

Development of a fed-batch Bioreactor protocol for the efficient propagation of *Saccharomyces cerevisiae* for wine making application

Internship of 6 months duration with industrial implication

Keywords: Bioreactor operation, control loops, nutritional optimisation, Microbiology, Data analysis

The yeast *Saccharomyces cerevisiae* is an organism of great industrial importance, notably used in the production of bread and alcoholic beverages, including wine and Champagne. This organism is Crabtree positive with a tendency to ferment its carbohydrate substrate, producing ethanol, rather than metabolising it respiratively with greater energetic efficiency. Although this natural property of yeast has allowed the production of ethanol even with rudimentary fermentation technology, it poses a problem when the aim of the *Saccharomyces* culture is production of yeast biomass. For this purpose, a fed-batch mode of bioreactor operation must be put into place with good instrumentation and using a nutritionally balanced growth medium. This would require the use of a fully instrumented bioreactor with a sophisticated control system.

At CentraleSupélec, and in LGPM, we develop and optimise new processes, including those with biotechnological applications. Previously, a patented process has been developed for the propagation of yeast in growth media composed of wine as growth medium. This has been practically demonstrated to function achieving an exceptionally high cell concentration at the end of the propagation process.

The aim of the current internship is to adapt and optimize the above process to the production of yeast using non-alcoholic growth medium. This process exists already and is applied at industrial scale, but the novelty of the work involved in this internship is the development of the fully automated process (start and forget).

The tasks involved in the project: The intern is expected to prepare growth media, to disassemble, reassemble and sterilize the bioreactor, to prepare starter culture of *Saccharomyces cerevisiae*, to make sterile growth medium, all in all the standard microbiological tasks involved in running a bioreactor culture. The project will additionally require many chemical/biochemical analyses. The most ambitious part of the work will involve programming the control loops to achieve best control of the culture and optimum growth.

The work will be primarily carried out at LGPM on the site of Paris Saclay University at Gif-sur-Yvette but in close collaboration with an industrial partner. There will be equally the opportunity for industrial visits to the site of production at a greater scale.

The possibility of a full CIFRE thesis after the internship exists for the motivated candidate depending on the success of the project and the satisfaction of the industrial client.

Profile of the candidate sought

Ideal candidates would be from engineering schools or M2 students from universities in the following subjects: Chemical/Biochemical engineering, Biochemistry, Biotechnology or Microbiology.

The intern will integrate into a research team with full technical support. Exigent work practices and attention to details are prerequisites as well as good team behaviour and interpersonal skills. The intern should be a quick learner with natural curiosity and interest with the aim of quickly becoming independent.

The candidate must be interested in industrial biotechnology and should be fluent in both French and English.

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Duration: 6 months (start flexible between February and May 2023)

Candidature:

The application, including a detailed resume (CV) and a covering letter, should be sent before 31st March, 2023 to the following contact: Behnam TAIDI – Professor and Project Manager (LGPM) - behnam.taidi@centralesupelec.fr

Place of stage: Laboratoires LGPM et SPMS, CentraleSupélec – 3 rue Joliot Curie - Gif sur Yvette 91190 (Campus de Paris Saclay).

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