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HABILITATION THESIS SUMMARY

Innovative wastewater treatment technologies: opportunities, perspectives and challenges

The habilitation thesis titled “Innovative wastewater treatment technologies: opportunities, perspectives and challenges” endorses to my scientific contribution to the advancement in research of innovative treatment technologies of some wastewaters (WWs), a topic that has significantly influenced the field of water resources management, but also the perspective of its technological implementation individually or in association with new modern ones in different industrial water and/or industrial/urban wastewater treatment sectors/services, *i.e.* chemical and textile industry, industrial water and urban wastewater management services, among others.

The *first interest research direction* developed in four chapters is grounded to the context and recent advancements in research of different components of the integrated systems for wastewater management in association with those of natural water resources, insisting on the technological treatment systems of different industrial effluents (*i.e.* industrial wastewater (WW) treatment) based on mechanical-physical-chemical processes and also of these unitary and/or mixed processes and operations in association with the biological processes for improvement of overall/global performance in removal of polluting loads and the fulfillment of legal qualitative and quantitative norms for discharging, and/or recycling/reuse. This part includes also a brief overview of my research references (articles, books and chapters) within topics in the aforementioned framework, that was began with my Ph.D. thesis (2000, title: *Optimization of some wastewaters treatment by using poly-electrolytes*), especially the scientific achievements concerning a very complex applicative

research which aimed to improve the understanding and design of innovative wastewater treatment technologies in terms of cost-efficiency for elimination of some polluting species based on coagulation-flocculation, advanced adsorptive and/or oxidative treatment processes by using 'low cost' adsorptive materials (*e.g.*, wasted materials, synthesis by-products, or preponderant inorganic and/or biomass wastes) and/or new oxidants in presence, or absence of specific catalysts (in homogenous or heterogeneous form), intense light (visible, and/or UV irradiation) or adequate known specific microorganisms. Moreover, the optimized coagulation-flocculation processes by using new natural or synthetic coagulants and/or polymeric flocculants, cellulose-based hydrogels and other ionic exchangeable materials have been also considered.

A *second accomplishment* of my research activity was focused to model and technologically/mathematically optimize a few wastewater treatment technologies using an association/combination of unitary mechanical, physical and chemical processes and operations into an efficient technological treatment process such as to reduce at minimum, or even zero level the pollution and contamination risk of all natural resources. Thus, it was evaluated the impact of natural aquatic environment pollution which must be insignificant for receiver of treated effluents (surface water nearby, or groundwater onsite of WW treatment plant area), the environmental impact being usually assessed by using simple and easy to be understand by the owners of productive activity methods, in principal by using of the alternative or simple method of the global pollution index (I_{GP} , or I^*_{GP}) or other integrated methods of impact assessment (environmental, social, economic and technological).

A *third accomplishment* of my research activity was to successfully characterize the quality of air, water and soil on the emplacement of different industrial productive companies and/or water management services in order to perform environmental balances of different types (0, I or II, emplacement report) requested by the authorized environmental regulator and/or controller (environmental competent authority) for authorized/integrated certified of different companies or services functioning, and also report emissions/evacuations/discharges from different economic units and appreciation of each contribution to possible alteration of environment quality, or to the pollution level in vicinity zones, sometimes even of validation the fulfilment of demands stipulated in the action programs for the management of water resources and quality framing of some surface water sectors in the category of 'good' water as requested by European and international organisations for Romania or in the remediation programs of some water sectors quality affected by the economic activity from vicinity. Moreover, the quality classification of different watercourses receiving the treated effluents considering a few representative physical, chemical, microbiological and/or biological quality indicators was

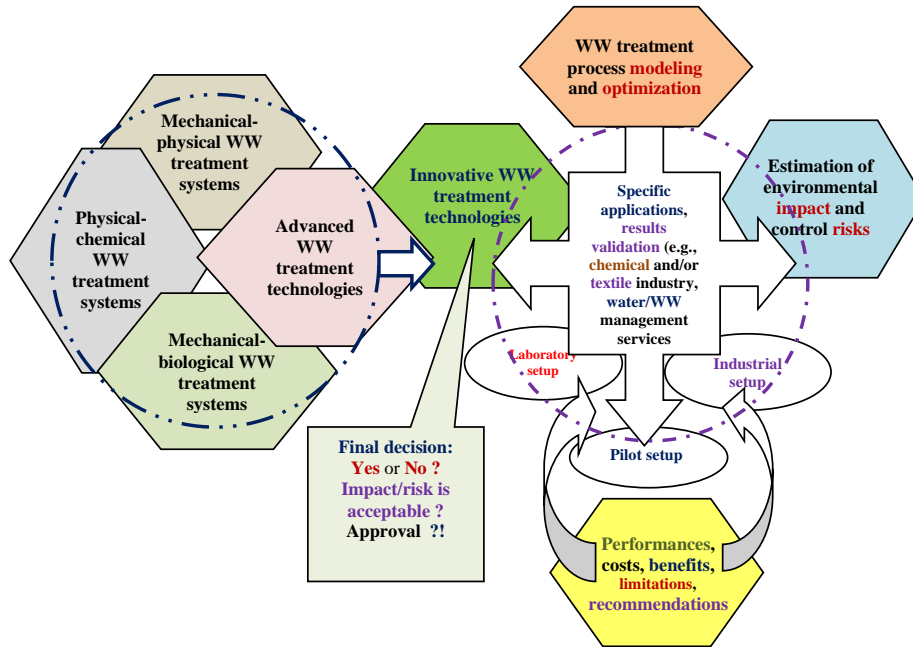
achieved for different flowing water perimeters and/or monitoring/supervision sectors associated more or less with its environmental and health risks.

For the intensive energy consuming WW treatment technologies, the possibility to integrate a few renewable energy resources to supply the useful energy for activating the operating and corresponding working regime of all installations and equipments implicated in the WW treatment technological process and maintenance service is considered in order to perform the expected performance/imposed efficiency in elimination of polluting species (ionic and molecular ones) and normal functioning of the WW treatment plant.

In the *last section*, it is presented the *Professional Development Plan* with the further expectations in accordance with the performed research activity till today, in connection with my ambitious and visionary personal goals, by consideration of a realistic strategy with achievable objectives for estimation and measurement of my personal development/progress and also of my research group. In addition, the research themes addressed have opened up new research directions that are part of existing ones at international level, and the well training of young people as vision, knowledge, competences of working in the laboratory/computational programs, able to address any complex research topic is good to be carried out by specialists with long experience in the field (personally, I worked for more than 30 years in higher education as a teacher) who know how to quickly differentiate non-compliances and solve them effectively and legally.

Summary: The habilitation thesis was structured in *six distinct chapters*: 1- a detailed overview towards the significance and the advancements in the wastewater treatment systems for pollution reduction, prevention and control; 2- coagulation-flocculation treatment process – conventional technology; 3- advanced oxidation-based treatment process – emerging technologies; 4- adsorption-based treatment processes – emerging technologies; 5- mixed wastewater treatment process performance; quality of final treated discharges and its impact against the natural water receptor, and 6- professional development planning: scientific strategy and development plan.

Significant achievements: 22 books, 3 chapters in international abroad books, 12 chapters (in English) in recognized national books, 5 university manuals, 51 ISI articles, 45 BDI articles, 40 articles in bulletins/ annals, 77 articles in proceedings (18 in ISI proceedings, 21 in abroad international proceedings, 30 in international proceeding in Romania, 8 national proceedings), 2 patents, >65 oral communications, 3 conferences, 30 research reports; 41 research contracts with industry (10 as director, 31 as member), 3 international contracts, and 10 grants/ projects; > 600 citations in ISI journals; h-index_Web of Science=13 (Publon, h-index=14); h-index_Scopus=12; h-index_Google Scholar=18.



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