Adsorption-based Process for Separation of Aleuritic Acid from Lac

by

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Dedicated

to

my Parents,

my Ph.D. Supervisors,

&

Prof. A. K. Gupta

CERTIFICATE

This is to certify that the thesis entitled '**Adsorption-based Process for Separation of Aleuritic Acid from Lac**' being submitted by **Ms. Navdeep Kaur** to the Indian Institute of Technology Delhi for award of Doctor of Philosophy is a record of bonafide research work carried out by her under our guidance and supervision in conformity with the rules and regulations of Indian Institute of Technology Delhi.

The research report and results presented in this thesis have not been submitted, in part or full, to any other university or institute for the award of any degree or diploma.

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New Delhi Navdeep Kaur

ABSTRACT

Aleuritic acid (9, 10, 16-Trihydroxy palmitic acid) is a hydroxy fatty acid usually isolated from lac. It is an important starting material for a large number of specialty chemicals required for flavours and fragrances. This thesis investigates the feasibility of an adsorption based process for isolation and recovery of aleuritic acid, because the current processes based on dissolution and re-crystallization result in low yields. In the present work, hitherto unknown adsorption characteristics of aleuritic acid over an anion exchange resin Tulsion A-27 MP have been investigated. The batch equilibrium and kinetic behavior of adsorption of sodium salt of aleuritic acid by the resin has been experimentally studied. Equilibrium adsorption data obtained has been correlated using standard adsorption isotherms. The isotherms show a characteristic dependence on initial concentration of solution. The observations during this study have been rationalized through a model developed on the basis of Langmuir adsorption of the ion on the resin while also accounting for the solution chemistry, hydrolysis and dissociation of different species involved.

Kinetic studies have been performed by monitoring the conductivity of a well-stirred batch of the resin in the adsorbate solution and monitoring the conductivity as a function of time. External mass transport limitations have been eliminated by studying the effect of stirrer RPM. Adsorption kinetics have been investigated for various resin loadings and the data was attempted to be fitted with several simple and more complicated models accounting for the microstructure of resin. These studies are successful in predicting the overall trend but were seen to be limiting in modeling the characteristic times in the process, captured by the slopes and curvatures of the curves. Finally, a modified model for mass transfer to a sphere from a finite solution appeared to work well in this situation and rationalization of the data has been achieved.

Finally column studies for adsorption and desorption, which highlight the feasibility or the use of adsorption on the column have been analyzed and alternate process based on the liquid-solid circulating fluidized bed technology has been proposed for the process. Various design and engineering considerations for the process are discussed.

TABLE OF CONTENTS