

DRYING OF GRANULAR MATERIALS IN ROTATING FLUIDIZED BED IN A STATIC GEOMETRY (RFB-SG)

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ABSTRACT

Scarcity of food and imbalance in production and consumption of the same are major problems in the world. This problem can be solved to a large extent by reducing the food loss which occurs due to the lack of suitable and economic technology in developing countries. Food preservation is the only way to reduce food loss. Drying is identified to be one of the postharvest technologies to reduce losses of food and improvement of quality as well. Drying is one of the most energy intensive unit operations in post-harvest processing. The purpose of reducing the moisture content is to prolong the shelf-life of the products of bio-origin by reducing the moisture activity to a level low enough where growth of microorganisms, enzymatic reactions, and other deteriorative reactions are inhibited. Some products of bio-origin such as herbs have to be dried before the active ingredients can be extracted. Furthermore, the products in the dry form losses weight and volume are reducing transportation costs. Most of the available dryers do not perform well and have low efficiency as reported in literature. One of the modern technologies emerging out to the market is the Fluidized bed dryer which is energy intensive. In conventional fluidized bed is found to have trouble due to mechanical vibration and sealing (need for rotating seal) in critical components. Further, particle feeding and removal from this type of dryer is difficult. Hence there is a need for development of an efficient dryer for quality drying.

Present work is focused towards development and performance analysis of a rotary fluidized bed with static geometry (RFB-SG). This dryer is developed based on the

concept of injecting the fluidization gas tangentially into the fluidization chamber with the help of multi gas inlet slots. Upon contact with particles, the gas- phase motion quickly shifts from tangential to radial direction and gas leaves the vortex chamber through a chimney. Due to inertia, the particles follow a different gas flow path and form a rotating particles bed. The fluidizations of the particles are depending on the radial gas-solid drag force and the countering centrifugal force. Thus a very high acceleration in order of 7-8 times that of acceleration due to gravity is achieved which helps in quick removal of moisture even from the core of the particles to be dried.

In the present work drying characteristics of different agricultural products, such as paddy and wheat grains were considered. Effects of air flow rate, relative humidity, air temperature and inventory on drying characteristics are established. Performance of RFB-SG was compared with a bubbling fluidized bed. A set of correlations for moisture removal are also developed. Finally comparison of thermo-economic aspects of both the dryer are presented. It was observed from this work that RFB-SG is one of the most promising dryers for cereal crop drying. Moreover, present study will be helpful in improving RFB-SG for scale up.