

Summary

The habilitation thesis is structured in to parts. To date, 15 personal scientific articles have been published in the field described, as main author or co-author, in journals with impact factor, 7 in other databases, as well as numerous papers presented at international symposia, national symposia with international participation, and national symposia.

The first part of the habilitation thesis concisely presents the main professional achievements. The research areas addressed concerned environmental engineering, the activity being closely linked to the topic of the doctoral thesis (2009), "*Contributions to the synthesis of non-benzidine direct dyes*," carried out under the guidance of Prof. Dr. Eng. Alfa Xenia Lupea.

The research began with the synthesis of some bis- and tris-azo direct dyes as alternatives to benzidine-based ones, having as central components *4,4'-diaminostilbene-2,2'-disulfonic acid* and *4,4'-diaminobenzanilide*, considered to be non-carcinogenic. The dyes were applied both on cellulosic fibers and incorporated into acrylic films, and their fastness properties and color parameters in the CIE Lab* system were determined.

The toxicity of dyes derived from *4,4'-diaminobenzanilide* was investigated on colonies of *Hydractinia echinata* and on heterotrophic bacteria, complemented by in vivo imaging examinations on human skin and testing of antibacterial properties.

The need to purify textile wastewater led to studies on physical purification (adsorption on natural and synthetic substrates) and chemical purification (advanced oxidation, electrochemical processes) of the synthesized dyes, as well as of commercial dyes.

Accordingly, a literature review is presented on the synthesis, applications, and toxicity of the aforementioned direct azo dyes as alternatives to benzidine-based dyes, and on their removal from wastewater.

The original part of the thesis comprises two sections: direct azo dyes derived from *4,4'-diaminostilbene-2,2'-disulfonic acid* and, respectively, from *4,4'-diaminobenzanilide*. **Nine** dyes were synthesized from the first category, **seven** of which were new, subsequently incorporated into acrylic films alongside a standard (TiO₂, Pigment 6, C.I. 77 891), applied on a cellulosic substrate.

The CIE Lab* spectrophotometric study (under three illuminants: D65, A, F2) revealed a notable coloring power and the phenomenon of metamerism. Similar conclusions, following the same protocol and accompanied by fastness determinations on cotton fibers, were obtained for a smaller number of new dyes derived from *4,4'-diaminobenzanilide*. Literature data on the color of these dye classes are extremely limited. It can be concluded that these compounds can be used as alternatives to benzidine-based dyes.

Furthermore, two new dyes derived from *4,4'-diaminostilbene-2,2'-disulfonic acid* and **one** derived from *4,4'-diaminobenzanilide* were monitored through *in vivo* imaging analysis on human skin, with encouraging results (no changes in skin color/texture or contact dermatitis). Antimicrobial activity testing on two Gram-positive bacteria (*Staphylococcus aureus*, *Streptococcus pyogenes*) and three Gram-negative bacteria (*Pseudomonas aeruginosa*, *Proteus vulgaris*, *Escherichia coli*) showed notable activity, more pronounced against *S. aureus* and *E. coli*.

Toxicity tests on heterotrophic bacteria from the Bega River, performed on five new dyes derived from *4,4'-diaminobenzanilide*, indicated a low degree of toxicity.

The purification of colored wastewater was approached through two pathways: photocatalysis (TiO₂-MoO₃ and UV light), which resulted in efficient degradation of **new** dyes belonging to both classes (monitored by UV-Vis spectroscopy and chemical oxygen demand), and electrochemical behavior via cyclic voltammetry for **five** new dyes derived from *4,4'-diaminostilbene-2,2'-disulfonic acid*, which showed that anodic oxidation follows an irreversible pathway, probably at the amide nitrogen level, common to their chemical structure.

The value of this data was reflected in 8 personal scientific articles in journals with impact factor and numerous papers presented at international symposia, national symposia with international participation, and national symposia.

The second part of the habilitation thesis presents the objectives from the perspective of scientific and academic career development. The thesis concludes with a list of 208 bibliographic references.

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