

## Polytech network form for PhD Research Grants from the China Scholarship Council

This document describes the PhD subject and supervisor proposed by the French Polytech network of 14 university engineering schools. Please contact the PhD supervisor by email or Skype for further information regarding your application.

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Polytech name	CLERMONT-FERRAND
University name	UNIVERSITE CLERMONT AUVERGNE
Country	France

PhD information	
Title	Design of an immobilized enzymes reactor with multicatalytic enzymes for deconstructing

	<b>polysaccharides and producing functional poly- and oligosaccharides</b>
<b>Main topics regards to CSC list (3 topics at maximum)</b>	II-13. Green chemistry IV-10. Biomaterials and polymer materials VI-3. Sustainable development engineering and lower cost manufacturing
<b>Required skills in science and engineering</b>	Required skills in: Enzymology, Bioprocess engineering, Genetic engineering, Glycochemistry, Polymer materials

## Subject description (two pages maximum)

The project aims to solve **both fundamental issues of biocatalysis and process engineering** in the field of **Immobilized Enzymes Reactors (IMER)**. Whether it is for producing functional poly- and oligosaccharides intended for biomaterials, cosmetic, food or medical fields, the use of enzymes in liquid media is often non-compatible with green processes, economically viable and reproducible. **Immobilization of enzymes on solid supports give many opportunities to address key technological bottlenecks.** Few studies are yet dedicated to the generation of these biomolecules by immobilized enzymes. The core of the project consists in (i) the **design of a continuous model IMER** for producing functional poly- and oligosaccharides (> 100 g) especially from **bio-resources** ; (ii) using **fusion enzymes** with **multiple enzymatic activities** (constructed by genetic engineering) for efficiently deconstructing **recalcitrant polysaccharides**.

The first compartment of the reactor will be dedicated to control the degree of polymerization (DP) of poly- and oligosaccharides produced by enzymatic depolymerization (glycoside hydrolases and multicatalytic enzymes). The second

compartment will allow to chimio-enzymatically (carboxylation, sulfation) modify the poly- and oligosaccharides by original paths, especially to toll manufacture bioactive PS. The last one, adaptable, will be used to purify the PS by ultrafiltration systems. The **original use** of epoxy-type matrices for the immobilization, *i.e.* **the convective CIM® Disk systems**, will be of first importance to **overpass main technological problems**, *e.g.* the diffusion problems due to the viscosity of PS in solution and the loss of catalytic efficiency during immobilization. The applicative development of the functional PS produced during the project will be structured around **two economical areas**, (i) **cosmetics** and (ii) **bio-sourced materials/biomaterials**. The project will benefit from **two collaborations with French and Italian partners**, contributing to **the national and international reputation** : (i) [Dr. Nicolas Bridiau](#) (Laboratoire Littoral Environnement Sociétés, LIENSs, Université de La Rochelle, France) will be contributing his expertise for **the screening of biological activities** (anti-coagulant, anti-diabete, anti-age, ...), with **a view of cosmetic and/or medical valorization**. (ii) [Dr. Carlo Punta](#) (Department of Chemistry, Materials, and Chemical Engineering “G. Natta”, Politecnico di Milano, Italia) will provide his skills for **designing bio-sourced materials (aerogels, etc.)** and developing **new delivery drug systems**.