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## PROBLEMS IN PRACTICE

## 1 • What makes a commercial adiabatic drier differ from a theoretical one?

The word *adiabatic* means no heat lost to the outside and that the sensible heat lost by the air is equal to the latent heat of the water evaporated. In an actual drier, the solid containing the water, and the water itself must be heated to the temperature of evaporation, before evaporation can begin. Radiation losses from the drier enclosure is the other factor causing deviation from the theoretical adiabatic process.

## 2 • What is a zone drier?

This term refers to a continuous drier where the drying medium is divided into two or more sections, in order to have better control of the temperature and humidity gradients through the drier, and often different velocities.

## 3 • If a material enters a drier containing 70 per cent water and 30 per cent solids, and leaves the drier with 10 per cent water and 90 per cent solids, (a) What is the evaporation per pound of dried product? (b) What is the evaporation per pound of bone dry material?

$$a. \frac{90}{30} - 1 = 2 \text{ lb water per pound dried product.}$$

$$b. \text{Water entering} = \frac{70}{30} = 233 \text{ per cent on bone dry basis.}$$

$$\text{Water leaving} = \frac{10}{90} = 11 \text{ per cent on bone dry basis.}$$

Water evaporated 222 per cent on bone dry basis.

Evaporation = 2.22 lb water per pound bone dry material.

## 4 • What items must be included in a calculation of the drier heat requirements?

- Heating water to be evaporated from the entering temperature to the temperature of evaporation.
- Evaporating water to be removed.
- Superheating evaporated water from the temperature of evaporation to the exit temperature of the air.
- Heating material from entering to leaving temperatures.
- Heating residual water from the entering to the leaving temperatures.
- Heating conveyor or other supporting materials.
- Radiation losses through the enclosure.
- Sensible heat in the exit air.

5 • The following conditions prevail in a drier; 250 lb water evaporated per hour. Air enters heater at 80 F dry-bulb and 65 F wet-bulb. Air exhausted from drier at 130 F dry-bulb and 100 F wet-bulb. Stock enters drier at 70 F. Heat required for warming stock and radiation losses are not considered. Fan is located ahead of heater. Find conditions of air entering and leaving drier, volume handled by fan, and temperature of air entering drier to supply the necessary heat, using Humidity Chart in Fig. 4.

Entering Air: Humidity,  $H = 0.01$  lb water vapor per pound dry air.  
Dew-point = 57 F  
Per Cent Humidity,  $\% H = 46$