SINCHEM doctoral research subject

Synthesis and applications of waterborne bio-based latexes

HOME INSTITUTION: Ecole Nationale Supérieure de Chimie de Montpellier (FR) (ENSCM), Charles Gerhardt Institute (Institut Charles Gerhardt, ICG), Montpellier, France; team "Engineering of Macromolecular Architectures" (Ingénierie et Architectures Macromoléculaires, IAM); supervisors: Dr. Patrick LACROIX-DESMAZES, Dr. Sylvain CAILLOL.

HOST INSTITUTION 1: Politecnico di Torino (IT), Department of Applied Science and Technology (DISAT), Torino, Italy; research group "Polymeric Materials" (POLYMAT); supervisor: Prof. Roberta Maria BONGIOVANNI.

HOST INSTITUTION 2: Synthomer (UK) Ltd., Harlow, Essex, United Kingdom; supervisors: Dr. Peter SHAW, Dr. Carl ROESCHLAUB.

PROJECT DETAILS:

Emulsion polymerization is scientifically, technologically and commercially a very important process. Emulsion polymerization produces high molecular weight colloidal polymers with negligible quantities of volatile organic compounds and takes place in aqueous medium which provides easier mass and heat transfer. It is a very versatile, inherently safe and environmentally friendly production process. Thanks to these unique characteristics, waterborne polymers produced by emulsion polymerization have found a myriad of industrial applications in synthetic rubbers, reinforced plastics, paints, adhesives, coatings, floor polish, sealants, cement and concrete additives, and nonwoven fabric, but also in cosmetics, biomaterials and other high-tech areas.

The depletion of fossil fuels, global warming and increased pollution are causing large-scale societal changes. It is now crucial for human societies to reduce their dependence on fossil resources and their environmental impacts. In the field of polymeric materials, it is essential to replace fossil raw materials with molecules derived from renewable resources. The use of vegetable oils or polysaccharides to manufacture plastics and composite materials has thus seen considerable developments in recent years. Surprisingly, however, only a handful of studies deals with emulsion polymerization from bio-based resources.

In addition, global regulations (such as REACH in Europe...) are strongly pushing industries to use less toxic substances in their processes. Styrene, which is used in more than 75% of synthetic latex is one of the key-substance to be replaced. In this project, we will develop latexes based on bio-sourced building blocks such has cardanol which is an aromatic renewable resource of great interest. In this project, the aim is to synthesize novel bio-based vinyl monomers and to develop the emulsion polymerization of these monomers to produce latexes for application such as coatings.

ICG-IAM will bring its expertise in the synthesis of building blocks (monomers, surfactants) from renewable resources and in emulsion polymerization (synthesis and characterization of latexes). DISAT-POLYMAT will bring its expertise in the formation and characterization of films as well as in complementary techniques such as photopolymerization or photo-crosslinking to increase the performances of polymer coatings. The industrial partner SYNTHOMER Ltd. will bring its expertise in industrial application testing of latexes (for instance in the fields of architectural coatings or pressure-sensitive adhesives).

The PhD student will gain experience in organic chemistry, polymer chemistry, emulsion polymerization, colloidal science, polymer materials and coatings. She/he will spend 21 months in Montpellier, 12 months in Torino, and 3 months in Harlow.