

Title: Comprehensive Evaluation of Aerated Soaking for Paddy Parboiling in an Eco-Friendly Manner

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Abstract: Aerated soaking of paddy is a simple novel technique to utilize water effectively. Therefore, automated water circulation was maintained in the aerated soaking systems using a motor and timer. The timer was set with 70 minutes on-time and 20 minutes off-time. Hence, aerated soaking systems with operating cycles of 70 minutes on-time and 20 minutes off-time were developed based on dissolved oxygen profile in soaking water. The quality parameters of soaking water and rice were analyzed and compared with the conventional soaking process. In addition, moisture absorption pattern was also studied in aerated soaking systems and compared with the conventional soaking system. Results revealed that the aerated soaking of paddy improved hydration rate and reduced soaking time with a considerable reduction in effluent quality in terms of BOD. The moisture contents of conventional soaking, submerged aerated soaking and exposed aerated soaking were $27.84 \pm 0.01\%$, $30.41 \pm 0.01\%$ and $31.48 \pm 0.01\%$ respectively after 24 hours of soaking. The BOD values of conventional soaking, submerged aerated soaking and exposed aerated soaking were 1575 mg/l, 600 mg/l and 472 mg/l respectively after the end of soaking. The higher DO resulted in the germination of paddy grain which in turn reduced the head rice yield. The values of pH, total dissolved solids, total solids and electrical conductivity of conventional soaking were highly different compared to submerged and exposed aerated soaking systems. The values of head rice percentage (HR- $79.15 \pm 1.15\%$) and broken rice percentage (BR- $20.84 \pm 1.15\%$) of conventional soaking were almost similar to submerged aerated soaking (HR- $79.51 \pm 1.62\%$ and BR- $20.49 \pm 1.63\%$), but remarkably different from exposed aerated soaking (HR- $60.74 \pm 2.00\%$ and BR- $39.25 \pm 1.99\%$). The use of a submerged aerated system yielded a positive outcome related to hydration rate, reduction in terms of BOD (975 mg/l) value with reasonable milling yield profile in terms of head rice percentage. Hence, the system of submerged aerated soaking can be considered as a viable initiative for an eco-friendly parboiling process.