Identifying microplastics in seawater

Type of the project
Semester project

Laboratory
Laboratory of Nanoscience for Energy Technologies

Professor
Professor Giulia Tagliabue and Florian Breider

Supervisor
Dr Alan Bowman

Contact person at Sailowtech
Shan Yao, Arthur Tabary

Student
To be determined

Context

Microplastics are a significant source of pollution in lakes and oceans worldwide. While this is well known, the effects of microplastics on the marine environment, and even the size and distribution of microplastics in the ocean, remains poorly understood. Thus, it is imperative that we develop methods to quantify environmental plastic pollution in water sources and be able to rapidly scale these methods.

Sailowtech is an association and a MAKE project that aims to raise awareness of environmental issues, particularly those relating to aquatic environments. It promotes frugal and participative field science, open-source science, and low-tech approach. To achieve this, Sailowtech organizes scientific sailing expeditions in lakes, seas, and oceans to discover field science, test the protocols and devices build by students during the semester.

Description of the project

Raman spectroscopy – which analyses the light scattered by a laser beam on a sample - is a technique that can be used to identify plastics, as each plastic has a unique optical fingerprint. Furthermore, when coupled to a microscope, plastics down to < 1 µm in diameter can be studied. We plan to implement low-cost Raman spectroscopy on the Sailowtech cruise, to help build a picture of microplastics in the environment. However, currently we are unsure of how microplastics' Raman signal with change: i) as the

microplastic size is reduced; ii) when microplastics are in water, especially the complex environment of seawater; iii) the effect of aging due to solar radiation and tropospheric ozone. This project will explore these three questions, with the aim of creating a microplastic Raman library for samples in seawater. This library will be instrumental in identifying microplastics during a Sailowtech cruise.
The ideal student for this project will have a strong interest in optical spectroscopy, with experience in some of microscopy, spectroscopy or data processing. Any student will be trained on using a Raman microscope at the start of the project, so prior experience here is not necessary.
Professor Breider has significant experience in the field of microplastics. Professor Tagliabue and Dr Bowman have significant experience in building Raman microscope systems and have collaborators specializing in low-cost systems. Thus, this project is achievable in the time scale available.

Deliverables

1. Understanding of how Raman signals change as the microplastic size is reduced.
2. A library of microplastic signals when samples are in seawater.
3. A written report presenting the results and work accomplished during the project.
4. An oral presentation at the end of the semester to present the results of the project.

Documentation

As a starting point, here is a summary on Raman spectroscopy on microplastics:
https://www.sciencedirect.com/science/article/pii/S0043135418304421

Planned interaction with Sailowtech

The library developed during this project will be implemented on a future Sailowtech cruise. Therefore, we will work closely with Sailowtech to identify in what form the library would be most useful, and working out which plastics they would most like to identify. There will be several coordination meetings with Sailowtech (around 3/4 in the semester) to monitor the progress of the project. In addition, the student doing this project will be a member of Sailowtech and will be able to participate in different activities during the semester, including potentially one of our expeditions.

Contact

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