

# **ABSTRACT**

**HABILITATION THESIS**  
**“ECO-FRIENDLY” POLYMERIC AND LIPID**  
**SYSTEMS WITH MINIMUM IMPACT ON**  
**THE ENVIRONMENT**

**Assoc.prof. DORINA RODICA CHAMBRE**

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In the current context, the EU legislation imposes measures to reduce environmental pollution by replacing fossil raw materials (oil, coal, methane gas) or chemicals (eg synthetic fibers, plastics, etc.) with renewable raw materials. Thus, the polymeric and lipid systems obtained from plants are becoming of major importance, being considered at this moment strategic raw materials.

In addition, to identify new methods of ecological treatment for these plant raw materials and to transform them into "eco-friendly" products with minimal impact on the environment, as well as rigorous characterization of their properties, sustained the importance of the habilitation thesis subject.

**The thesis** is based on **17 published scientific articles** and is structured according to general objectives as follows:

1. *obtaining and characterization of "eco-friendly" polymeric systems based on cellulosic and lingo-cellulosic materials for the textile industry or for the biocomposites using ecological methods with minimal impact on the environment*
2. *the physico-chemical and thermal characterization of extracted lipids systems from seeds used for products with minimum environmental impact (biodiesel) or products with added value.*

**Chapter 1** presents the general aspects related to the topic of the thesis, the justification of the theme, the structure and general and specific objectives of the thesis, as well as the list of the scientific articles on which it is based.

**Chapter 2** has **10 specific objectives** related to *Bioscouring* treatment as an alternative method to the alkaline treatment of cotton, linen and hemp fibers and fabrics as well as the *Bleaching* of bast fibers with polymeric POM-type or enzymatic catalysts. The experimental results showed that the bioscouring process in the presence of sodium citrate (biodegradable) as a new complexing agent is an effective treatment for the elimination of pectin. As shown from the characteristics of the wastewater this treatment has a minimal impact on the environment with the obtaining of "eco-friendly" cellulosic and lingo-cellulosic polymeric systems with applications in the textile or biocomposite industry. Regarding lignin oxidation, the results indicated that POM systems are more efficient catalysts than *Laccase* for whitening ligno-

cellulosic systems with low impact on the environment due to the possibility of reusing in several bleaching cycles.

The use of **sodium citrate as a complexing agent in the bioscouring process** of cellulosic and ligno-cellulosic polymeric systems and of **poly oxo-metalates (POMs)** in bleaching treatment of bast fibers is a **novelty** in the textile field and the **obtained results** not only **complete the existing data** in the literature but also **open new research directions**. The data given by the **TG/DTG/DTA analysis** open a **new direction** for this **technique** as an alternative method to characterize the efficiency of bioscouring or bleaching process of the polymeric systems especially when, it is correlated with FT-IR analysis technique.

**Chapter 3** has **7 specific objectives** and the experimental data showed the role of the fatty acid profile, the content of unsaturated fatty acids and the content of antioxidants in the thermal decomposition and the thermo-oxidative stability of the lipid systems which are used in food area or to produce biodiesel with minimal impact on the environment. The addition of natural extracts reduces the peroxides amount formed during heating and improves the thermal stability of high oleic lipid systems.

The results obtained from the lipid systems analysis **develop the existing data with new information** and also open new research perspectives on the thermal behavior of vegetable and animal fats. Also, the method used to determine the antioxidant activity, led to the **improvement of the DPPH** method by proposing a **new equation** that allows the direct estimation of the antioxidant activity without calibration procedure.

**Chapter 4** presents aspects related to the didactic and research activity carried out by the author of the thesis, as well as the future development proposals both on scientifically and professionally field.

**Through the approached subjects which were aimed to the obtaining and characterization of the "eco-friendly" polymeric and lipid systems with minimal impact on the environment, the habilitation thesis is assign in the Environmental Engineering field.**