World Journal of Microbiology & Biotechnology 11, 607–609

Optimization of single-cell-protein production from cassava starch using *Schwanniomyces castellii*

Tipparat Hongpattarakere and Aran H-Kittikun *

***Schwanniomyces castellii* B5285 grew faster and produced greater biomass and higher protein yield than either *S. alluvius* ATCC 26074 or *S. alluvius* 81Y when these amylolytic yeasts were grown with 2% (w/v) cassava starch as sole C source. With 0.5% (w/v) glutamate as N source, *S. castellii* reached 7.12 g cell dry mass/l, with a protein yield of 6.4 g/100 g starch. The optimal agitation speed, aeration rate and pH for growth of this yeast in a fermenter were 400 rev/min, 1.67 vol./vol.min. and 5.0, respectively. Tween 80 at 0.1% increased cell dry mass to 8.90 g/l, cell yield to 44 g/100 g starch and protein yield to 7.4 g/100 g starch.**

Key words: Cassava starch, *Schwanniomyces castellii*, single-cell protein.

Cassava (*manihot*, tapioca), a tropical, starch-containing tuber with 32% carbohydrate and 0.7% protein content, is a very suitable raw material for single-cell-protein (SCP) production (Brook *et al.* 1969; Reade & Gregory 1975; Azoulay *et al.* 1980). More than 25% of the 600 known yeast species grow on starch as sole C source (Martin & Uden 1977; Clementi *et al.* 1980; Touzi *et al.* 1982; Rossi & Clementi 1985). Species of the genus *Schwanniomyces* produce an α-amylase and an amyloglucosidase required to provide the glucose monomer for cell growth (Wilson *et al.* 1982; Calleja *et al.* 1986).

Single-cell-protein production from *Schwanniomyces castellii* was optimized in the present study, using cassava starch as C source.

Materials and Methods

Microorganisms and Growth

Schwanniomyces castellii B5285 (from the Department of Microbiology, Chiang Mai University), *S. alluvius* ATCC 26074 and *S. alluvius* 81Y (from the Department of Microbiology, University of Queensland) were grown for inoculum cultures on (g/l): KH_2PO_4, 2.0; $MgSO_4.7H_2O$, 1.0; $(NH_4)_2SO_4$, 1.0; peptone, 3.5; yeast extract, 3.0; and cassava starch, 20, with the initial pH adjusted to 5.4 using 1 M H_2SO_4. The growth medium itself contained (g/l): yeast extract, 0.1; cassava starch, 20; and N source, 5. Cultivation was carried out, either by shaking at 150 rev/min in a 250-ml conical flask (50 ml working volume) or in a 2-l fermenter (1.2 l working volume), at 28°C. All the experiments were repeated three times.

Analyses

Growth was followed turbidometrically at 660 nm (A_{660} of 1.0 = 10.65 g cell dry mass/l). The 36-h cultures were centrifuged at 5000 × *g* for 10 min. Dry mass was obtained by oven-drying at 100°C. Protein was determined using Lowry's method and reducing sugar using the method of Somogyi & Nelson (Nelson 1944). Starch was estimated using a slight modification of the methods of Anon. (1984) and Somogyi & Nelson (Nelson 1944).

Results and Discussion

Strain Selection

In the inoculum medium (Figure 1), *S. castellii* had the highest specific growth rate of 0.125 h^{-1} and was accordingly selected for further optimization studies.

Optimization of N Source

Although of all the N sources tested (Table 1) sodium glutamate gave the best growth, the final pH increased to 6.9 when this source was used. To maintain a low pH and so avoid bacterial contamination, various ratios and

The authors are with the Department of Industrial Biotechnology, Faculty of Agro-Industry, Prince of Songkla University, Hat Yai 90110, Thailand; fax: 66 74 212889. *Corresponding author.