PhD thesis abstract
Polymer composites based on renewable raw materials

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Vegetable oils represent the most used renewable raw material in polymers aria due to a series of advantages, including the fact that they are abundant natural resources, with a low acquisition cost, are eco-friendly and not the least their chemical structure versatility which offer many reactive positions which can be functionalized.

The aim of this research study consists in obtaining of composite materials starting from two different vegetable oils: a well known and used - linseed oil and a less known, unexploited yet in this area - camelina oil. To accomplish this goal, vegetable oils were chemically modified using two different synthesis strategies: to the one hand, functionalizations of the two start materials by grafting methacrylate groups and polyethylene glycol hydrophilic units and to the other hand, functionalization of camelina oil only with methacrylic groups. The obtained compounds were further used as start material for the composites and polymers synthesis, in different ways.

The first direction consists in synthesis of polymeric materials by cross-linking reactions of the monomers derived from camelina oil with polyethylene glycol functionalized with methacrylate groups, with different molecular weights and reinforced with hybrid nano-compounds POSS. By materials characterization there was establish that both polyethylene glycol chains length and type of POSS cages used as reinforcing agent have a strong influence on general properties.

The second direction is the synthesis of interpenetrating polymer networks (IPNs) using methacrylated camelina oil, dimethacrylated polyethylene glycol (with molecular weight of 750 g/ mol) and an epoxy resin by simultaneous polymerization, involving non-competing mechanisms: free-radical process for methacrylate moieties and anionic polymerization of epoxy resin. The obtained materials were advanced characterized and there was registered a strong dependence on the methacrylate/ epoxy ratio.

A third research direction represents the synthesis of hybrid materials based on epoxidized camelina oil reinforced with epoxy-functionalized POSS cages, by a thermal process in the presence of phthalic anhydride as cross-linking agent. The synthesized hybrid materials registered excellent thermal and mechanical properties especially when POSS with a higher functionalization degree was load in the oil-based organic matrix.

The fourth direction of the research study represents preliminary attempts and consists in obtaining of hydrophilic polymers based on camelina oil derivatives, involving two different techniques: bulk polymerization under visible radiation and emulsion polymerization with UV radiation respectively. Polymeric structure was proven by FT-IR and thermo-gravimetric analysis.