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Drying kinetics parameters of various food materials employed in the reaction engineering approach (REA) to describe global and local drying rates

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ABSTRACT

An effective drying model should be accurate yet require a small number of experiments to generate the parameters. The relative activation energy of various food materials, important drying kinetic properties used in reaction engineering approach (REA), is evaluated and summarized. The REA is then implemented to model the global and local drying rates of food materials. By using the relative activation energy, the REA describes well (R^2 higher than 0.99) global drying rate of food materials. The REA can be coupled with a set of equations of conservation of heat and mass transfer to model the local drying rate of food materials. The relative activation energy is indeed proven to be accurate to model the local drying rate. While the predictions are accurate, the REA is very effective to generate the drying parameters since the relative activation energy can be generated from one accurate drying run since different drying conditions of the same material with similar initial moisture content would result in the similar relative activation energies. The drying kinetics parameters generated here are readily

used for design of new equipment, evaluate the performance of existing dryers and monitor the product quality.

Keywords: drying, relative activation energy, reaction engineering approach (REA), local and global drying rates

INTRODUCTION

The effective drying model should be accurate, physically-meaningful and require minimum number of experiments to generate the drying kinetics parameters. The reaction engineering approach (REA) has been created and researched by the group of Professor X.D. Chen since 1996 and it was shown to be able to model various challenging drying cases accurately [1-2]. The REA relies on the relative activation energy to represent the change of internal behavior of materials during drying. It can be obtained from one accurate drying run then it can be implemented for modeling drying of the same material with the similar initial moisture content at other conditions. Although the REA has been proven to be accurate to model various challenging drying cases [3-6], there has been no comprehensive report on the relative activation energy of various food materials for describing the global and local drying rates. This paper is aimed to summarize the relative activation energy of various food materials as well as show the applicability of these relative activation energies to model the global and local drying rates. The outline of the paper is as follows: initially the REA is introduced followed up by summary of relative activation energies of various food materials and the implementations to describe the global and local drying rates of food materials.