

**DESIGN OF AN EXPERIMENTAL PLANT FOR THE DRYING OF INSTANT COFFEE OPERATING IN CLOSED**

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**ABSTRACT**

An experimental plant for the drying of instant coffee in two stages operating in closed cycle was designed. The purpose of the plant is to recycle the drying air after removing the absorbed humidity and the entrained dust, in such a way that the volatile compounds removed during the drying process are retained in the air stream, which eventually becomes saturated, stopping the absorption of volatile compounds. The plant consists of a 0.3-m diameter and 4-m height spray dryer, a fluidized bed dryer with a 0.15-m wide and 0.5-m long distributor and an effective flow area of 5 %, a cyclone, a longitudinal finned double pipe cooler-condenser with a transfer area of 0.58 m<sup>2</sup> and an adsorption column whose breakthrough time is reached in 100 minutes. In order to design the plant, experimental work to determine some parameters was required. These parameters are the curves of drying kinetics and minimum fluidization velocity of instant coffee; the adsorption curve of a silica-gel adsorption column; and other parameters such as porosity, bulk and particle density, and particle size distribution of instant coffee. Differential mass and energy balances were solved in order to dimension and optimize both dryers. In addition, simulations were carried out to determine the influence of some variables on the main operation parameters. Both dryers are able to operate with either atmospheric or dry air, providing that the temperature of the air stream entering the spray dryer is at least 200 °C, and the one entering the fluidized bed dryer is at least 80 °C, with a inlet gas velocity of 0.18 m/s to prevent excessive entrainment of solid material.