Thesis Title	Study of Death Kinetics and Drying Rate of Baker's Yeast Using a Batch Fluidized Bed Dryer
Thesis Credits	12
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Degree of Study	Master of Engineering
Department	Food Engineering
Academic Year	1998

Abstract

The purposes of this research were to study the effect of fluidized bed drying conditions on the properties of dried baker's yeast products, in order to obtain mathematical models of the death kinetics of the yeast cells and the effective mass diffusivity within the granulated yeast during drying, that will be used to scale-up a continuous fluidized bed dryer. In the work, the granulated yeast samples were prepared by mixing a cream yeast with a wheat bran with dry weight ratio of 1:1, and then the mixture was extruded and cut to produce granulated yeast cylinders of about 1.0 mm in diameter for three different lengths, 1.2 ± 0.1 , 1.6 ± 0.6 and 3.2 ± 0.9 mm respectively. The drying experiments were performed in a bench scale batch fluidized bed dryer with 100 mm in diameter, which was operated at 1.4 m/s of air velocity and three air temperature levels, 40.0 , 60.0 and 76.8 $^{\circ}$C. The results showed that the viability of yeast cells during drying was decreased as the temperature of drying air was increased, but was increased as the size of granulated yeast was increased. The optimum drying temperature at 40.0 $^{\circ}$C and the granular length of 1.2 ± 0.1 mm were selected for the subsequent work.

The death kinetics of yeast cells during drying can be expressed as a first-order equation having the temperature dependent death rate constant in form of the Arrhenius's relationship. The Arrhenius constant and the activation energy were not affected by yeast temperature, but the Arrhenius constant was increased as moisture content was decreased, whereas the activation energy was decreased as moisture content was decreased.

The values of the effective mass diffusivity within the granulated yeast at various moisture contents during drying were estimated from the slopes of the drying curves. The effective mass diffusivity was found to be a function of the yeast temperature in form of the Arrhenius's relationship. The Arrhenius constant was decreased as moisture content was decreased, whereas the activation energy was increased as moisture content was decreased.

To study the effect of additives on the viability of dried baker's yeast products, three additive types, 1.15 percents (g/g dry yeast) Guar Gum , 7.5 percents (g/g dry yeast) Sorbitan Monostearate and 1.0 percents (g/g dry yeast) Calcium Monohydrogen Phosphate were added into the granular length of 1.2 $\pm$ 0.1 mm. The drying experiments were then carried out using the drying temperature of 40.0 $^{\circ}$C and the air velocity at 1.4 m/s. The results showed that the viability of the granulated yeast with additives was higher than that without additives. The viability the granulated yeast with additives was 62.3-71.0 percents, whereas the viability of the granulated yeast without additives was only 41.5-51.9 percents. It was found that the addition of additives increased the rate of drying, and consequently, reduced the drying time.

Keywords : Baker's Yeast / Drying / Fluidized Bed Dryer / Death Kinetics / Moisture Transfer