Authentication of fats and fat products used in food and feed

Reporting

Project Information

FATAUTHENTICATION

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Final Report Summary - FATAUTHENTICATION (Authentication of fats and fat products used in food and feed)

Background:

An authentic product is one which strictly complies with the declaration given by the producer in terms of

ingredients, natural components, absence of extraneous substances, production technology, geographical and botanical origin, production year, and genetic identity (Kamm et al., 2001, Food Rev Int, 17: 249-290). Fraud, intentionally o not, is committed when the authenticity of the product is not respected. Food or ingredients mostly likely to be targets for fraud are those of high-value as for instance, those characterized by a particular composition and sensory quality (i.e. monovarietal extra virgin olive oils), organic products, products originated from a certain geographical origin (i.e. products under a protected designation of origin (PDO)), or sustainable food products (i.e. sustainable palm oil), among others. In most of these examples, authenticity is only assessed by administrative controls and inspections; however, having an analytical tool to verify product authenticity would be very supportive to them.

Aim:

The global aim of the FATAUTHENTICATION project is to develop models, based on analytical determinations, to verify the authenticity of fats and oils, covering both bulk oils as well as the authenticity of food and feed products by using their lipid fraction. Several sub-studies were designed in order to cover different authenticity aspects of interest within the fat and oil sector.

Work plan included a first general literature review, on oil and fat authentication. It was focused on the oils interesting for this project, such as palm oil and olive oil. Part of the literature review has been published in two book chapters, one in palm oil authentication (Tres et al., In: Oil palm: cultivation, production and dietary components. Nova publishers, 2011) and the other one about the authentication of vegetable oils under a PDO (Tres et al., In: Food Protected Designation of Origin: Methodologies and Applications, Elsevier B.V. 2013).

Then, the project was divided in three main studies: oil biological and geographical variation (study 1); oil technological variation (study 2); assessment of oxidation (study 3). Study 1 was divided in various sub-studies according to the commodity involved. First, models to identify the geographical origin of palm oil were developed. The production of palm oil has increased in the last decades, and since it mainly takes place in tropical areas, this has raised environmental concerns. The production and certification of sustainable palm oil has started in certain regions. Our aim was to develop a model to analytically verify the geographical origin of palm oil, in order to link it - at a later stage - to the production of sustainable palm oil in these areas. Successful models based on the fatty acid composition and volatile fingerprint (assessed by proton transfer reaction mass spectrometry (PTR-MS)) combined with chemometrics have been developed and validated, and thus the analytical verification of the geographical origin of crude palm oil is now feasible at a continent level. These results are especially important for sustainable palm oil producers and importers, since the objective for 2015 for some food companies is to use palm oil coming only from sustainable plantations. This analytical tool could be very supportive to the administrative controls currently conducted to verify palm oil. Indeed, some palm oil companies have already shown their interests in applying these models to verify the crude palm oil supplied by their local plantations.

A different sub-study was devoted to authenticate monovarietal olive oils. The approach followed (in collaboration with the University of Granada, Spain) was based on the assessment of the volatile profile of olive oil by PTR-MS, combined with chemometrics. A model, which included 5 different varieties, has been developed and validated. This model might be of interest for olive oil certification bodies, since a good

reputation is essential in a high price commodity such as monovarietal olive oil. Also, consumer associations and retailers might also be interested in applying models like this. The models has been created for 5 of the main monovarietal olive oils used in Spain, but it could be expanded in the future to other varieties (by collecting and analysing new authentic samples) if necessary.

Another sub-study was focused on the authentication of organic feed by their lipid profile. For the production of organic eggs, hens need to be fed with organic feeds. Since organic feed and food are susceptible to fraud, the authentication of organic feed is of interest for feed producers, egg producers, retailers, organic certification bodies and regulatory authorities. Models to discriminate between organic and conventional feeds have been developed with two aims: screening (based on near-infrared spectroscopy, which is a rapid, low cost technique), and confirmation model (by fatty acid fingerprinting). This approach allows that only those feed samples revealed as suspicious in the screening model need to be analysed by wet-chemistry. Several organic certification bodies have already shown their interest in applying this model, as for instance, SKAL, which is the Dutch certification body for organic products.

Study 2 was devoted to technological variation. New feed ingredients are emerging on the feed market. Dried distilled grain solubles (DDGS) are a sub-product of the production of alcoholic beverages and biofuels. Due to their fat content, they are been used in feeds. But since they are processed products the verification of their botanical and geographical origin gathers a special interest especially for feed producers aiming at having higher information of the ingredients they use. Models to verify both botanical and geographical origin have been developed and validated. An article describing these results is being prepared. Finally, in study 3, one of the state-of-the-art analytical techniques used in this project, PTR-MS, combined with chemometrics, was investigated as an alternative analytical tool to measure oxidation of oil samples. It has been proven that it would be suitable to measure the evolution of oxidation of vegetable oils, which could become an on-line application of the technique in the future. Furthermore, together with other analytical determinations, it also revealed some omega-3 supplements in the Dutch market that had a high oxidation status, which was even higher than the thresholds recommended by some omega-3 producer associations such as the GOED. The oxidation status of these omega-3 products is not regulated in the European Union (EU), but recently the European Food Safety Authority (EFSA) published a scientific opinion on the topic.

Potential impact and use of results

The authentication models that have been so far developed could be routinely used to verify the authenticity of those products. Regulatory authorities, food and feed processors, retailers and consumer groups are all interested in ensuring that products are correctly labelled. Currently, the verification of labelling compliance for most cases (organic, sustainable, PDO products) is done by administrative controls and inspections. The models developed in the framework of this project could offer an objective support to these administrative controls, assuring the quality of the sector, and protecting producer and consumer interests, and promoting a fair competition. So far, some of these models have already been applied to verify the identity of suspicious samples (i.e. organic feeds and eggs) provided to RIKILT by SKAL, the Dutch certification body for organic products. Since these models are based on quite common analytical facilities, their transfer to other laboratories would be feasible. Even, some of them, such as near-infrared spectroscopy, could be transferred to portable instruments that would allow on site

measurements.

Furthermore, this project has developed tools to identify the origin (botanical and geographical) of some new feed-ingredients: DDGS. Verifying the botanical and the geographical origin is of importance for feed ingredients, since they will determine the final feed composition, and its nutritive and production value.

Finally, the sub-project on the assessment of oxidation status of omega-3 supplements has revealed that oxidation in some samples exceeds the thresholds recommended by some omega-3 producer associations (i.e. GOED). This means that the oxidative quality of these supplements varies within the sector, which affects to the quality of the product and its stability.

Fellow development:

This project has offered the fellow several opportunities of professional and personal development. First, she has acquired new analytical (PTR-MS and in spectroscopic techniques) and statistical skills (chemometrics) that will enrich her background. She has been involved in management activities, which have given her an essential expertise to establish her future career in science: she has conducted courses on project management and on intellectual property rights, and contributed to several management activities related to the project. She has been encouraged to establish international collaborations by attending several conferences and symposia, and even by being involved in the organisation of an international workshop. Also, she supervised several master students. Apart from this, joining the RIKILT Authenticity and Nutrients cluster in the RIKILT has offered her a new perspective of science. Since RIKILT is a research institute, the approach to project management, acquisition, dissemination of results and transfer of knowledge is different from the one she was used before in a University. The synergism of these two working scenarios might be very positive for her future work. Furthermore, the fact that this project allowed her to work and live in a different country has enriched her communication and personal skills.

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