NRC·CNRC
Biotechnology Research Institute
CNRC·NRC
Institut de recherche en biotechnologie

L-10269

Method for high-yield enzymatic synthesis of non-ionic biosurfactants

SUMMARY

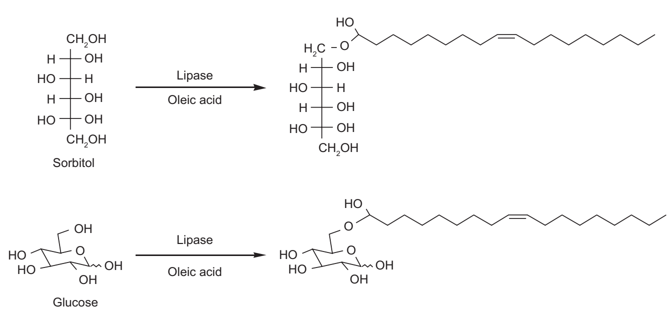
Non-ionic surfactants are widely used in areas such as food, pharmaceuticals, personal care and household or industrial detergents because of their ability to influence the properties of surfaces and interfaces. Positive attributes that include biodegradability and non-toxicity make sugar and sugar alcohol-based surfactants particularly appealing. However, their application has been previously limited due to problems with the preparation of the sugar / sugar alcohol esters. This technology solves this major limitation and makes the expanded large scale commercial application of this useful class of molecules practical.

APPLICATIONS

- General applications where non-ionic surfactants are used including food, pharmaceuticals, household and industrial detergents.
- Useful in markets such as oil recovery, environmental detoxification, and agriculture.
- Enzymatic production of a broad range of biosurfactants including generation of molecules that cannot be prepared using chemical synthesis.

CONCEPT

To obviate the limitations of chemical synthesis, as well as the low efficiency of currently available enzymatic catalysis of sugar/sugar alcohol esterification, a method that promotes high yield and good conditions for esterase/lipase activity by the continuous removal of generated water was developed. The method resolves all the problems inherent to sugar ester synthesis by carrying out the reaction at once in solvent media and under reduced pressure. These conditions allow evaporation of water, followed by its condensation and adsorption in a water-trap before returning the solvent to the reaction media. Lowering the pressure allows the solvent to reflux at the optimum temperature for the biocatalyst. The process allows the use of a vast number of solvents with a large range of boiling points in order to insure that optimal temperature conditions for the stability of enzymes is maintained. Judicious combination of parameters such as solvent used, temperature and pressure of the reaction increases the contact between the two substrates and promotes the displacement of the reaction equilibrium towards the end product.



Lipase-catalyzed reaction in mild conditions allows for selective esterification of primary hydroxyl groups, without the side reactions leading to by-products often encountered in the classical chemical esterification reactions.

FEATURES AND BENEFITS

Increases reaction yields using an easy to manage system

The key limitation in the reaction is excess water; by addressing this throughout the reaction process by continuous removal, the yields are greatly enhanced. Further, since the adsorption agent is not directly in the reaction media, it does not affect at any time the different products of the reaction and their recovery, nor the biocatalyst itself.

Enables development of a wide variety of products

Sugars, such as glucose and fructose, or sugar alcohols, such as sorbitol or xylitol, can be esterified with fatty acids of various chain lengths and degrees of saturation: this will lead to products having different HLB (hydrophilic-lipophilic balance) that can be specifically formulated to obtain preparations having various detergent, emulsifying, and wetting capacities.

Ecologically clean method

Compared to chemical processes, the enzymatic process has a low environmental impact with little or no ancillary degradation products. Furthermore, biosurfactants are biodegradable, non-toxic, non-skin irritant, odorless, tasteless, and easily obtained from renewable agricultural feedstock.

PROTECTION STATUS

Sugar/sugar alcohol esters (NRC no. 10269).

CONTACTS

Yves Quenneville
Tel.: (514) 496-8507
Business Development Officer
E-mail: yves.quenneville@cnrc-nrc.gc.ca

Daniel Desmarteaux
Tel.: (514) 496-5300
Business Development Officer
E-mail: daniel.desmarteaux@cnrc-nrc.gc.ca

Dr. Robert Lortie
Tel.: (514) 496-6158
Microbial & Enzymatic Technology Group
E-mail: robert.lortie@cnrc-nrc.gc.ca

IPSO 10269 12/09/06

National Research Council Canada
Conseil national de recherches Canada

Canada