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How metabolomics is used to support the MetaPath solution through metabolic profiling of sourdough fermentation industry ecosystem models ?

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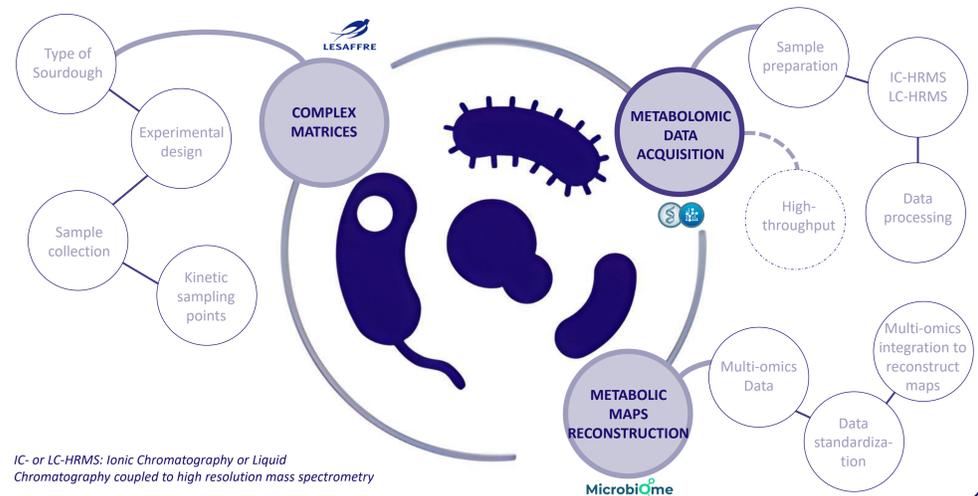
⁴ LESAFFRE Institute of Science & Technology, Innovation Strategy Office, 59700 Marcq-en-Baroeul, France

Introduction

Consumer expectations and societal evolutions are at the heart of the concerns of fermentation professionals. The organoleptic properties of their products are closely correlated to its manufacturing process but also to its composition specifically the microbial ecosystems introduced to produce this fermentation.

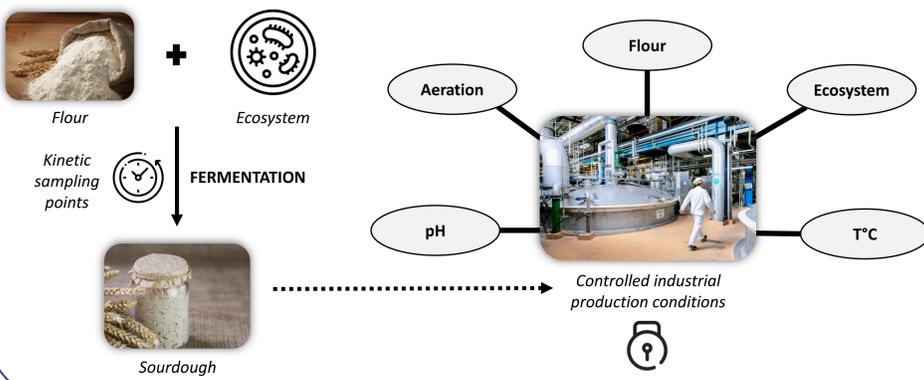
In this context, the Bpifrance MetaPath project aims to reconstruct the metabolic maps of these microbial ecosystems in order to guide the industrialist in the selection of microbial strains at the time of product design. This will enable them to better control and understand the organoleptic properties of finished products in a natural way, in line with consumer expectations. As a partner in the MetaPath project, the MetaToul platform aims to perform metabolic profiling of ecosystems in the sourdough model of industrial partner Lesaffre.

Material and methods

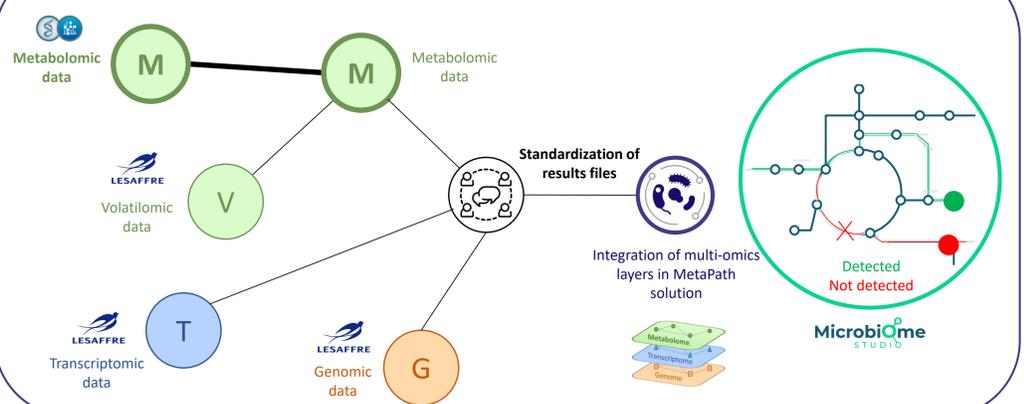


Results and discussion

1- COMPLEX MATRICES



3- METABOLIC MAPS RECONSTRUCTION



2- METABOLOMIC DATA ACQUISITION

VALIDATED

Lyophilized and ground sourdough + IDMS (13C-Yeast extract)

Extraction
Concentration
Solubilization
Centrifugation
Transfer x2

Proteins quantification for normalization
Freedom Evo200 Tecan®

IC55000+ (KOH) – QExactive+ Thermo®

AS11-HC : Glycolysis, Krebs cycle, Pentose phosphate pathway

Vanquish – LTQ Velos Orbitrap Thermo®

1) PEPPI : Amino acids
2) Kinetex C18 : CoA
3) Hypersil Gold : Mevalonate pathway

NEW

One analysis > HILIC : amino acids, CoA, methionine pathway, trans-sulfuration pathway, folates pathway, glycolysis, Krebs cycle, pentose phosphate pathway, ...

ACP – normalized ratios C12/C13 /mg dry weight/mg proteins

Color Key
Column 2-Score

Heatmap – normalized ratios C12/C13 /mg dry weight/mg proteins

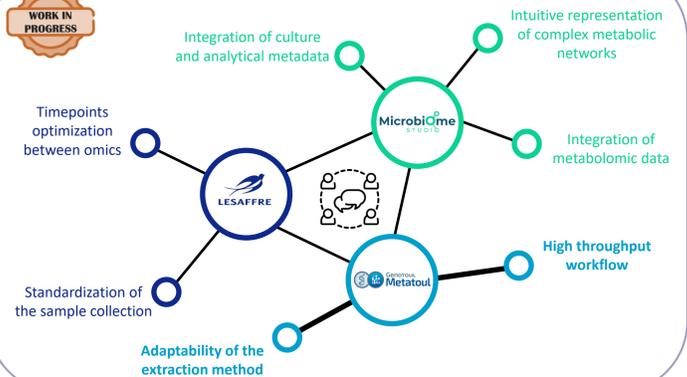
Change of bacteria

Change of flour

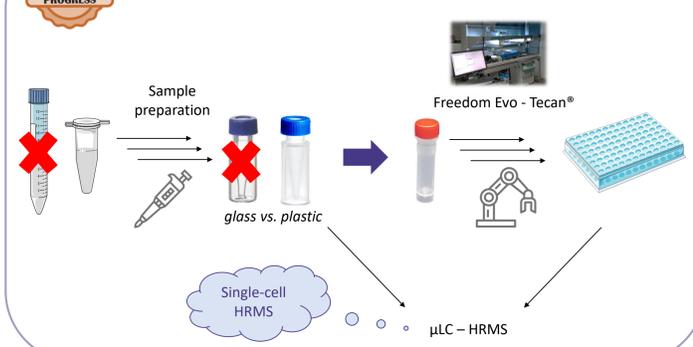
Sourdough 2 – Bacteria 1
Sourdough 2 – Bacteria 2
Sourdough 1 – Flour 1
Sourdough 1 – Flour 2



ECOSYSTEMS MODELS EVOLUTION



MINIATURIZATION & AUTOMATIZATION



ECORESPONSABILITY

WORK IN PROGRESS

g CO₂ / 2

g CO₂ / 4

Sample preparation	Actual	Miniaturized	+ Automated
g eCO ₂ / sample	9.28	4.37	2.53
€ / sample	1.11	0.64	1.03

Analysis

* Consumables only, without gloves

Conclusions

Different sampling and sample extraction systems have been validated to this day on this complex sourdough matrix. It allows the detection of central and energetic metabolism but also of a wider detection. We currently cover the main pathways of the studied microorganisms such as glycolysis, Krebs cycle, pentose phosphate pathway and mevalonate pathway. This system is validated and is used for the reconstruction of metabolic maps of the studied ecosystems by Abolis / Microbiome Studio partner. The planning of the final sampling phase remains to be discussed in order to control the production of high throughput metabolomic data.

Acknowledgments

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