A SIMPLE APPROACH TO IMPROVE THE QUALITY OF RICE PADDY PROCESSING WASTEWATER

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In Sri Lanka, there are 70,000 rice mills performing parboiling of 2.8 million metric tonnes of paddy (rough rice) per year. Rice processing is the country's largest agro-based sector, producing more output per unit of product than any other industry.

In the rice industry, two kinds of products, raw rice and parboiled rice, are produced for consumers.

Parboiling is an energy and labour-intensive pre-milling process. Parboiling aims to improve the quality and yield of the rice (head rice). More than 67% of the world's population consume parboiled rice.

Milling of paddy without any pre-treatment is highly susceptible to breakage and loss of minerals and vitamins. The rice mill industry in Sri Lanka uses different types of soaking such as cold, hot, and vacuum soaking. However, most of the milling industry uses the cold soaking process, which takes 48 – 72 hours for the paddy to reach 30% moisture content. The duration is dependent on paddy variety and environmental factors.

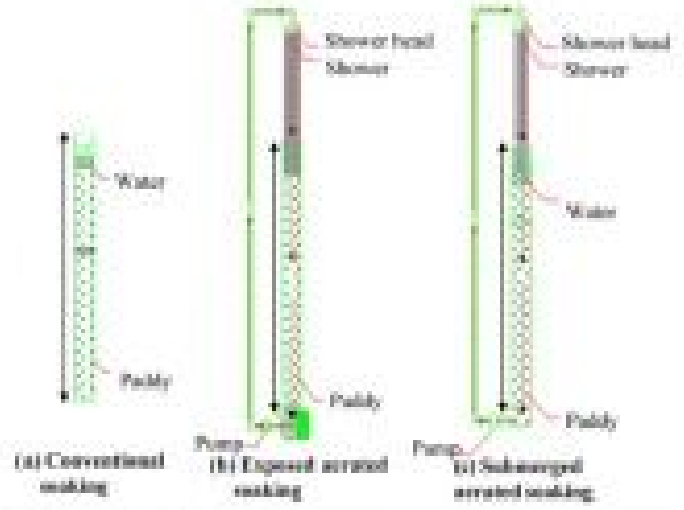
Wastewater coming from rice mill operations contains high concentrations of organic and inorganic substances, causing significant pollution. The volume of wastewater generated is 0.4 to 0.52 L per kg of paddy processed. In Sri Lanka, many rice industries discharge effluent without any treatment directly into the environment. The release of wastewater to surface water can affect the fertility of fish, another important food source. Moreover, soil respiration and enzyme activities can be inhibited by about 25% – 34%.

Research shows such wastewaters have a low concentration of dissolved oxygen (DO) – 0.9 mg/L, a moderate concentrations of chemical oxygen demand (COD) – 650 mg/L, chloride (140 mg/L), total dissolved solids (TDS) – 670 mg/L. Total suspended solids (TSS) – 530 mg/L, and biological oxygen demand (BOD) – 459 mg/L) were much higher than the recommended standards set by the Sri Lanka Standards Institution (SLS) for the discharge of effluent into inland surface waters.

MODIFIED AERATED SOAKING SYSTEM

A modified aerated soaking system can help improve effluent quality, as it maintains a positive DO value through water circulation and the addition of oxygen. Moreover, this activity prevents anaerobic fermentation of organic matter, reduces the BOD value of the wastewater, minimizes microbial colonies in the effluent, and reduces odour development.

In a conventional soaking system, the use of stagnant water is common. With aerated soaking systems, water is circulated through the paddy column. In a submerged aerated soaking system, water is circulated through submerged paddy grain. A pump draws water, which then gets sprinkled through overhead shower heads to increase DO diffusion.



Line diagrams of different soaking systems.

An exposed aerated soaking system can lead to germination of paddy grain, due to a higher amount of DO concentration which induces metabolic activity within the grain. This is not good for milling yield, as grains tend to germinate more quickly.

In summary, a submerged aerated soaking system is more effective than other conventional, or exposed aerated soaking systems. It will help maintain the positive dissolved oxygen (aerobic) concentration in the soaking water and increase the hydration rate of the paddy.

Furthermore, it reduces the time taken for the soaking process and reduces the chemical and biological oxygen demand of the effluent and significantly reduces effluent volume. Hence, it is viable and a novel option for a better parboiling process. ■

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