

MELiSSA loop Metabolome

Key words: Metabolic pathways, Mass balance, degree of freedom, robustness, circular system,

Abstract: The MELiSSA loop has to design to allow the recovery of human metabolic needs from the space mission wastes. Due to the need to produce edible biomass, the MELiSSA loop contains several biological processes assembled as a circular system. Among the key challenges of such a system, two are often mentioned: the stability of this compartmentalised approach, and the management of inhibiting or limiting trace elements, up to the ppb level.

In fact, this “bio” feature of the MELiSSA loop, often presented as a weakness, provides a substantial plasticity, as it would allow to benefit of the extremely high diversity of metabolic pathways that are up or down regulated by the culture conditions.

Based on the existing state of the art, the objective of this work is to create a metabolic map of the MELiSSA loop, where molecules, flows and stocks will be identified. Starting from the existing literature, the proposed PhD project shall study one by one the MELiSSA processes and progressively elaborate the MELiSSA metabolome (a catalogue of the produced metabolites and the identification/evolution of their corresponding pools) . Optimum cultures conditions will be first elaborated and special attention to potential secondary metabolic pathways will be given in parallel with the description of the main metabolic pathways.

This work shall be supported with simulation tools, its trade-off will be part of the PhD progress.

Impact on MELiSSA: Definition of control strategies and operation.

MELiSSA Partners: UClermont Auvergne (F), U Mons (B), SCK.CEN (B)

References:

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Desired knowledge: Candidates preferably possess a deep knowledge in biochemical pathways, preferably including secondary metabolites: pigments, antibiotics, pheromones, molecules. He shall be familiar with associated tools (e.g. data base, chemical simulation tools,..).