specific experimental range of conditions. This methodology can be adapted to enhance the energy efficiency of other types of pneumatic conveying systems.

Keywords
Bulk solids; Energy efficiency; Optimization; Pneumatic conveying; Solid feeder.

Biographies
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