What are some tips for handling my hygroscopic material in a pneumatic conveyor?

During pneumatic conveying, hygroscopic materials are at risk of absorbing moisture from the carrying gas through relative humidity or material exposure. This can cause changes in material and conveying properties, undesired chemical reactions, and conveying line buildup.

The relative humidity in the conveying gas can be affected by many factors, including weather, time of day, and temperature. To mitigate the variation, condition the gas for both moisture level and temperature. Refrigerant dryers can remove free moisture from the atmosphere and are good for alleviating condensation concerns. Desiccant dryers can extract moisture and achieve deeper levels of dryness. Heating the gas will further decrease the relative humidity. Controlling the relative humidity as opposed to letting it vary will increase product and process consistency.

Limiting material exposure to the gas will ultimately limit absorption as well. This is best accomplished by increasing the material-to-air ratio, either by increasing the material flow or decreasing the conveying gas flow. Dilute-phase systems operate below optimal capacity and above minimal velocity, so gaining control over the material flow and gas flow and optimizing the material-to-air ratio will reduce overall exposure. Dense-phase systems already operate with high material-to-air ratios and will inherently limit exposure.

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If the hygroscopic material becomes cohesive when moist, it should be kept in a dry environment to avoid agglomerating and caking. You can achieve this through basic system design, such as pneumatically conveying with dry air or gas or blanketing storage hoppers and silos with dry air or gas. If you’re handling fine powders, try installing fluidization dry air or ga discharge aids on your hoppers. For other powders, use a dust collector or bin vent filter with reverse pulse-jet cleaning that has filter media with a nonstick coating or surface treatment. If the material still turns cohesive, nonstick surface coatings on all material contact surfaces will help prevent caking. Using lump breakers or vibratory sieves can reduce agglomerates and eliminate segregation. Make sure the hopper and silo, discharge cone angles, and discharge nozzle sizes are designed specifically for handling your hygroscopic material.

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Hygroscopic materials absorb moisture from the atmosphere, so the simple answer is to pneumatically convey these products in an atmosphere with little or no moisture. For dense-phase pressure systems using compressed air, the compressor should have a dryer to remove enough moisture so the material isn’t affected. For dilute-phase pressure or vacuum systems, add dehumidification equipment at the conveying air inlet to reduce moisture. Some additional tips include using a positive-pressure purge of dry air or gas in hoppers or silos to prevent the ingress of moisture-laden atmospheric air. A weighted atmospheric damper on the clean-air discharge of the corresponding bin vent or filter can also help. You should also consider using a moisture-free conveying medium, such as nitrogen.

Mike Weyandt, corporate sales manager, Nol-Tec Systems, 651-780-8600

You can eliminate moisture in the conveying gas by installing a dryer at the pickup point in a vacuum system or at the blower intake in a pressure system. Make sure the dryer capabilities match your system requirements. Alternatively, try reusing conditioned gas by recirculating it in a closed-loop system using a heat exchanger to compensate for temperature rise across the blower and a make-up tank to compensate for any gas leakage.

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For pressure conveying, it’s important to add a dryer to the supply line. If you’re using a low-pressure conveying system with a differential pressure of less than 500 mbar, try heating the conveying air and isolating the conveying pipe. As long as the conveying line temperature stays higher than the inlet temperature, moisture shouldn’t be a problem.

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Hygroscopic materials are exposed to moisture in a conveying system in two ways—as water vapor in the conveying air or as liquid water that has condensed on equipment interior surfaces. Reducing the conveying air dew point to a low level before it comes in contact with the material will prevent moisture pick up. One common error in system design is cooling the air or equipment surfaces to the air dew point level or below. This causes water to condense out of the airstream and be absorbed by the conveyed material. Any conveying equipment that’s not in a temperature-controlled area should be insulated to avoid wide temperature swings on equipment surfaces. Air, equipment, and material temperatures should be kept well above the conveying air dew point temperature. Compressed air used for fluidizing devices and filter pulsing must also be kept at acceptable dew point levels.

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