Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : CASTELAIN Given names :

Status (prof., assistant prof., …) : RESEARCHER

Laboratory : Toulouse Biotechnology Institute Website address : www.toulouse-biotechnology-institute.fr

Institution : INSA Toulouse Website address : www.insa-toulouse.fr

Scientific competence of the supervisor:

The direction of this thesis is composed of a biophysicist, Mickaël Castelain who covers the field of biological adhesion to inert or biological surfaces using multi-scale approaches (optical tweezers, atomic force microscopy, shear-stress flow chambers, quatrz microbalance), from the biofilm to the single molecule.

Two major publications in the field proposed for the PhD :

1. Mickaël Castelain, Marie-Pierre Duviau, Virginie Oxaran, Philippe Schmitz, Muriel Cocaign-Bousquet, et al.. Oligomerized backbone pilin helps piliated Lactococcus lactis to withstand shear flow. Biofouling, 2016, 32 (8),
2. Surface Conditioning Effects on Submerged Optical Sensors : A Comparative Study of Fused Silica, Titanium Dioxide, Aluminum Oxide, and Parylene C Zibin Nan, Pascal Floquet, Didier Combes, Claire Tendero, Mickaël

Website address of the personal page :

Supervisor's email : mickael.castelain@insa-toulouse.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-10

Title : Fungal Spore Germination and Hyphal Growth Under Shear Flow – Unraveling Adhesion Mechanisms in Soft and Dynamic Environments

Subject :

Filamentous fungi play a crucial role in various natural and industrial environments, including biotechnological processes, and bioremediation systems. Spore germination and hyphal growth under flow conditions strongly influence their adhesion to surfaces and overall development, yet the underlying mechanisms remain poorly understood.

This doctoral research aims to experimentally characterize the influence of flow conditions on spore germination and hyphal growth using millifluidic chambers. Adhesion measurement approaches, combining advanced microscopy and real-time tracking techniques, will be implemented to analyze the impact of hydrodynamic constraints on initial adhesion, morphogenesis, and hyphal growth dynamics.

A key innovative aspect of this study is the development of a shear flow chamber adapted for soft materials, allowing for the investigation of hyphal adhesion and growth on biomimetic or deformable substrates. This setup will enable a deeper understanding of how mechanical forces influence surface colonization and the structural organization of fungal pellets.

Keywords :

Shear flow, filamentous fungi, adhesion

Expected collaborations :

Laboratoire de Génie Chimique (UT3 Toulouse), Imperial College London, CIRIMAT (INP Toulouse), FIRI (Vietnam)

Background required from the applicant :

The candidate should have a solid foundation in laboratory techniques such as microscopy (e.g., fluorescence, confocal, phase contrast), culturing microorganisms, and experimental design. Experience with micro/millifluidics and shear stress applications would be an advantage, but not a strict requirement, as training will be provided.

Familiarity with quantitative analysis (including statistical and computational tools) and data modeling to interpret experimental results would be a key strength. Knowledge of biophysical principles related to flow, adhesion forces, and

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

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