

## ABSTRACT

Rice is the staple diet for more than half of the world's population and is consumed principally in Asia and Africa. Paddy is subjected to more processing and handling operations than any other grains. Parboiling of paddy and subsequent drying to remove the excess moisture are the major energy intensive processing operations in rice milling industry.

Still air drying studies were carried out on parboiled paddy at different temperatures ranging from 70 to 150°C. Data was analysed for drying kinetics. The milling quality was determined. Thermogravimetry technique was used for analysing single kernel drying kinetics in two different modes viz. dynamic and isothermal. A thin layer drying set-up was designed, fabricated and used in convective air drying studies of parboiled paddy. The parameters selected were 70-150°C drying air temperature, 0.5-2 m/s air velocity and 5-20 cm grain bed depth. Process parameters were optimized based on drying time, specific energy and milling quality (head yield). Effect of mixing, tempering and step drying process were evaluated.

Drying time required, drying rate constants, heat and mass transfer coefficients, effective moisture diffusivity and head yield were determined for both still air and convective air drying. Drying rate was limited by diffusion process in parboiled paddy. Thermogravimetry gave satisfactory information regarding drying kinetics comparable to bulk grain and other sources of food materials. Three dimensional Janders diffusion model explained the moisture removal process of parboiled paddy. Empirical models were developed for drying time, drying rate constant, moisture ratio, moisture diffusivity, specific energy and head yield. Drying temperature had greatest effect on drying time and grain bed depth had greatest effect on milling quality. Mixing, tempering, multi-step drying and control of grain temperature enhanced the milling quality while reducing the drying time and specific energy requirement. Higher drying air temperature can be used in conjunction with a low temperature step for parboiled paddy drying.

**Key words:** Parboiled paddy, Still air drying, Convective air drying, Multi stage drying, Drying kinetics, Thermogravimetry, Moisture diffusivity, Milling quality.