

Sustainable formulations for encapsulation of antibacterial/antiviral agents and natural extracts

Summary

TalTech School of Science, Department of Chemistry and Biotechnology offers a 4-year PhD position in chemistry. Supervisor: Senior Researcher Yevgen Karpichev; Co-supervisor: Senior lecturer Kristel Vene

Research field:	Chemistry and biotechnology
Supervisors:	Kristel Vene Yevgen Karpichev
Availability:	This position is available.
Offered by:	School of Science Department of Chemistry and Biotechnology
Application deadline:	Applications are accepted between November 16, 2020 00:00 and December 16, 2020 23:59 (Europe/Zurich)

Description

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There is a high societal demand for development of innovative greener chemicals and products. It enhances the overall sustainable profile of formulated products widely used in bimedcine, food technology, and cosmetics. Micro- and nanoemulsions are among the most promising delivery systems for different, especially lipophilic, substances in transparent water-based systems. The greener surfactants to compose nanoemulsions are expected to be readily biodegradable (to pass OECD Closed Bottle Test), possess low aquatic toxicity ($LC_{50} > 10\text{mg/l}$) and designed considering the 12 Principles of Green Chemistry. Natural extracts (green tea extract, grape seed extract, aloe vera extract, other polyphenols), essential oils (clove, oregano, zataria), or their main compounds (thymol, carvacrol, cinnamaldehyde etc.) and nanoparticles with demonstrated virucidal activity can be postulated as potential candidates to develop antiviral formulations. As well, the growing consumer demand for minimally processed, easily prepared, and ready-to-eat "fresh" food products with minimal chemical preservatives pose major challenges for food safety and quality. In essence, food flavor is a crucial driver of eating behavior, therefore, controlling its stability and release is highly important.

The aim of this PhD project is to develop formulations based on sustainable surfactants, both synthetic and derived from renewable sources (biomass), e.g. lignin or cellulose. The methodology for preparation, characterization, studying stability of micro/nanoemulsions as well as controlled release of the active ingredients will be set up. A variety of the naturally obtained antiviral candidates (essential oils, natural extracts and bacteriocins) are to be studied for encapsulation along with synthetic pharmaceutical ingredients. An integral part of the PhD project will be applying novel nanoemulsions for food applications, such as edible coatings and stabilization and control of food flavor.

Qualifications:

- a university degree within a related field and a good background in at least one of the following area is essential: organic chemistry, colloid chemistry, biomedicine, food science
- skills in organic synthesis and/or formulation analysis, and extraction are desirable. Food and/or biotechnology background is also a nice-to-have property
- good knowledge in spoken and written English

The applicants should fulfill the following requirements:

- good cooperation ability, creativity and a curious mind
- innovative mind or willinnes to gain the innovation skills
- readiness to perform short-term scientific mission to the collaborators' teams abroad



- willing to master new techniques and methods



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