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Surfactant-assisted green liquor dregs pretreatment to enhance the digestibility of paper mill sludge

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Abstract

This study optimizes a novel surfactant-assisted green liquor dregs (GLD) pretreatment of paper mill sludge (PMS), both of which are wastes from the kraft pulping industry, using a combined Response Surface Methodology (RSM) design. Optimized conditions give a maximal reducing sugar release of 16.38 g/L. A substantial reduction in heavy metals aluminum, chromium, cobalt, arsenic, lead, and copper after pretreatment illustrates the enhancement of substrate digestibility by reducing toxic elements. Separate hydrolysis and fermentation (SHF) and simultaneous saccharification and fermentation (SSF) for hydrogen production are assessed. SSF produced a hydrogen yield of 3.72 mL/g, displaying a 36.26% increase from pretreated PMS compared to SHF. These findings provide insights into possible methods of reducing process duration, energy input, and costs incurred with waste disposal within the paper industry. Furthermore, improved hydrogen yield using an SSF process demonstrates the potential beneficiation of pulp and paper GLD and PMS wastes.