Facts on Spray Drying: Viable Solution for Georgia’s Kaolin Industry

Spray drying is the most widely used industrial process involving particle formation coupled with drying. It’s well suited for continuous large-scale production of dry solids in powder, granulate, or agglomerate form from solutions, emulsions, and pumpable dispersions

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Drying, the unit process in which a liquid is removed from a solid by vaporization, is an important, often vital, process in the chemical, food, pharmaceutical, mineral, and ceramic industries.

More than a score of major drying systems are used, and each system is available in numerous configurations. A partial list of the more important dryer types include tunnel, rotary, spray, fluid bed, flash, drum, and hearth. More specialized equipment includes infrared, microwave, and freeze dryers.

Dryers are classified as direct in which the product is directly contacted by heated gases (air, combustion gases, inert gases) or indirect in which the product makes contact with a heated surface. Both configurations are often available as continuous or less efficient batch dryers.

The choice of dryer type depends on the physical state of the feed material as well as the form of the dried product. Feed types include solutions, emulsions, dispersions, pastes, powders, crystals, granules, fabricated shapes, and sheets. Often, several dryer types are used on the same feed material, but no single dryer type is practical for all of the feed types listed.

Besides feed form, considerations when choosing a dryer include the following:

1. Drying characteristics
2. Conveyance of material to and from dryer
3. Product properties (stability, form)
4. Product collection (main product, dust)
5. Infrastructure requirements (space, fuel, power, utilities, environmental)
6. Economics (capital, operating cost, maintenance, labor, scale)

Pilot and preferably scaled-up tests by experienced personnel at well equipped facilities are an absolute necessity prior to selection of equipment. Such tests should also allow sampling to prospective customers to confirm that product meets their requirements and specifications.

The majority of industrial dryers are continuous units operating on direct fired combustion gases. Theoretical operating relations between inlet temperatures, air flow (ACFM), and BTU required per pound of water evaporated are given in the nomograph (Figure 1).

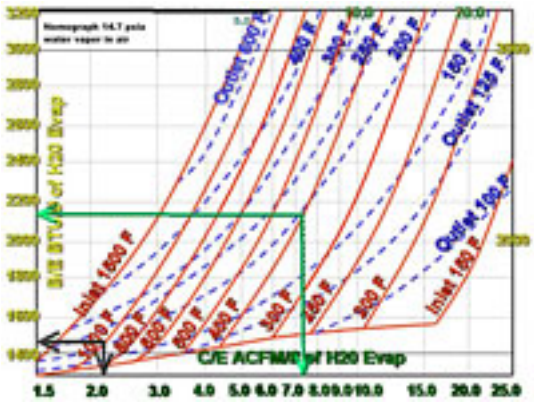

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Figure 1: Dryer Shortcut Chart for Temperatures to 1,500&#176F (Click image for larger version.)

For example, an inlet of 250&#176F and outlet of 200&#176F at 7.2 ACFM per lb of water requires 2,150 BTU per lb of water evaporated. On the other hand, at an inlet of 1,000&#176F, an outlet of 200&#176F, and an air flow of 2.1 ACFM, only 1,440 BTU per lb of water is required.

However, the efficiency of a dryer also depends on the dryer configuration, feed form, and product form. The Georgia kaolin industry has used and evaluated a wide variety of dryer types on different products in their plants. Kaolin is a naturally occurring aluminosilicate clay produced by a sophisticated flow sheet involving up to a dozen steps including electro-kinetic dispersion, classification, delamination, magnetic separation, selective flocculation, filtration, and drying. The U.S. industry is concentrated in Georgia (90 percent of value produced) and is highly competitive intrastate as well as from alternative pigments and imports.

As a result, there has been relentless R&D continuing to improve and optimize process performance and economics. A good part of this effort is spent on drying, which is the most energy-intensive step. An example of the results of such investigation is summarized in Table 1.

Table 1:
Comparison of Evaporative Efficiency of Dryer Types

Dryer Type	Feed Solids