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Design and process optimization of a push a button and walk away microwave based green extraction technique for naturally occurring bioactive compounds

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An ecofriendly microwave-assisted extraction (MAE) technique with a low carbon output was developed for the rapid extraction of bioactive oleanolic acid from *Gymnema sylvestre*. Several different influential extraction parameters such as microwave power, extraction time, solvent type, solvent composition, preleaching time, loading ratio and extraction cycle were studied in a systematic fashion for the determination of optimum extraction conditions. Under optimum conditions, 8 min of MAE produced a maximum yield of 7.6% (w/w) of oleanolic acid which was found to be 4 times, 3 times and 1.2 times more efficient than maceration, stirring extraction and heat reflux extraction, respectively. The recovery of oleanolic acid was taken as the indicative marker for the stability of oleanolic acid at the derived operating extraction conditions. Results showed that average complete recovery at the operating extraction conditions varied from 97.6% to 98.2% with no change in retention time of oleanolic acid, thus abolishing any fear of thermal degradation. The calculated RSD value was 3.5%, which indicates an acceptable level of precision. The RSD of the chromatographic analysis was 0.62%. With regard to environmental impact, the quantity of carbon dioxide released to the atmosphere was 1440 g CO_2 g^{-1} extract for heat reflux extraction. This is alarmingly more than the 53.336 g CO_2 g^{-1} extract for MAE. From the results of scanning electron microscopy, a new synergistic phenomenon of heat transfer and mass transfer was proposed. Henceforth the proposed extraction method can be called as green extraction technique having comfort of operation to the extent of "push a button and walk away".

Biography

Mandal Vivekananda has completed his PhD at the age of 30 years from Jadavpur University, Kolkata, India and he is currently working as a faculty in premier Government University in India. He is also the Associate Editor of Phcog Mag (indexed in Pubmed & Scopus). He holds 4 patents and more than 24 high impact publications and 2 books to his credit in the field of analytical chemistry and process optimization. He has delivered more than 8 invited lectures at several national and international conferences.

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