



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Studies on Extraction and Purification of Rebaudioside-A and Dehydration of Aloe Vera Gel

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SHORT ABSTRACT

The present work comprises into two parts. In the first part, extraction and purification of rebaudioside A from 'Stevia' leaves using water, as a green solvent, were performed followed by process modeling and optimization. The second part covered the dehydration of aloe vera gel using hot air, microwave, and hybrid drying techniques.

Stevia rebaudiana (Bertoni) is a medicinal herb which contents eight sweet-tasting glycosides. Among which rebaudioside-A (Reb-A) is the most predominant, having the sweetening potential of about 450 times as compared to the sucrose solution (0.4 % w/v). Reb-A is proposed as a future alternative to sugar. But the challenges lie in its extraction and purification processes due to its lesser quantity in the leaves.

The present work studied the extraction of Reb-A using water as a green solvent. The effect of extraction parameters, namely, extraction time, leaves to water ratio, and temperature on Reb-A recovery was investigated. Response surface methodology (RSM) was applied to optimize the extraction process along with the Artificial Neural Network (ANN) modeling. The optimum extraction time was found as 51 min for a leaves to water ratio of 2.36 % at 71°C by which 73 % Reb-A recovery was achieved.

Membrane based separation study using ultrafiltration (UF) membrane for the purification of Reb-A in both batch and cross-flow setups was performed. The selection of UF membrane was made in terms of its transient flux

decline and Reb-A recovery. The effects of transmembrane pressure drop (TMP) and feed flow velocity on color, clarity, total solids, purity, and selectivity were investigated in detail in the cross-flow ultrafiltration. TMP drop of 414 kPa and Re number of 1667 were found to be most suitable operative conditions with the selectivity of 0.45 and flux value of $5.86 \times 10^{-6} \text{ m}^3 \text{ m}^{-2} \text{ s}^{-1}$ for 30 kDa UF membrane. Field's fouling models were tested for cross flow flux decline data. The cake filtration showed the best fitting under the whole operating conditions.

Aloe vera (*Aloe barbadensis* Miller) is a perennial herb which is nowadays a prime concern of many researchers for its intense immune-therapeutic benefit. The process of dehydration of aloe vera gel often fails to retain its physico-chemical properties in the dried aloe vera gel. This part of the works proposes hybrid drying processes of aloe vera gel instead of a single prolonged drying method. The performance of microwave-assisted drying (MWAD) and four proposed hybrid drying processes, i.e., centrifugation followed by freeze drying (CFFD), microwave followed by freeze drying (MWFFD), centrifugation followed by HAD (CFHAD) and microwave followed by hot air drying (MWFHAD) had been evaluated in terms of its carbohydrate and protein contents, and functional properties of dried aloe vera gel. Among all drying techniques, CFFD, and CFHAD showed the highest carbohydrate and protein retention of 91.8, 82.3 % and 90.9, 85.6 %, respectively.

Further, in MWAD, the influence of three independent parameters, namely, microwave power, gel quantity and drying time on moisture ratio was investigated. A 'two level' face-centered central composite design (FCCD) developed a multivariate regression model to evaluate their effects on the moisture ratio. The optimal MWAD condition was established as 49.82 W g^{-1} power density and 5.78 min of drying time corresponding to the moisture ratio of 0.15. An ANN model of 3-5-1 neural network architect with the 'Levenberg-Marquardt backpropagation' algorithm showed the best prediction of the output response. Finally, eight drying kinetic models were tested to study the behavior of MWAD of aloe vera gel. Two term model was the best fitted with the effective moisture diffusivities ranges from 2.025×10^{-6} to $7.087 \times 10^{-6} \text{ m}^2 \text{ s}^{-1}$ and, the drying efficiency was found to vary from 50.8 to 68.7 %.