

**Title** Moisture diffusivity of rough rice under infrared radiation drying  
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### **Abstract**

To design efficient infrared (IR) dryers for rough rice, it is important to understand the drying behavior of rough rice under IR heating. The objective of this study was to determine the moisture diffusivity of rough rice under IR heating followed by cooling. The effects of initial moisture content, rice temperature, drying bed thickness, tempering, and cooling methods on moisture diffusivity and moisture diffusivity coefficient were investigated. Samples of freshly harvested medium grain rice (M202 variety) with initial moisture content (MC) of 25.8, 31.2 and 33.8 g moisture/100 g dry solid were used. They were dried with IR radiation intensity of  $5348 \text{ W/m}^2$ , for six exposure times, 15, 30, 40, 60, 90 and 120 s. The tested drying bed thicknesses were single-layer, 5 mm and 10 mm. The unsteady diffusion equation based on Fick's law and slope methods were used to describe moisture diffusivity. The results indicated that rough rice moisture diffusivities under IR heating and cooling were significantly affected by rice temperature and tempering treatment, respectively. High heating rate and moisture diffusivity were achieved with IR heating. It took only 60, 90 and 120 s to achieve about  $60 \text{ }^\circ\text{C}$  rice temperature with corresponding moisture diffusivities of  $4.8 \times 10^{-9}$ ,  $3.6 \times 10^{-9}$  and  $3.4 \times 10^{-9} \text{ m}^2/\text{s}$  during heating for drying bed thicknesses of a single layer, 5 mm and 10 mm, respectively. The moisture diffusivity coefficients during heating and cooling of IR dried rice with tempering were much higher than those of convective drying, which reflected the high drying rate of the IR drying method.