Applications of Computational Fluid Dynamics (CFD) in Food Processing

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Abstract: Food processing industry has become one of the major sources of employment in 21st century. Due to the use of automation and modern food processing equipment, processing of food is occurring in large scale. It is a great challenge to meet the increase in demand of people regarding food taste and flavour as well as maintaining food quality. Food processing has a major role in grain processing, dairy and baking industries. Some common processed food includes cheese, breakfast cereals, tinned vegetables, bread, meat products, snacks and biscuits. Since the processing of food basically involves mechanical processes, the design and development of these processes along with the food processing equipment require a simulation tool with high performance. Heat transfer and fluid flow is a common phenomenon in case of food processing. Advent of high speed digital computer and powerful numerical methods make numerical solution of the flow equations in seasonable time Computational Fluid Dynamics (CFD) today is an alternative cost effective simulation method of real life flows. In this chapter, the potential utilization of CFD is discussed in several food processing methods such as drying, cleaning, pasteurization, baking, sterilization, mixing and refrigeration.

Keywords: CFD, Food Processing, Simulation, Fluid Flow, Temperature distribution

1. Introduction

Computational Fluid Dynamics (CFD) is a method of obtaining numerical simulation of fluid flow within a definite region of fluid. It involves the use of computer along with advance mathematics to find the solution of governing equations of fluid flow. The Navier-Stokes transport equations which consist of mass, momentum and energy equations are numerically solved to determine the profile of fluid flow along with the quantities of heat and mass transfer. Due to the versatility of CFD, it is used extensively as a simulation tool in the field of automotive, power plant, HVAC, hydrodynamics and designing of thermal equipment. It helps to predict the air flow movement over