MSc projects or research projects available at the Department of Plant Breeding, SLU, Alnarp

1. Designing bio-fibers by electrospinning

Natural polymers from plants such as, potato starch and wheat gluten proteins are of considerably high interest to be used as raw materials for making bio-based plastics. Wheat gluten protein and its constituents, gliadin and gluten, have been processed into bio-based films, foams and sheets for various applications. Modified potato starch (MPS) is a novel raw material that showed interesting film-forming properties. Fiber electrospinning is a process allowing to make uniform nano-fibers that can be used for designing textiles for various applications. Owing to several advantages to the protein from wheat and potato starch is of interest to transform both polymers from solution into nanofibers using electrospinning processing.
In this project, we want to optimize electrospinning processing of wheat protein (including gliadins and glutenins) and potato starch, individually and as a protein-starch blend with an aim to produce fibers of various qualities. We are also interested in characterization of polymerization properties using HPLC, structure, as well as mechanical properties of the produced fiber materials.

Requirements: High-self driven motivation and technical/engineering background, as well as willingness contribute to the project.

Techniques involved in the project: electrospinning, HPLC to study protein polymerization and protein-protein interactions (both SE- and RP-) and assisting with SEM microscopy analysis.

For more information, please contact Ramune Kuktaite, SLU, Alnarp, email: ramune.kuktaite@slu.se

Useful links: https://en.wikipedia.org/wiki/Electrospinning
https://en.wikipedia.org/wiki/High-performance_liquid_chromatography

2. 3D printing of bio-based materials through laser fusion/binder jet printing

3D printing is a technology that has recently received a lot of attention due to its ability to print 3D structures via a layer-by-layer approach. The main feature of this technology is allowing the design of complex structural parts without the use of harsh chemicals using a dispensing technology that is gentle enough for biologically based material. Biological materials, such as protein components from plants, have already been used as raw materials for making high temperature processed bio-based plastics of various qualities. For example, wheat gluten protein and its constituents, gliadin and gluten, and potato protein have been processed into bio-based films and sheets for various applications. Owing to several advantages of the proteins from the plant origin it is of interest to test the hypothesis that it is possible to transform these protein components from plants into 3D objects using 3D printing technology.

In this project, we want to optimize 3D printing processing of various plant protein components and produce 3D printed plant protein items of various qualities. We are also interested in characterization of polymerization properties using chromatography, as well asthe mechanical properties of the produced 3D processed materials.

Requirements: Highly-self driven, motivated student with a technical/engineering background, as well as a willingness contribute to the larger project.

Techniques involved in the project: 3D printing, high pressure liquid chromatography to study protein polymerization and protein-protein interactions, and mechanical testing analysis.

For more information, please contact Ramune Kuktaite, SLU, Alnarp, email: ramune.kuktaite@slu.se

Useful links:
https://en.wikipedia.org/wiki/3D_printing
https://en.wikipedia.org/wiki/High-performance_liquid_chromatography

3. Designing “green” materials through a single screw extruder

The use of single-screw extruders in production processes has progressed significantly during the latest years. Plant proteins, such as wheat gluten, are very promising bio-based raw materials opening new opportunities for developing bio-based alternatives to conventional synthetic plastics. For example, wheat gluten protein and its constituents, gliadin and gluten, and potato protein have been processed into bio-based films and sheets for various applications. Owing to several advantages to the protein from the plant origin is of interest to investigate whether green plastic fabrication is possible in order to transform proteins into thermoformed objects, stretch-blown items using a single screw processing method.
In this project, we want to evaluate the use of a single screw processing of various plant protein components and produce thermoformed plant protein items of various qualities. We are also interested in characterization of polymerization properties of proteins using HPLC, study structure, as well as mechanical properties of the produced green materials.

Requirements: Highly-self driven, motivationed student with a technical/engineering background, as well as willingness contribute to the project.

Techniques involved in the project: extrusion, high pressure liquid chromatography to study protein polymerization and protein-protein interactions and microscopy techniques.

For more information, please contact Ramune Kuktaite, SLU, Alnarp, email: ramune.kuktaite@slu.se

Useful links:
http://www.hanserpublications.com/SampleChapters/9781569904480_SAMPLE%20CHAPTER%20Campbell-Spalding.pdf
https://en.wikipedia.org/wiki/High-performance_liquid_chromatography