

## DOCTORAL DISSERTATION ABSTRACT

This doctoral dissertation "Synthesis, surface properties and application of amphoteric surfactants containing labile groups" was written at the Department of Engineering and Technology of Chemical Processes at the Faculty of Chemistry at the Wrocław University of Technology and Madonis company under supervision of Prof. Kazimiera Anna Wilk, Ph.D. Eng. The dissertation was written in Polish.

The general objective of the dissertation was to develop a technological methodology for the production of mild amphoteric surfactants of desired very good surface properties, as well as to evaluate their suitability as an active multifunctional ingredient in a new generation of shampoos, which do not contain the addition of sodium chloride, biocompatible and mild.

The following dissertation consists of two main parts: theoretical (literature) and research. The theoretical part introduces the topic of amphoteric surfactants, as well as the current classification of these compounds and their structure. The paper further describes surface properties and micellar association of aqueous surfactant solutions. Additionally, a brief description of the functional properties of amphoteric surfactants is also presented and followed by a literature review, which describes cosmetic chemistry formulations containing amphoteric surfactants.

The research part of the dissertation consists of two areas. The first part includes the development of new structures of amphoteric surfactants, which are the following groups of derivatives: [3-(alkylmethylamino)-3-oxopropyl] dimethylammonium 2-hydroxypropanesulfones (CnDMPAS; n=10, 12, 14, 16) and [3-(alkylmethylamino)-3-oxopropyl] dimethylammonium acetates (CnDMPAB; n=10, 12, 14, 16). Convenient synthetic pathways were subsequently developed for both series as well as to optimise the isolation and purification of the obtained amphoteric surfactants CnDMPAS and CnDMPAB. The behaviour of the CnDMPAS and CnDMPAB surfactants on the free surface and in water was evaluated based on surface tension isotherms and contact angle measurements: determination of critical micelle concentration (CMC) values, thermodynamic parameters of adsorption and micellisation, ability to lower surface tension, and determination of wetting on different surfaces.

The second area of the research deals with the physicochemical and functional properties of the new amphoteric surfactants – CnDMPAS, CnDMPAB and the requirements for currently designed formulations such as hair shampoos prompted the replacement of cocamidopropyl betaine with the newly synthesised compounds CnDMPAS and CnDMPAB, and the determination of their impact on selected application properties of washing compositions. This research became the impetus for designing hair shampoo-type formulations containing the largest possible number of ingredients of natural origin with a minimum of synthetic additives or those that may affect the skin and hair in a negative way. The research involved conducting a number of measurements in accordance with standards for hair shampoo type formulations, of both the model one and the one containing new surfactants. The obtained cosmetic formulation of the shampoo type was subjected to organoleptic evaluation and the following measurements were carried out: pH, viscosity, density, foaming ability and foam stability index, solubility. The microbiological safety of the analysed formulations was also determined. Furthermore, a dermatological test was performed to confirm that the obtained cosmetic formulations are safe when applied to the skin.

In conclusion, the following doctoral dissertation involved the research of great cognitive and methodological importance as well as application potential.