

SINCHEM PhD subject

Clean synthesis of Novel Green Surfactants

This project will focus on solving a major issue for the home care and cosmetics industries; “how to create the next generation of environmentally acceptable surfactants for use in the everyday products that we all rely upon”.

Our focus will be on exploiting the use of enzymes to create new, short, functionalised polymers from renewable monomers. Example enzymes include the use of lipases for poly condensation reactions and also exploration of other enzyme systems such as cutinases and peroxidases to form polymers. The polymeric chains will be built from renewable molecules such as glycerol, sorbitol and a range of other co-monomers.

The Green credentials of our project are further strengthened by our use of supercritical carbon dioxide as a unique and clean solvent medium that can eliminate toxic residues. In addition we will exploit supercritical carbon dioxide to lower viscosity and to remove condensation by products and push the polymerisations to higher conversion. Preliminary work has shown that enzymes and supercritical CO₂ (scCO₂) can be used very effectively in combination, and this project will be designed to exploit and build upon these early studies.

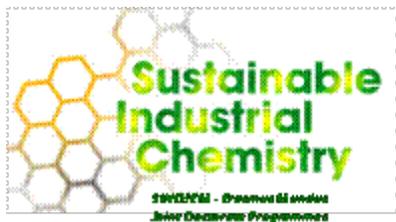
The project will be hosted in Nottingham with important input from Montpellier to explore new enzymes, monomers, and possibly other enzymatic polymerisations (e.g. enzymatic ring opening polymerisation (eROP)). Moreover we will work closely with Croda who have extensive interests in the development of new sustainable surfactants and subsequent commercialisation.

Supervisor of Thesis: **Professor SM Howdle**

Location: **The University of Nottingham (UK)**; the School of Chemistry is one of the leading UK research centres. Our research group has significant expertise in both polymer synthesis and polymer processing using supercritical fluids. www.nottingham.ac.uk/supercritical. This project will build upon a strong track record of enzyme based polymerisations in scCO₂ and will give you a wide range of valuable skills and experience in polymers including synthesis, characterization and applications as well as the opportunity to learn high pressure supercritical fluid technologies.

Partners:

Montpellier (France). Full partner. Proposed Co-Supervisors of Thesis: Dr. Patrick Lacroix-Desmazes and Dr. Cécile Bouilhac. The Montpellier group has experience in enzymatic polymerisation (C. Bouilhac), possesses good expertise in scCO₂ (P. Lacroix-Desmazes) and has a good track record in the synthesis of amphiphilic copolymers both in scCO₂ and in



conventional solvents. In addition, they have access to the equipment needed for the characterization of surfactants (e.g. surface tension...). The work at Montpellier will focus on the exploration of new enzymes, new monomers, and possibly will extend to the use of other enzymatic polymerisations such as eROP. The polymerisations will be performed in conventional solvents before comparing to $scCO_2$. In addition the recognized expertise of the Montpellier group in controlled radical polymerisation (CRP) will enable unique combinations of polymerisation methods.

Croda (UK) - Associate partner candidate. This partner has strong interests in the development of new green surfactants and can provide real industrial application test expertise for new candidate molecules.