



Company Information

Company Name	<i>Thermo Fisher Scientific</i>	Date Submitted	<i>03/28/2023</i>
Project Title	<i>Automated microplastic sample preparation system for rapid microplastics screening by FTIR (THERMO_MICRO)</i>	Planned Starting Semester	<i>Spring 2023</i>

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	3	Electrical	1
Computer	1	Systems	

Company and Project Overview:

Thermo Fisher Scientific Inc. (NYSE: TMO) is the world leader in serving science, with annual revenue of approximately \$40 billion. Our Mission is to enable our customers to make the world healthier, cleaner and safer. Whether our customers are accelerating life sciences research, solving complex analytical challenges, increasing productivity in their laboratories, improving patient health through diagnostics or the development and manufacture of life-changing therapies, we are here to support them. Our global team delivers an unrivaled combination of innovative technologies, purchasing convenience and pharmaceutical services through our industry-leading brands, including Thermo Scientific, Applied Biosystems, Invitrogen, Fisher Scientific, Unity Lab Services, Patheon and PPD.

Microplastics in the environment is of great concern as it's true impact on human health and overall environmental impact is not yet fully known. Widescale use of plastics in our everyday lives coupled with improper disposal of plastics waste has resulted in the rapid proliferation of



microplastics in water all over the world. Thermo Fisher Scientific provides a range of analytical techniques for the analysis of microplastics. The bottleneck in microplastics analysis often comes from the time consuming and labor-intensive sample preparation steps required to filter microplastics from water samples and get it into a suitable form for analysis. This project aims to develop an automated method for full sample preparation (after filtration) for microplastics analysis via FTIR (Fourier Transform Infrared Spectrometry). Automation of this sample preparation method will facilitate use of FTIR as a rapid screening tool for the analysis of microplastics which will have significant contribution to the work being undertaken in this area and aligns with our mission at Thermo Fisher Scientific to enable our customers to make the world healthier, cleaner and safer.

Project Requirements:

This project aims to develop an automated device for full sample preparation of microplastics samples and analysis/screening via FTIR (Fourier Transform Infrared Spectrometry). Automation of this sample preparation method will facilitate use of FTIR as a rapid screening tool for the analysis of microplastics which will have significant contribution to the work being undertaken in this area and aligns with our mission at Thermo Fisher Scientific to enable our customers to make the world healthier, cleaner and safer.

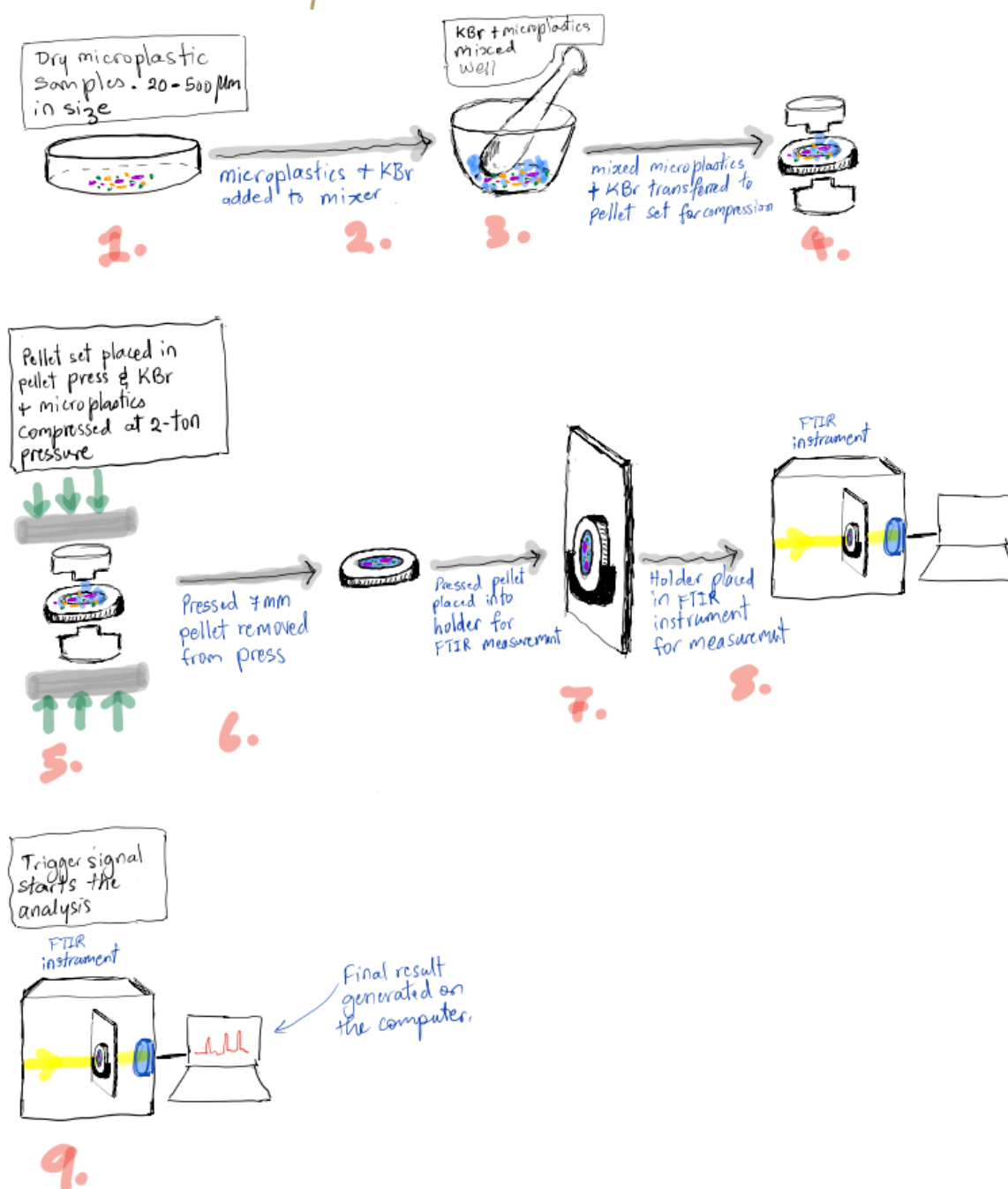
This project is envisioned to take more than one senior design team to accomplish. The plan for the first team (THERMO_MICRO, Phase 1) would be to analyze a concept for the process, then design and implement a portion of the design. It is anticipated that a Phase 2 team would continue work on the project starting in Fall of 2024 to continue the design and implementation.

Outline of work

1. Develop an automated system/solution for steps 2 to 9 below.
2. Current status is all steps are done manually.



INDUSTRIAL SOLUTIONS LABORATORY



The scope of the project would include steps 2 to 9. The pellet set (#4), press (#5), holder (#7), FTIR instrument (#8) and trigger commands (#9) would be provided by Thermo Fisher Scientific. Students would be asked to automate steps 2 to 9 so a user having dry microplastic samples can add to a device that automate steps 2 to 9. The ideal solution would be a device (preferably small footprint) that can sit next to the FTIR instrument on a lab bench. The automated solution could be a carousel, robotic solution or any solution that automates steps 2 to 9.



Figure 1: Manual sample preparation pathway for FTIR analysis.

Hardware, chemistries and software available

1. Nicolet-FTIR, <https://lnkd.in/ganQMtFp>
2. Pellet press and pellet set <https://www.youtube.com/watch?v=wPNmyXjc570>
3. Sample loading Accessory
4. KBr (potassium bromide), polymer standard beads (microplastics).
5. FTIR Software, Software development kit.
6. FTIR Instrument and laptop

Output

Current manual method is time consuming for screening purposes. Goal of this project is to automate the sample preparation of microplastic samples for FTIR analysis/screening. This will not only speed up the process but also make the steps highly reproducible and reduce user variability. This can prove to be a valuable technology for environmental scientist interested in screening for microplastics from water samples.

Expected Deliverables/Results:

- Automated sample preparation system/device which streamlines preparation of microplastic samples and analysis via FTIR spectrometer for rapid microplastics screening
- Schematic, final plans, solution and cost breakdown of parts and components
- Description of additional work to be done and further optimization

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Ability to build device to automate steps outlined in project.
- An overview will be necessary with the students assigned to this project so that they can gain a better understanding of how the final project output will be used for FTIR analysis. In addition to some in person and remote sessions we can also share additional presentations, papers and generate customized recorded content and video to aid in students having a better understanding of background information in preparation for the project.