Innovative Training Networks

"FOODENGINE"

Enginomics in food quality design: the case of shelf-stable fruit-, vegetable- and legume-based foods

Marie Curie Actions

FOODENGINE

ESR10: A multivariate approach to model nutrient degradation in fruit-based products after thermomechanical processing and storage - focus on ascorbic acid and phenolics

The PhD project will investigate the reactivity of ascorbic acid and phenolic compounds in fruit-based products induced by thermal or thermomechanical processes and storage. The studied system will be progressively complexed (in terms of reactive molecules and structure) to approach the reactivity of a real matrix while including transfer phenomena.

Strawberry will be used as reference fruit. The important process parameters will be extracted from the industrial way of transforming strawberries in Döhler.

Literature on strawberry processing is rich and the first step will be to create a database with all information regarding:
- composition of different varieties of strawberry (including enzymes and micronutrients);
- experimental data of nutrient degradation (caused by enzymes, temperature, high pressure…) associated with the structure of the treated product (juice, puree…);
- models established to describe these degradations with their parameters (kinetic rate constants, physical parameters such as oxygen diffusivity…).

All this information will enable to propose a model, including a reaction scheme and the heat and mass transfers, regarding the vitamin C and phenols degradation and to test it on the experimental data found in literature. From this work, missing data will be identified and an experimental plan to acquire it in controlled conditions will be built. To do so, a non-reactive model medium supplemented with reactive constituents, in perfectly controlled conditions of agitation, oxygen and temperature and with increasing structure complexity will be used. Ohmic heating will also be tested as an alternative technology to get rid of temperature gradients in thick or solid product. Finally, the model will be adjusted and tested on real product to assess its capacity in predicting the nutrient degradation extent during processing.

Provisional agenda

Recruitment: 1st October 2018 (M10) to 30th September 2021 (M45) at AgroParisTech (Massy, France).

Secondments:
- 1 month in Döhler during the first year (M12): contact with Döhler supervisors, discovery of the industrial way of producing strawberry products, identification of the critical process parameters.
- 5 months in Döhler during the third year (M35-39): adaptation of the model to the industrial production, test of the model prediction on real products.

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Task repartition and deliverables:

Year 1:
- Deep analysis of literature data to propose a reaction scheme → Literature review
- Literature data modeling and kinetic rate constants identification → Research article
- Identification of the missing information and experimental plan in model matrices for the 2nd year

Year 2:
- Definition of the matrices for the experiments (non-reactive medium + reactive constituents)
- Experimental plan realization for data acquisition and treatment

→ Research article

Year 3:
- Adaptation of the model (reaction scheme + kinetic rate constants + physical transfers) for more realistic products (juices, purees)
- Validation of the model

→ Research article

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Application procedure here: https://euraxess.ec.europa.eu/jobs/319057

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