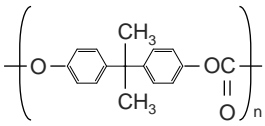


# Microplastics Calibration Standard-Low set (MPCS-L) for MPs analysis using Py-GC/MS

The Microplastics (MPs) Calibration Standard (MPCS) is used to identify and quantify MPs using Py-GC/MS. It allows the user to easily create calibration curves for quantification of MPs. Two MPCS with different diluents (SiO<sub>2</sub> or CaCO<sub>3</sub>) are available. Both MPCS contain a few µg each of commonly used 12 polymers which are homogeneously dispersed with a solid diluent for easy weighing on semi-microbalances. This product has a polymer concentration of approximately one-tenth of the MP Calibration Standard set (Product No.: PY1-4940). Suitable for quantitative analysis of trace MP samples.

## MPCS information (12 polymers)

Diluents : Calcium Carbonate (CaCO<sub>3</sub>) or Silicon dioxide (SiO<sub>2</sub>)

|   |   |   |
|---|---|---|
| $\text{-(CH}_2\text{CH}_2\text{)}_n$              |  | $\text{-(CH}_2\text{CH(CN))}_1\text{-(CH}_2\text{CH=CHCH}_2\text{)}_m\text{-(CH}_2\text{CH(C}_6\text{H}_5\text{))}_n$ |
| Polyethylene (PE)                                 | Polycarbonate (PC)  | Acrylonitrile-butadiene-styrene resin (ABS)   |
| $\text{-(CH}_2\text{CH(CH}_3\text{))}_n$          | $\text{-(CH}_2\text{C(CH}_3\text{)(COOCH}_3\text{))}_n$                           | $\text{-(CH}_2\text{CH=CHCH}_2\text{)}_m\text{-(CH}_2\text{CH(C}_6\text{H}_5\text{))}_n$                              |
| Polypropylene (PP)                                | Poly(methyl methacrylate) (PMMA)  | styrene-butadiene rubber (SBR)  |
| $\text{-(CH}_2\text{CH(C}_6\text{H}_5\text{))}_n$ | $\text{[C(=O)-C}_6\text{H}_4\text{-C(=O)-(CH}_2\text{)}_2\text{-O]}_n$            | $\text{-(O-C(=O)-NH-C}_6\text{H}_4\text{-CH}_2\text{-C}_6\text{H}_4\text{-NH-C(=O)-O-R)}_n$                           |
| Polystyrene (PS)                                  | Polyethylene terephthalate (PET)*   | Polyurethane (PU)**   |
| $\text{-(CH}_2\text{CH(Cl))}_n$                   | $\text{[C(=O)-(CH}_2\text{)}_5\text{-NH]}_n$                                      | $\text{[C(=O)-(CH}_2\text{)}_4\text{-C(=O)-NH-(CH}_2\text{)}_6\text{-NH]}_n$  |
| Polyvinyl chloride (PVC)                          | Nylon 6 (N6)  | Nylon 66 (N66)  |

\* The use of SiO<sub>2</sub> diluent is recommended for PET.

\*\* PU can be analyzed only when CaCO<sub>3</sub> diluent is used.

## Selection of a MPCS from the two types of products

In most studies on Py-GC/MS analysis of environmental MPs, MPs are extracted from various matrices. After pretreatment processes, collected particles are put in a sample cup for pyrolysis. To enable easy weighing for the quantitative analysis of MPs, use of fine particles (SiO<sub>2</sub>) as a diluent (Method-A) was reported, but PU showed unfavorable pyrolytic behavior for quantification (Ref.1).

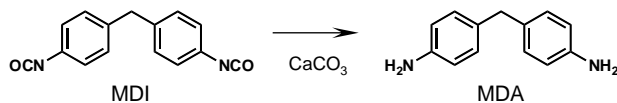
When CaCO<sub>3</sub> was used as a diluent instead of SiO<sub>2</sub>, the problem on PU quantification was eliminated due to the weak catalytic activity of CaCO<sub>3</sub> at a pyrolysis temperature of 600 °C (Method-B, Ref. 2). With the MPCS, two types of diluents are available (A: MPs-SiO<sub>2</sub> and B: MPs-CaCO<sub>3</sub>) so that one can select either method-A or method-B depending on the target polymers.

- References
- 1) M. Matsueda et al., *J. Anal. Appl. Pyrolysis* 154 (2021) 104993.
  - 2) T. Ishimura et al., *J. Anal. Appl. Pyrolysis* 157 (2021) 105188.
  - 3) K. Matsui et al., *J. Anal. Appl. Pyrolysis* 149 (2020) 104834.

# Use of catalytic action of CaCO<sub>3</sub> in the pyrolysis of polymers

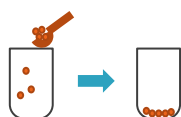
## ● Polyurethane (PU)

One of major pyrolyzates of PU is methylenediphenyl diisocyanate ( e.g., MDI). However, it is hard to quantitate PU using the MDI GC peak due to the high reactivity of MDI. Therefore, the more stable pyrolyzate, diamine (MDA), is preferred for quantitation of PU. CaCO<sub>3</sub>, which has weak catalytic activity, reacts with MDI to form MDA in the pyrolyzer.

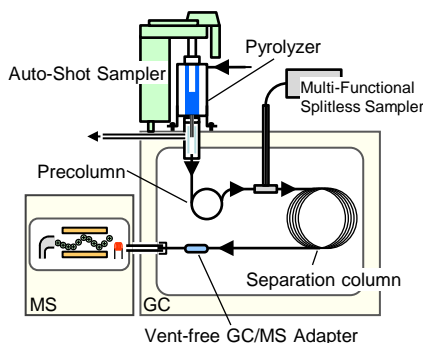


## Example

1. Put 4 mg of MPSCS into a sample cup



2. Py-GC/MS measurements



3. Making calibration curves and quantitation of polymers in unknown samples based on a software, F-Search MPs (Ref.3).

