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Optimisation of Linamarin Extraction from Cassava Leaves by Ultra-Sonication and High-Performance Dispersing

SAJID LATIF, SONNAL LOHIA, JOACHIM MÜLLER

University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany

Abstract

Cassava (*Manihot esculenta*) ranks as one of the most important crops, grown in 105 countries and a staple crop for nearly one billion people. It's mainly grown for starchy roots while other parts of the plant are considered as waste products, which lead to environmental pollution due to their disposal. Cassava leaves are rich in protein (17–38 %) but cyanogenic glucosides (linamarin) limit their use as food and feed. This research focuses on obtaining the optimal conditions for extraction of linamarin from cassava leaves by using response surface methodology (RSM). Conventional (Soxhlet) and non-conventional (ultra-sonic and high-performance dispersing) extraction methods were performed for two different organic solvents: ethanol and methanol. The process was carried out for solvent concentration (75, 85 and 99.9 %), solid-to-liquid ratio (01:10, 01:15 and 01:20 g ml⁻¹) and time (ultra-sonic – 10, 20 and 30 minutes; high-performance dispersing – 10, 15 and 20 minutes). The optimal conditions for an ultra-sonic extraction were found to be time 20.41 minutes, solvent concentration 86.58 % methanol at 35°C and 40 kHz, which yielded 81.2 % extraction efficiency. The parameter solid-to-liquid ratio had no significant effect on the ultra-sonic extraction and interestingly an inter correlation between time and solvent concentration was found. The optimal conditions for an high-performance dispersing extraction were found to be 19.95 minutes, 88.0 % methanol, 0.19 g ml⁻¹ at 35°C and 11000 rpm, which yielded 88.8 % extraction efficiency. These two optimised methods are relatively simple, less time consuming, cost effective, feasible and environmentally sustainable for the extraction of linamarin from cassava leaves. This extracted linamarin can be utilised as a bio-pesticide and leading to a circular bio-economy.

Keywords: Bio-pesticide, Box-Behnken design, cassava leaves, high-performance dispersing, linamarin, ultra-sonic