

## Project information

### Keywords

microplastic, analysis, deuterium

### Project title

De la Plast – Deuterium labeled polymer standards in advanced instrumental methods for detection and quantification of nano- and microplastic

### Year

2020

### Project leader

Vladimir Nikiforov

### Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

Tromsø: 69.67°N 18.79°E, Bergen: 60.23°N 5.19°E, Munich 48.08°N 11.34°E

### Participants

Vladimir A. Nikiforov (NILU), [van@nilu.no](mailto:van@nilu.no)

Tanja Kögel (IMR), [Tanja.Kogel@hi.no](mailto:Tanja.Kogel@hi.no)

Ørjan Bjorøy (IMR), [Orjan.Bjoroy@hi.no](mailto:Orjan.Bjoroy@hi.no)

André M. Bienfait (IMR), [andre.marcel.bienfait@hi.no](mailto:andre.marcel.bienfait@hi.no)

Oliver Jacob (TUM), [oliver.jacob@tum.de](mailto:oliver.jacob@tum.de)

Natalia P. Ivleva (TUM), [natalia.ivleva@tum.de](mailto:natalia.ivleva@tum.de)

### Flagship

Plastic in the Arctic

### Funding Source

Fram Centre flagship Plastic in the Arctic

### Summary of Results

Two samples of fully deuterated polystyrene (d-PS) and polymethylmetacrylate (d-PMMA) have been used to evaluate the feasibility of the approach by applying the same internal, isotope labelled polymer standards to different polymer chemical identification and quantification methods: py-GC/MS-Orbitrap, FTIR, Raman microspectroscopy and GC-MS with pre-analytic derivatization/transformation of polymers. It was shown that confident detection of separate traces of deuterated and native polymer can be achieved by all tested methods.

Significant effort was put to development of methods for preparation of microparticles of defined and uniform size.

The next steps will be assessment and harmonization of size distribution, introduction and recovery of internal standards of d-PS and d-PMMA micro- or nanoparticles into sample matrices and extension to other polymer types.

Based on the already achieved results, further activities are planned within the pending application for project EUROPLAST

Master and PhD-students involved in the project

Oliver Jacob, a Ph.D student from TUM

#### Published Results/Planned Publications

A scientific publication in a high-ranked scientific journal is planned for 2021

#### Communicated Results

1. André Marcel Bienfait, T. Kögel, Ø. Bjørøy and M. Sanden, Nanoparticle Separation via Crossflow Filtration, SETAC Europe 3.-7.5.2020 - SciCon (should have been Dublin, was online), Poster 3.04P.17

2. Vladimir Nikiforov, Tanja Kögel, Natalia Ivleva, De la Plast - Deuterium labeled polymer standards in advanced instrumental methods for detection and quantification of nano- and microplastic. Project presentation at Autumn Teams Meeting of Plastic in the Arctic, Tromsø, 30.09.2020

3. Vladimir A. Nikiforov, Tanja Kögel, Ørjan Bjørøy, André M. Bienfait, Oliver Jacob, Natalia P. Ivleva, Deuterium labeled polymers as internal standards for analysis of micro- and nano-plastic in environmental samples by mass-spectrometry and vibrational spectroscopy. SETAC NA, 15-19.11.2020 - SciCon2, Platform presentation

#### Interdisciplinary Cooperation

The project main goal is in the field of environmental analytical chemistry and this first year was dedicated to tests and improvements in analysis. Within the environmental analytical chemistry the project covers all aspects of it and aims at universal solution (deuterium labeled internal standard) for different analytical methods.

In 2021 a Workshop is planned that will offer the initial results to interdisciplinary community.

#### Budget in accordance to results

The activities carried out in 2020 and summarized above could not have been carried out without funding from the Fram Centre. As the project is ongoing, finalization of results are expected in 2021 provided continuation of funding.

#### Could results from the project be subject for any commercial utilization

No

#### Conclusions

The project is in its first year, yet universality of deuterated polymers is fully confirmed for all targeted methods: Pyrolysis - GC/MS, Chemical transformation - GC/MS, FTIR spectroscopy, Raman microspectroscopy.