OPTIMIZATION OF ENERGY CONSUMPTION IN SPOUTED BED REACTORS (SBR) APPLIED TO SAPONINS REMOVAL ON BITTER QUINOA ECOTYPES

M. Obando, R. Escalera, C. Quiroga y L. Arteaga

ABSTRACT

The energy per unit mass, required for the novel saponins removal process from bitter quinoa grains (*Chenopodian quinoa Willd* sp.), by means of a Spouted Bed Reactor (SBR) was minimized. Basic SBR performance characteristics and operation conditions were studied on grains of the Real Blanca ecotype, grown at Oruro and Potosi departments, located in the Bolivian Altiplano.

Experimental runs were carried out using two laboratory-scale cylindrical-conical SBRs of 7.5 and 20 cm in diameter, 1.4 – 5 mm outlet diameter nozzles at static bed heights within 7.5 and 17.5 cm. Air was supplied by a 400 $Lmin^{-1}$ piston compressor, which included a 10 – 280 $Lmin^{-1}$ rotameter and an air filter for the removal of oil and humidity. A factorial design was applied, which included, as independent variables: reactor diameter, nozzle outlet diameter, bed height and processing time. Dependent variables were: energy per unit mass of processed grains, residual saponins content and mass loss percentage.

The factors which had larger effect on energy per unit mass were nozzle oulet diameter and reactor diameter, followed by process time and bed height. The minimum energy per unit mass was 0.23 kWh kg^{-1} for the following combination: 3 mm : 20 cm : 12.5 cm : 60 min for nozzle diameter : reactor diameter : bed height : processing time, achieving a saponins concentration of 0.01% in treated grains and a mass loss percentage < 5%. These values are smaller than those reported before [11].

New values of K and n constants were obtained for Lama's equation used for the calculation of the spouted bed pressure loss: K = 9.2572 and n = 0.3308, for the 7.5 cm SBR and K = 12.8453 and n = 0.3451 for the 20 cm SBR. Using these values, the overall pressure loss experimental and calculated values fit fairly well. These overall pressure losses are smaller than those reported [11] and would be satisfied using more affordable air blowers, instead of the expensive high pressure screw-compressor required formerly.

Keywords: Quinoa, Saponins Removal, Spouted Bed Reactor, Energy Consumption