International Symposium on
Setting their Table: Women and the Periodic Table of Elements
Feb. 11-12, 2019 - Murcia (Spain)

United Nations Educational, Scientific and Cultural Organization
2019 IYPT International Year of the Periodic Table of Chemical Elements

Biotechnologic Cosmetics, Enzymatic Production of Spermaceti

Fuensanta Máximo, Mar Serrano, Claudia Montiel, María Gómez, Asunción María Hidalgo, Antonio Bódalo

Univ Murcia, Fac Química, Dept Ing Quim, Campus de Espinardo, 30100 Murcia, Spain

Topic: Old Elements, New Technologies: how to improve the quality of life

Abstract:

The enzymatic synthesis of fine chemicals is a promising approach to overcome the major problems of the traditional chemical routes and implement eco-friendly and low energy consuming industrial processes. The spermaceti is a solid wax rich in high-molecular-weight esters, extracted from the cranial cavity of the sperm whale *Physeter macrocephalus* L. Since the 1980s, the sperm whale is a protected species and its hunting has been banned, so new industrial processes had to be developed in order to find a synthetic pathway for obtaining this ester mixture. The most common method is based on the reaction between the carboxylic acid and the alcohol at high temperature (120-160 ºC) using an acid catalyst (H_2SO_4, HCl, etc.) or heterogeneous catalysts of various nature These methods present many disadvantages: handling with very corrosive and hazardous chemical compounds, high energy consumption and the deterioration of the synthesized product. Additionally, the extreme reaction conditions favor the formation of numerous by-products that might have a negative effect on the process economy, as this entails the need of complicated separation and purification processes to recover the ester of interest.

A solution to these problems is the synthesis of the main components of spermaceti by enzymatic catalysis from the appropriated fatty acids and fatty alcohols. Spermaceti is a wax rich in high molecular weight whose the major constituents are cetyl esters of linear long fatty acids, mainly myristic and palmitic but also lauric and stearic, and relatively low triglyceride content.

The aim of this poster is to present a green process to obtain the main components of spermaceti in a solvent-free system. A noticeable number of lipases are capable of catalyzing the process, among them some commercial immobilized lipases (Novozym® 435 and CalB immo Plus of *Candida antarctica* lipase, Lipozyme® RM IM of *Rhizomucor miehei* lipase and Lipozyme® TL IM of *Thermomyces lanoginosus* lipase) and other immobilized derivatives prepared by the research group.

In order to facilitate the comparison between the properties of the obtained esters with the commercial ones, they have been obtained and characterized separately, although the simultaneous synthesis of all components of spermaceti is perfectly feasible.

Natural spermaceti

Biotechnologic spermaceti

Acknowledgements: This work has been funded by Spanish MINECO (CTQ2015-66723-R). We wish to acknowledge D. Ramiro Martínez Gutiérrez who kindly supplied most of the biocatalysts.