

ABSTRACT

Cassava pulp, a low cost solid byproduct of the cassava starch industry, has been proposed as a high potential ethanolic fermentation substrate, due to its high unextracted starch level (65.5%) and 13.12% fiber residual, low ash content and tiny particle size of the lignocellulosic fibers.

As the economic feasibility of its process depends on complete degradation of the polysaccharides to fermentable glucose, the comparative hydrolytic potential of six commercial enzymes such as Cellobiase[®], Dextrozyme[®] GA, Termamyl[®] 120 L, Celluclast[®] 1.5 L, Viscozyme L, and Pectinex[™] Ultra SP-L was studied. The three earlier mentioned enzymes were expressed as an amyolytic enzyme, Celluclast[®] 1.5 L had major activity as cellulolytic enzyme, and both Viscozyme L and Pectinex[™] Ultra SP-L had main activity as pectinolytic enzyme.

Dextrozyme[®] GA (5.63 mL/kg substrate, 50°C, pH 5, 24h) showed the most effective activity on hydrothermal (90°C, 10min) treated cassava pulp (12%, dw/v) and approximately 689 g glucose was released per kg cassava pulp or equivalent to 90,18% dextrose equivalent (DE).

Maceration of higher concentration (23% dw/v, particle size <177µm) of cassava pulp by Celluclast[®] 1.5 L (16.7 mL/kg substrate, 50°C, pH 5, 180min), then liquefied and saccharified by Termamyl[®] 120 L (25 mL/kg substrate, 90°C, pH 5, 30min) and Dextrozyme[®] GA (5.63 mL/kg substrate, 50°C, pH 5, 24h), respectively resulted in a glucose yield of 738g/kg cassava pulp or equivalent to 96.6% DE.

Crude multi-enzyme ({ Viscozyme[®] L 85,8 mL/kg substrate } + { Cellobiase[®], 5.63 mL/kg substrate }, 50°C, 24h, pH. 5) composed of non-starch polysaccharide hydrolyzing enzyme activities, including cellulase, pectinase and hemicellulase act cooperatively to release the trapped starch granules from fibrous cell wall structure for subsequent saccharification by raw starch degrading activity. A high yield of fermentable sugars, 535 g/kg cassava pulp released or equivalent to 70.1% DE.

Based on the experiment result, the need of cassava pulp for ethanol production can be estimated. For instance, 5.57kg of 40% water content cassava pulp was needed for production of 1.0 kg ethanol. With the same condition, 3.93kg dry cassava pulp (15% water content) was needed to produce 1 kg ethanol.

Key words: bioconversi, multi-enzym, onggok, DE, hydrothermal