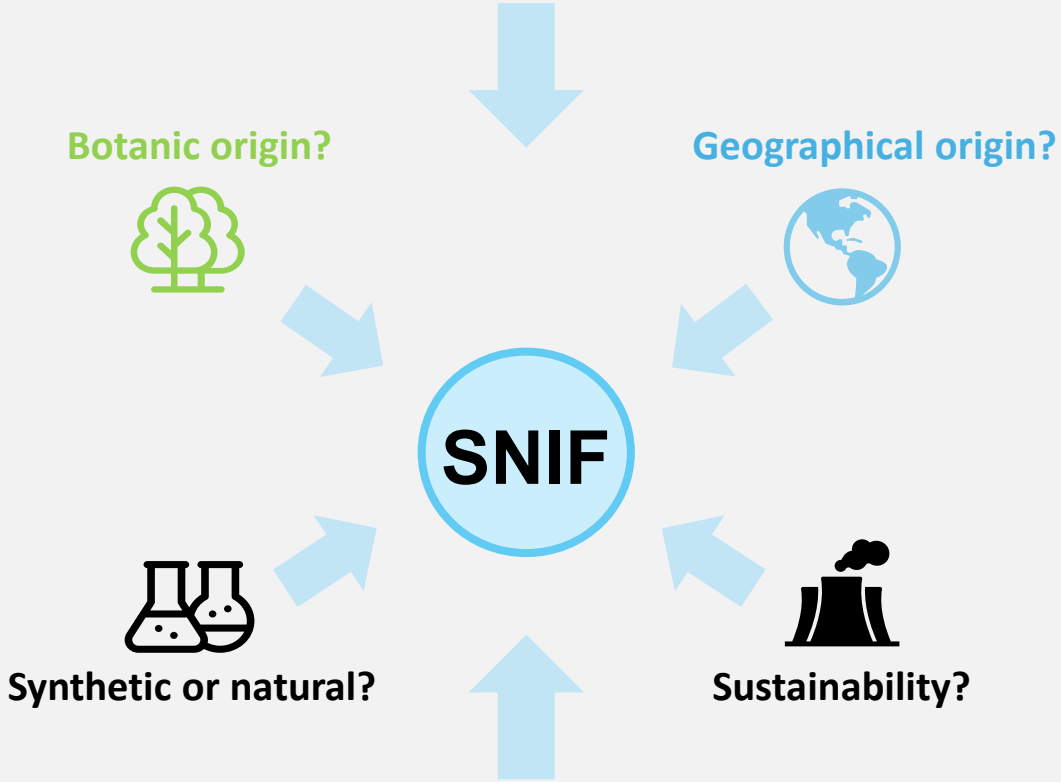
Ingredients for Food Industry



Database

NMR

Biotechnology

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Abstract

The **Lombard food industry** represents approximately 10% of the regional GDP (**16 billion euros in 2022**). This sector stands out both for the quality of its raw materials and for their transformation in products highly appreciated by the consumers, even at the international level.

The market demand for **natural-based ingredients** is growing steadily, partly based on the prejudices arisen in recent years against synthetic products, which are erroneously considered to be less healthy than their natural counterparts. This market trend influences the price of natural and synthetic products, making the latter significantly cheaper. It also promotes the **increasing adulteration** of commercial products, through partial or complete substitution of ingredients of natural origin with their synthetic form or with substances of different geographical/botanical origin from that declared. Countering this phenomenon is important to ensure the **authenticity of products** and the transparency of the entire distribution process and to maintain consumer confidence in the food safety. To this end, **analytical approaches** based on chromatographic (GC-MS, HPLC, LC-MS), spectroscopic (IR, UV, NMR), isotopic (IRMS and **SNIF NMR**) and DNA analysis techniques have been developed.

Two approaches have been developed so far: *i)* the development of targeted methods, *i.e*. based on the specific analysis of molecular markers useful for verifying the **authenticity of the ingredient**; *ii)* the use of untargeted methods that do not require prior knowledge of the composition and are implemented with chemometrics to create robust databases to be used as reference for authentication. The use of untargeted methods has allowed the incorporation of -omic technologies, such as metabolomics, among the methods developed for the authentication of a wide range of foods.

At the same time, the increasing demand of **natural products** has led to an intensive exploitation of agricultural land and to **unsustainable farming** practices, which, together the **climate change** could pose further threats to the food industry. An emblematic example is the sandalwood oil, traditionally produced by hydro-distillation of *Santalum album* wood. Due to its intensive exploitation, *Santalum album* was added to the red list of endangered species in 1998. Very recently it has been commercialized Santalol oil, which, in terms of composition and odorous properties, is very close to the natural one, but it is produced on biotech basis from **renewable raw materials** (cornstarch). This innovation had great benefits for **biodiversity protection** and for sustainability.

In conclusion **SNIF project** is aimed at: *i*) promoting the **cooperation between academic and industrial partners** to optimize advanced methods for the authentication of food ingredients based on metabolomics (using GC/MS, LC/MS and NMR techniques depending on the nature of the ingredient) or **isotopic analysis** (IRMS, SNIF-NMR); *ii*) making biocatalysed procedures available to industrial partners for the **sustainable production of food ingredients** from renewable sources, reducing waste and energy consumption.