

ABSTRACT

The pneumatic dryer is a standard piece of equipment used for drying particulate materials in which the moisture is mainly present as surface moisture. In spite of this, however, little or no work has been published on gas to particle transfer processes in such equipment. Thus, a vertical dryer 17 feet long and 1 in. I.D. was built and operated in order to study these transfer processes. Granulated sugar was chosen as the material because of its suitability for this type of equipment and also because of its local application.

The two main variables studied in the system were the Reynolds number, N_{Re} , and the solids to gas ratio, N_{α} . A volumetric heat transfer co-efficient was calculated from data obtained by using a computer technique based upon differential heat balances. The volumetric heat transfer co-efficients were correlated in the form of a modified Nusselt number N_{Ph} , against the Reynolds number and the solids to gas ratio, to give the following:-

$$N_{Ph} = 232.6 (N_{Re})^{1.223} (N_{\alpha})^{0.3784}$$

$$265 < N_{Re} < 568 \quad 0.65 < N_{\alpha} < 2.00$$

A volumetric mass transfer co-efficient was calculated from data by first calculating the volumetric heat transfer co-efficient from the above correlation and then using a computer technique based upon differential heat and mass balances. The volumetric mass transfer co-efficients

obtained were correlated in the form of a modified Sherwood number, N_{Pm} , against the Reynolds number and the solids to gas ratio as follows:-

$$N_{Pm} = 2.023 \times 10^{11} (N_{Re})^{-2.52} (N_{\alpha})^{2.47}$$

$$310 < N_{Re} < 495 \quad 0.51 < N_{\alpha} < 0.97$$