

Beneficiation of Pulp and Paper Mill Sludge for the Generation of Single Cell Protein for Fish Farming

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Abstract : Fishmeal is extensively used for fish farming but is an expensive fish feed ingredient. A cheaper alternate to fishmeal is single cell protein (SCP) which can be cultivated on fermentable sugars recovered from organic waste streams such as pulp and paper mill sludge (PPMS). PPMS has a high cellulose content, thus is suitable for glucose recovery through enzymatic hydrolysis but is hampered by lignin and ash. To render PPMS amenable for enzymatic hydrolysis, the PPMS was pre-treated to produce a glucose-rich hydrolysate which served as a feed stock for the production of fungal SCP. The PPMS used in this study had the following composition: 72.77% carbohydrates, 8.6% lignin, and 18.63% ash. The pre-treatments had no significant effect on lignin composition but had a substantial effect on carbohydrate and ash content. Enzymatic hydrolysis of screened PPMS was previously optimized through response surface methodology (RSM) and 2-factorial design. The optimized protocol resulted in a hydrolysate containing 46.1 g/L of glucose, of which 86% was recovered after downstream processing by passing through a 100-mesh sieve (38 µm pore size). Vogel's medium supplemented with 10 g/L hydrolysate successfully supported the growth of *Fusarium venenatum*, conducted using standard growth conditions; pH 6, 200 rpm, 2.88 g/L ammonium phosphate, 25°C. A maximum *F. venenatum* biomass of 45 g/L was produced with a yield coefficient of 4.67. Pulp and paper mill sludge hydrolysate contained approximately five times more glucose than what was needed for SCP production and served as a suitable carbon source. We have shown that PPMS can be successfully beneficiated for SCP production.

Keywords : pulp and paper waste, fungi, single cell protein, hydrolysate

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