Technifax

VACUUM DRYING

Littleford Advances Vacuum Drying Process

Effective drying is often a crucial step in many production operations. In addition to its obvious importance in developing an attractive and usable product, it is frequently utilized to: facilitate product handling, reduce shipping costs, increase process equipment capacity, and optimize product preservation during shipment and storage.

Littleford brings a new dimension to vacuum drying with a unique method of agitating and individualizing the solid particles to be dried. This is accomplished by various mixing elements, simply referred to as "plows". The size, shape, geometric arrangement and peripheral speed of the plows rotating within a horizontal cylindrical vessel force the product into three dimensional motion. This motion individualizes each particle, continuously exposing tremendous particle surface area for drying. The particles constantly collide with one another and with the heated interior walls of the jacketed vessel.

The efficiency of heat transfer, a function of how fast the product is moved within the dryer, is optimized by the selection of the plow speed. As seen in Figure 1, upon achieving a critical plow speed, further increases in speed do not proportionately increase heat transfer. Thus, heat transfer optimization has been achieved at the critical speed.

Figure 2 compares the heat transfer coefficients attainable in several dryers. As can be seen, the Littleford dryer exhibits excellent heat transfer coefficients, often 2 to 3 times higher than those of a ribbon or paddle dryer.

Most solids pass through a "paste" stage during the drying process. This presents problems for conventional dryers, such as the caking of product in static dryers and the balling of the product in tumble dryers. The close and overlapping configuration of Littleford's plows minimizes cake buildup without balling the product.

Littleford dryers, equipped with independently operated high shear choppers, reduce the particle size of the product, exposing undried material. This action allows the faster, external mechanism to remain in effect, thus shortening the drying time required.

Figure 1

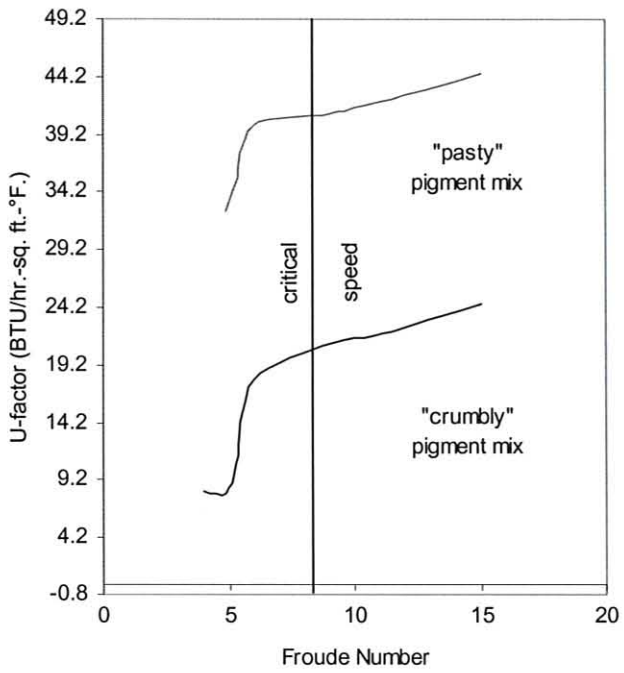
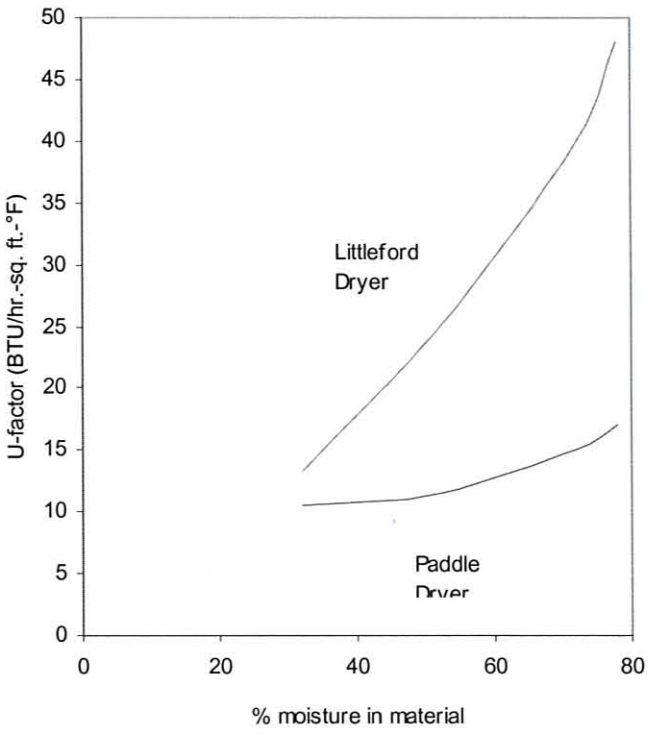


Figure 2



During the drying cycle, as illustrated in Figure 3, most products pass from the "paste" stage into a stage where there is a propensity to form lumps. With continued drying the surface of the lumps becomes unsaturated and internal drying must occur. The drying process and the drying rate slow down as moisture migrates to the surface at a rate dependent more upon the characteristics of the product than the drying process parameters.

Figure 3

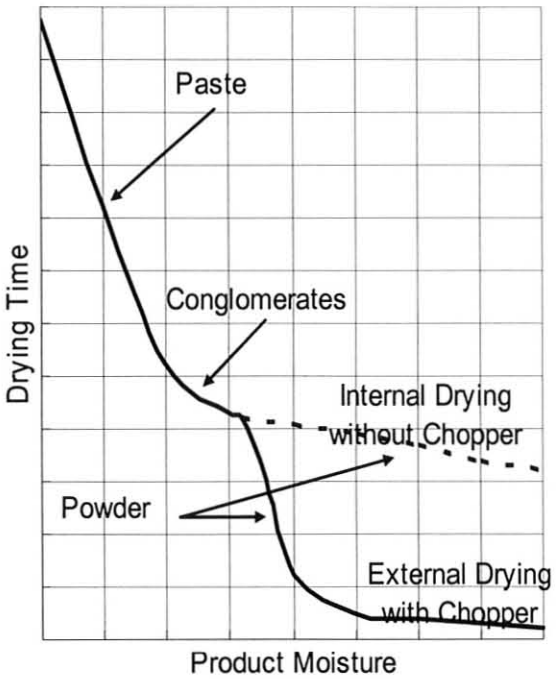
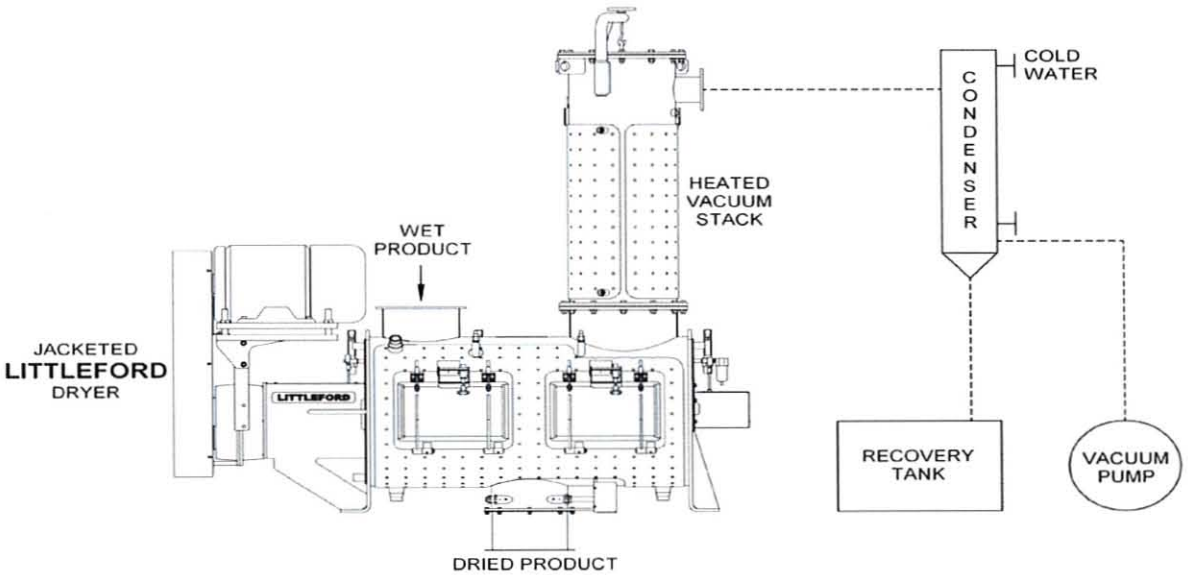


Figure 4 depicts a typical vacuum drying operation. Within the dryer itself, a vacuum promotes liquid evaporation at much lower temperatures than a conventional atmospheric hot air dryer. As evaporation occurs vapor pressure pushes the vapors into the integrally top-mounted vacuum stack. Here, the large diameter of the stack is sufficient to prevent the vapors from reaching transport velocity and carrying product out of the dryer. The vapor then enters a condenser where exposure to low temperatures causes it to condense back into a liquid. The drop in vapor pressure across the condenser creates a vapor pressure differential within the system which pulls vapor from the dryer to the condenser. The condensate then flows into a recovery or holding tank, especially advantageous when expensive solvents are being used. The entire system vacuum is maintained by a vacuum pump capable of maintaining a medium vacuum level.

For even higher levels of vacuum, pressure or temperature, Littleford offers the "DVT" Polyphase® Reactor. The DVT quickly distributes reactants and provides precise control of chemical reactions, following which, the product can be efficiently dried in the same vessel.

Littleford dryers and Polyphase reactors are available in a wide variety of working capacities and with a wide range of optional equipment. Let us put our engineering and design experience to work for you.

TYPICAL DRYING OPERATION



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