VALORIZATION OF AN ANDEAN CROP (YACON) THROUGH THE PRODUCTION OF A YEAST CELL-BOUND PHYTASE UNDER OPTIMAL FERMENTATION CONDITIONS

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ABSTRACT

The suitability of the yeast *Debaryomyces occidentalis* to produce phytase activity on a *Smallanthus sonchifolius* (yacon) extract-based medium (YM) was studied.

Optimal conditions for phytase production were evaluated in YM at 28 °C and pH 5.5, with an inoculum of 10^7 cells/mL, in shaken flasks, using a Box-Benkhen optimization

design, and analyzed by response surface methodology. Phytase location was determined by subcellular fractioning and protoplast formation.

Maximum phytase titres were obtained with 0.11 % w/v yacon reducing sugars, 0.65 % w/v $(NH_4)_2SO_4$ and 16 hours of fermentation. The maximum phytase activity attained under these conditions was over 6-fold higher than in non-optimized medium. Scaling-up in a STR-type bioreactor further increased phytase productivity by 1.5-fold. Phytase produced was associated to the cell wall fraction, and presented optimal temperature and pH range values of 75-80 °C and 4.0-5.0, respectively, retaining 80 % of its activity at 80 °C for 40 min. From Lineawever plots *Km* and *Vmax* for phytase were calculated, being 2.5 mM and 357 mU/mg protein, respectively. Fe^{+2}, Cu^{+2} and Zn^{+2} inhibited enzyme activity by 87, 48 and 35 %, respectively. Progressively increasing phosphorus concentration in the medium inhibited enzyme production, up to 60 % with 0.1 % w/v H_2KPO_4.

Yeast biomass, phytase production and production kinetics in YM were similar to those produced in a cane molasses-based medium. Yacon resulted in a promising alternative feed stock to produce a yeast-bound phytase potentially applicable in the feed industry as a nutritional additive.