**EMPIR Call 2020 – Fundamental, Industry and Normative**

Selected Research Topic number: **SRT-i18**
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# Title: Analytical contaminants assessment in food


## Abstract

Food contamination is a global safety issue caused by several factors along the food chain. The quantification of the contaminant levels and the understanding of the source of the contamination are often a challenge. The overcoming of these issues will allow a high level of food safety at all stages of production and distribution process. Also, the harmonisation of the analytical methods for the quantification of contaminants is needed to provide information about whether a food product is compliant with the norm, considering that harmonised European legislation is lacking for several contaminants. This is a fundamental step for the food industry to solve disputes and to reduce the related economic losses. The project will focus on developing traceable measurements and characterisation for food contamination and its source in the production-packaging-storage chain.



## Keywords

Food safety, food contaminants, Mineral Oil Saturated Hydrocarbons (MOSH), Mineral Oils Aromatic Hydrocarbons, MOAH, Polycyclic Aromatic Hydrocarbons, PAH, endocrine disruptors, metal traces, food packaging materials.


## Background to the Metrological Challenges

For food industries the quantification of the level of contamination and the identification of the source of contamination are topics of paramount importance. Various analytical methods have been developed to analyse contaminants in foodstuff, but strategies to improve their reliability are needed. Moreover, it is mandatory to establish key standard methods and to develop certified reference materials. False negatives and improved limits of detection are also of great concern when food contaminants have to be identified and the evaluation of the measurement uncertainty is fundamental for contextualizing the amount of chemical detected. Guidelines are also needed for the uncertainty estimation of measurement results in the food field. here are several issues that need to be addressed with the following contaminants; Mineral Oil Saturated Hydrocarbons (MOSH) Mineral Oils Aromatic Hydrocarbons (MOAH) and Polycyclic Aromatic Hydrocarbons (PAH), endocrine disruptors and metal traces. These include the lack of validated analytical procedures to reliably quantify these contaminants in variable lipid content food matrices, the lack of specific reference materials and, except for PAHs and metal traces, the lack of a harmonised EU regulation.

For MOSH and MOAH the analytical issues for the quantification of food contaminants are the limited reliability and reproducibility (among laboratories) of the established methods which are affected by the presence of interferences and, often, by the complicated sample preparation procedures.

For PAHs, the harmonisation of validated analytical protocols ensuring the reliable quantification of these at a low concentration is needed, in particular for complex matrices such as oils and fats, for which the availability of Certified Reference Materials (CRM) is very limited. This lack of certified reference materials for several contaminants limits the rapid take-up of analytical methods by industries. The limit of detection and limit of quantification are defined respectively as less than 0.30 µg/kg and less than 0.90 µg/kg for each of the priority PAHs.

Endocrine disruptors also have been found to contaminate vegetable oils, in particular phthalates have been detected in concentrations higher than that allowed by European Regulation 10/2011, both in refined oil and in virgin and extra virgin olive (EVO) oils. These findings open the question about the origin of the contamination, since in refined oils traces of phthalates can be due to the use of the solvent in the extraction processes, but this explanation is not applicable for virgin and EVO oils. One of the issues in this field is therefore the possibility to identify the source of the contamination, while the other is the large costs and the complexity of the analytical techniques.


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The use of recycled packaging materials generates additional problems, especially because this not only increases the potential sources of contamination, but also in many cases a wide range and levels of chemicals can migrate from the packaging into foods, such as endocrine disruptors, MOSH/MOAH, PAH and metal traces. On the other hand, in the context of packaging, reuse and recycling are both practical and political means to initiate a change, which is expected to deliver both economic and environmental benefits. Therefore, progress in these fields is increasingly needed for two reasons: (i) the consumer's awareness of the food safety issues, that requires in-depth information on food contaminants provided by the industry to the end-users and (ii) the concept of a circular economy that has been developed as a tool to prevent and reduce detrimental human activities, in particular related to food packaging materials and their recycling. The determination of levels of contaminants from food packaging material, and the comparison between traditional and recycled materials will support the advancement of the industrial research in the field of food safety preservation and food packaging sustainability.

## Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on the traceable measurement and characterisation of food contamination and its source in the production-packaging-storage chain.

1. To identify and quantify MOSH and MOAH in defined and characterised food matrices to reach the limit of quantification 0.1 mg/kg to 0.5 mg/kg depending on the food matrix. This will include a clear definition and characterisation of these food matrices.
2. To develop sensitive analytical procedures for the detection of PAHs, and very volatile PAHs such as naphthalene, acenaphthene, and fluorene along with fast and automatized clean-up processes, minimizing the use of hazardous substances. CRM (Certified Reference Materials) of fat food matrices will be developed. Traceable and high accuracy reference materials for key contaminants in vegetable oils and fats will also be developed.
3. To develop validated and traceable methods for the detection of possible organic contaminants from virgin (not recycled) food packaging materials focusing on endocrine disruptors (polychlorobiphenyls (PCBs) and phthalates) and address the goal of identifying the possible origin of the contamination.
4. To develop analytical methods for the detection of inorganic contaminants from recycled food packaging materials (e.g. lead, cadmium, mercury, inorganic tin, and arsenic) in traces of vegetable oils and fats with a target sensitivity of 0.1 mg/kg wet weight. In parallel, the quantification of minerals oils, PAH and endocrine disruptors from recycled materials will also be addressed, and the results compared with those from virgin food packaging materials.
5. To facilitate the take up of the technology and measurement infrastructure developed in the project by the measurement supply chain (e.g. conformity assessment of raw materials, NMIs, DIs), standards developing organisations (e.g. CEN, ISO, Codex Alimentarius) and end users (e.g. reference laboratories, the food industry).

Proposers shall give priority to work that meets documented industrial needs and include measures to support transfer into industry by cooperation and by standardisation. An active involvement of industrial stakeholders is expected in order to align the project with their needs – both through project steering boards and participation in the research activities.

Proposers should establish the current state of the art, and explain how their proposed project goes beyond this.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 1.5 M€, and has defined an upper limit of 1.8 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution across all selected projects in this TP.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

## Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to the food industry sector.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work.

## Time-scale

The project should be of up to 3 years duration.