Chapter 11

OVERALL CONCLUSION AND FUTURE SCOPE

The governing equations for simultaneous heat and mass transfer for the different types of the dryer were modeled along with the development of a computer program. A simulation was carried out, and the results were obtained by varying various input parameters. An algorithm and associated computer program have been developed for simulation of different types of the dryer for particulate materials where internal diffusion of water plays a dominant role. The simulation studies have been conducted for the detailed performance prediction of the dryer for drying for a different type of drying material such as cereal grains and ceramic material like kaolin. The validity of the simulation program is confirmed by the internal consistency of the results generated. An optimum design of the dryer can be arrived at using a given set of input parameters. Also, optimum performance from an existing dryer geometry can be obtained by judicious selection of input parameters. Based on a developed computer program. The effect of tempering and drying treatments on the fissuring grain and the effect of exhaust gas recirculation was also investigated, integrating the intra-kernel moisture distribution. The following outcomes were drawn from the present study:

1. The developed mathematical model and computer program for a different type of dryer can be easily extended for the analysis of other materials.
2. Optimum design conditions and performance parameters can be approached with the help of the Intra-kernel moisture distribution model proposed in this study.
3. Tempering is found to be a very effective tool for preserving higher quality in terms of keeping the maximum value of moisture gradient inside the rice kernel coming out from

the dryer to an acceptable limit. This reduces the chances of fissuring to a great extent. The throughput can be increased with an increase in temper duration.

4. Inlet material flow rate has the most important effect on thermal efficiency. Increasing the inlet material flow rate increases the efficiency but decreases the drying rate. At a lower flow rate of material, efficiency is low, but there is more scope of exhaust air recirculation, and the efficiency increases upto70 to 80%.
5. Higher temperatures of outlet air with low humidity offer the scope for recirculation, making the thermal efficiency high.
6. The detailed rating analysis results provide insight for efficient utilization of a given dryer geometry during varying climates over the year. Such developments for varying operating parameters can be utilized for designing an optimum geometry for a specific purpose.

Future Work

In the field of drying, there is a lot of studies to be done. It's critical to know when to start a new R&D project and when to stop working on it and search for a new "disruptive technology" to pursue. There are countless examples of long-standing technology being completely replaced by newer ones. There is a risk of suffering from time to time. In light of the fierce global competition, it is critical for businesses to update their technology on a regular basis. According to a recent BBC investigation, nanotechnology is on the verge of going the way of the dotcoms. Drying is a crucial step in the manufacture of thin films and nanoparticles, although it has restricted use. Newcomers joining a field that is likely to become saturated quickly, especially if it has a limited scope, should take caution. The water content of the moist feed material should be kept to a minimum to lessen the thermal burden on dryers. Traditionally, vacuum or pressure filters, decanters, centrifuges, and

other devices have been used to accomplish this. Drying colloidal substances, such as solid waste from paper mill treatment, food wastes, coal mine tailings, or oil sands, is problematic owing to the tiny particle sizes (5 mm) involved. The following unique processes have effectively emerged in recent years, partially as a consequence of technological push and partly as a result of market pull. The theory and methods of Electro-osmotic dewatering (EOD dewatering) have been highlighted by [Chen and Mujumdar] and [Vijh], among others. Traditionally, vacuum or pressure filters, decanters, centrifuges, and other devices have been used to accomplish this. The following unique processes have successfully evolved throughout the years, partially as a consequence of market pull and partly as a result of innovation. Impinging Jet Dryers, impinging Stream Dryers, microwave drying, radio frequency drying, induction, and ultrasonic drying are some of the most recently developed drying technologies. Others include pulse combustion drying, which was originally created for propulsion but is now used for combustion. Applications In the domain of drying technology, vibrating bed dryers, which were initially designed for solids conveying, impinging streams (opposing jets), which were originally developed for mixing, and combustion applications, require a lot of research and development.