SHIMADZU
Excellence in Science

New Products

Options for the AIMsight™ Infrared Microscope and AIRsight™ Infrared/Raman Microscope

Perform Microplastics Analysis More Quickly and Accurately

– Determine Even the Mass and Volume of Particles –

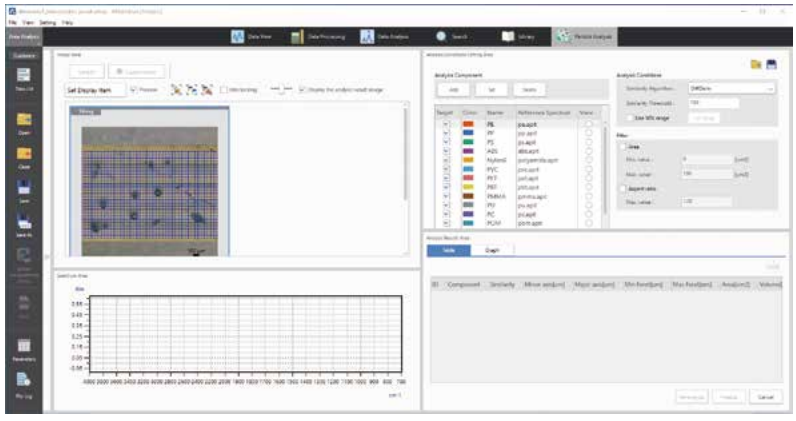
Particle Analysis Program

Batch Measure the Size, Mass, and Volume of Multiple Particles, and Display Graphs for Easy Visualization

By adding a particle analysis program to AMsolution, the software for the AIMsight infrared microscope and the AIRsight infrared/Raman microscope, the chemical images obtained from mapping measurements*1 can be used to calculate individual particle qualities, as well as the major axis, minor axis, mass*2, and volume*2. In addition, this statistical information can be easily displayed. The program can be used from the [Particle Analysis] tab page, thereby maintaining the same operational setup as the AMsolution analysis software. The particle analysis program can be used for a variety of analyses, including the analysis of microplastics and contaminant analysis.

*1: The optional High-Speed Mapping Program is separately required.

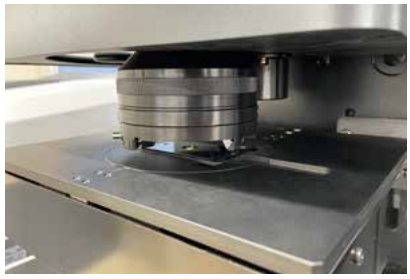
*2: Mass and volume are calculated based on the theoretical formula (Formula (1) [log10(M)=b·log10(S)+a]) used in the article referenced below. This theoretical formula applies only to microplastics. Shimadzu cannot guarantee the validity of the mass results.
Tomoya Kataoka, Yota Iga, Rifqi Ahmad Baihaqi, et al. Geometric relationship between the projected surface area and mass of a plastic particle. Water Research. 2024;261:122061.



Particle Filter (PF) Holder

Keeping the Membrane Filter Level Makes It Easier to Focus on the Surface, Improving the Particle Analysis Accuracy

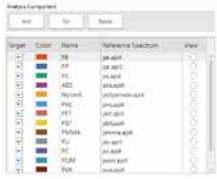
The PF holder fastens the Membrane Filter (PTFE or stainless steel (SUS)) used in microplastics analysis by gripping it. This prevents the Membrane Filter from sagging during drying, which keeps the surface flat and enables more accurate measurements.



Details of the Functions Included in the Particle Analysis Program

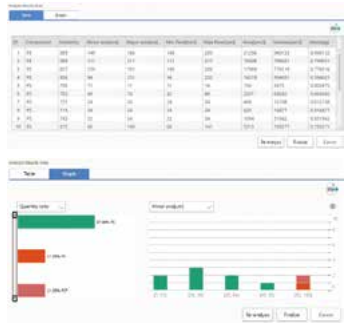
Settings for the analysis components

- Select the analysis components from those registered by the user or select the standard, built-in components.
- Conditions for contaminants and microplastics analysis are included as standard.



Confirmation of analysis results

- The analysis results can be confirmed in tabular form or as graphs.
- The corresponding particle position in the image is highlighted with a red frame in sync with the row selection in the table.
- In the graphs, the horizontal bar chart displays the ratio or the number of particles by component in descending order, and a histogram by item.
- In the images, the distribution of each component is indicated in a specified color.



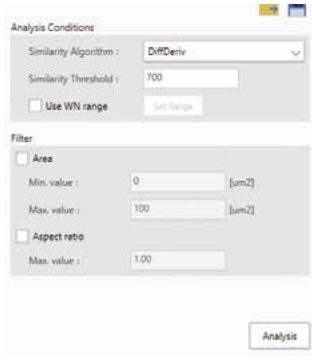
Output of analysis results

- Reports can be created easily in a special report format.
- Information from the analysis results tables or graphs can be output in CSV file format.

Note:
The analysis conditions can also be specified.

Configuring the analysis conditions/the size to be analyzed

- A similarity algorithm and a threshold value can be specified as the analysis conditions.
  (Presented as qualitative results showing the components with the highest congruence between the reference spectrum and each spectrum within the measurement area, and that exceeded the threshold value.)
- If fibers, for example, are to be excluded, they can be selected by configuring the aspect ratio.



Why Is It Possible to Calculate the Mass from the Area?

The research group under Associate Professor Tomoya Kataoka at the Graduate School of Science and Engineering at Ehime University used an ultramicrobalance to measure the mass of 4390 microplastic particles collected from 17 rivers in Japan at 35 locations. They found that there is a significant geometric relationship between particle mass and projected area (shown in the figure to the right).
Further, by using this relationship, they have shown that it is possible to estimate the mass concentration of plastics in the environment simply and with high accuracy. *

The devised formula: log10(M)=b·log10(S)+a ...(1)

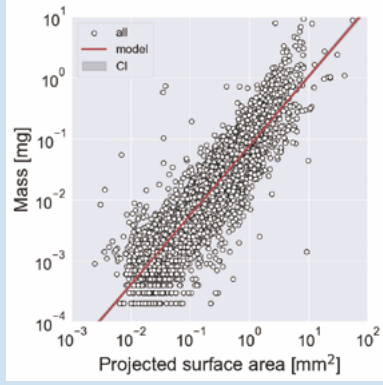
By taking the logarithm of the area S and the mass M, their relationship is shown to be linear.
As for the values of a and b, the optimal values differ depending on the shape (such as spherical or fibrillary) and the type of polymer, but when all the particles were included, the following values were determined.

a = -1.12±0.01, b = 1.14±0.01 ...(2)

Using the formula, the mass is calculated from the area by substituting the values in (2) into formula (1).

Tomoya Kataoka, Yota Iga, Rifqi Ahmad Baihaqi, et al. Geometric relationship between the projected surface area and mass of a plastic particle. Water Research. 2024;261:122061. [Fig. 3.]

* https://research.ehime-u.ac.jp/post-1500/



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