

ABSTRACT

Proto type mechanized rice pre-conditioner has been designed and tested for uniform heating and mixing of grains during its pre-conditioning. Moisture reduced exponentially with heating time for salt treated parboiled rice (30% wb initial moisture; 0.0, 2.5, 3.5 and 5.0% salt) with simultaneous linear increase in kernel hardness. The system took about 90 minutes to arrive puffing moisture level of 10 – 10.5% (wb) for salt treated rice; slightly more than no-salt rice (control). The machine-conditioned rice puffed well with both microwave oven and tradition method of puffing. Salt in the kernel exhibited profound effect on percentage of puffing and expansion ratio for microwave puffing of pre-conditioned rice with different energy input levels (9 - 30 kJ; 450 - 1000 W power and 20 - 50 s). The optimized range of microwave power, heating time and salt concentration were estimated to be 780 – 942W, 26.2 - 33.7s and 4.6%, respectively. Comparison of microwave puffing of machine-conditioned rice (MCR) and traditionally-conditioned rice (TCR) showed that average percentage of puffing was higher with the former but average expansion ratio was higher with the latter. Storing of pre-conditioned rice up to 90 days under specific condition and packaging did not show much change in its moisture content, so also the microwave puffing quality. Moisture sorption isotherms of pre-conditioned rice with different salt concentrations and temperature followed a cross-over phenomenon beyond water activity values of 0.55 – 0.75 and best fitted to GAB sorption isotherm model. Microstructures of surface and core of raw, parboiled, conditioned rice kernels showed distinct effects of salt concentration and prolong heating during pre-conditioning process on densification of the surface that ultimately led to develop its impervious character. Good agreement between theoretical prediction of temperature profile of the rice kernel under microwave heating and experimental results was observed.

Keywords: grain puffing, puffed rice, mixing index, pre-conditioning of rice, microwave puffing, microstructure of rice, moisture sorption isotherm, puffing process modeling