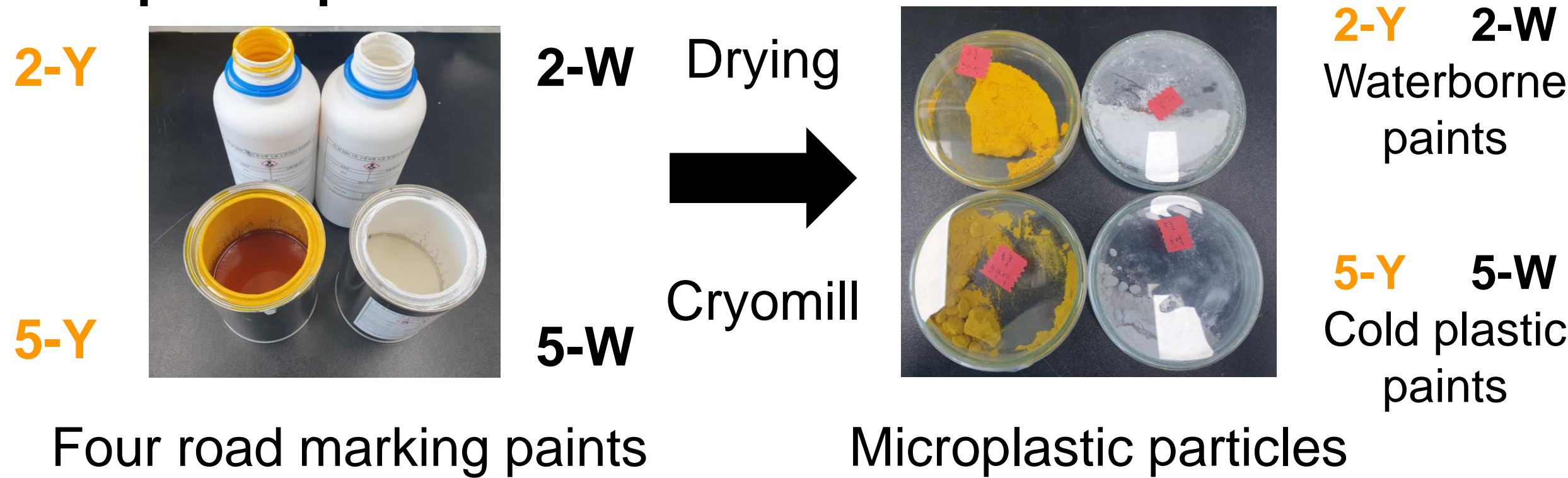


Introduction

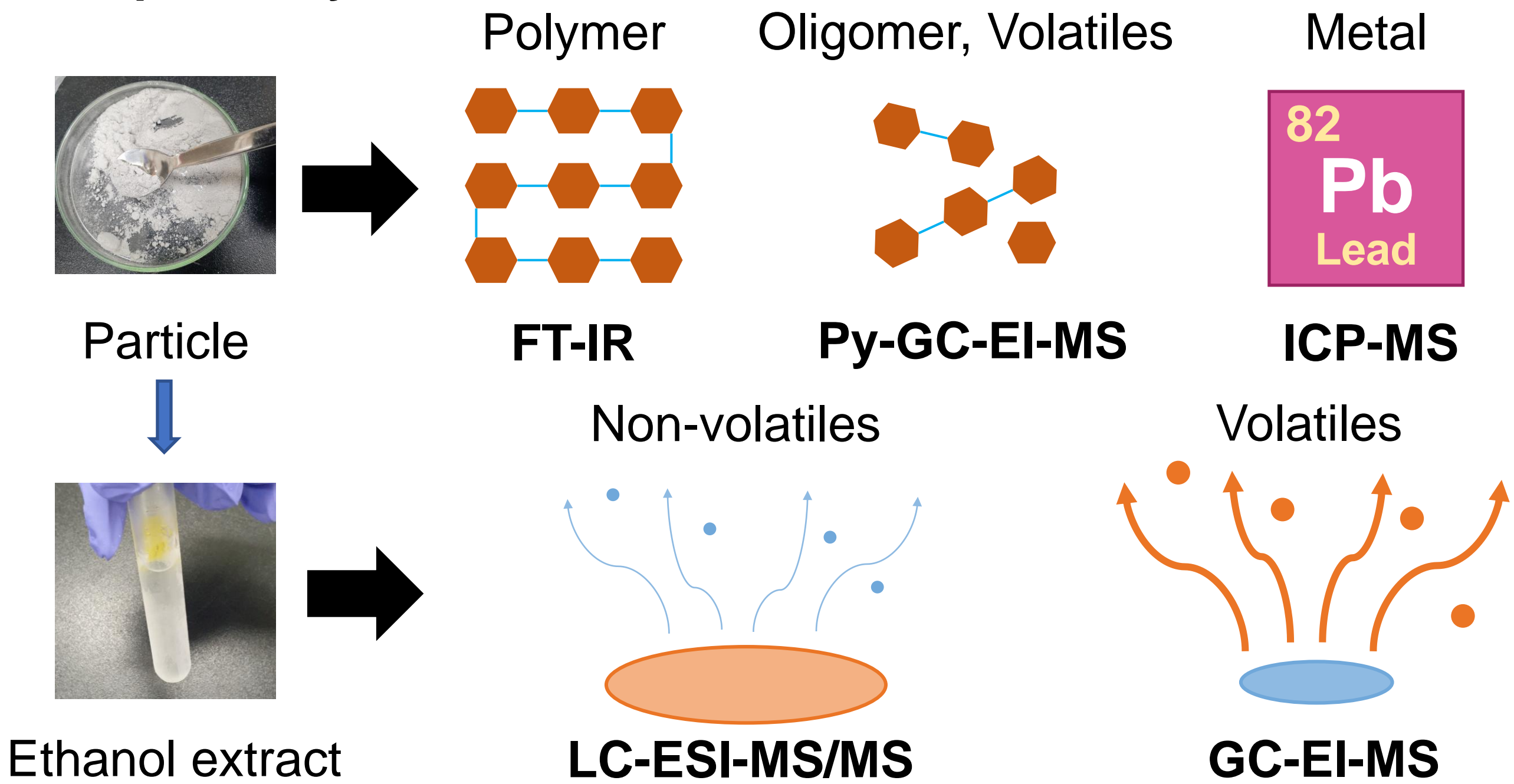
- Road marking paints are a significant source of microplastics in soil environment.
- Hazard assessment of the chemical additives in road marking paints remains limited.
- This study employed multiple MS techniques to analyze the chemical profiles of four road marking paints.

Method

1. Sample Preparation



2. Sample Analysis



Results

1. FT-IR analysis of polymer

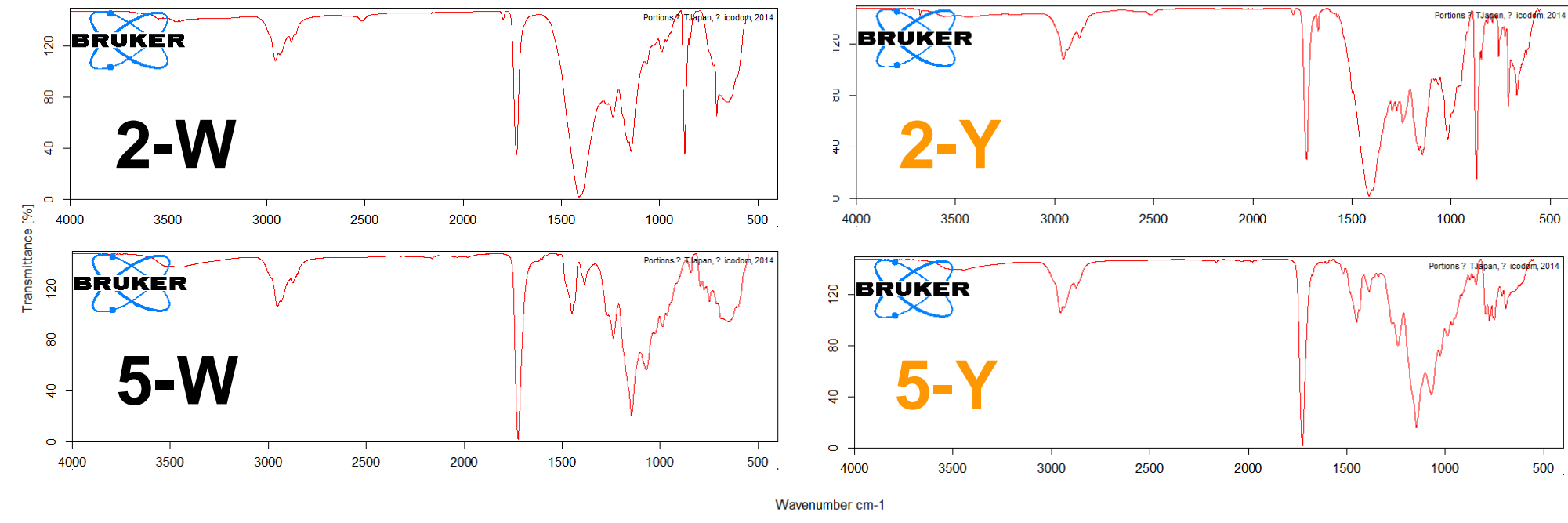


Figure 1. FT-IR spectra of the road marking paint samples

- FT-IR library search identified four paint samples as consistent with acrylic paints.
- Samples 5-W and 5-Y were definitively identified as poly(methyl methacrylate) (PMMA) based on their library match.
- All samples exhibited characteristic peaks for PMMA at 3000 & 1700 cm^{-1} , the presence of PMMA in samples 2-W and 2-Y as well.

2. ICP-MS metal analysis

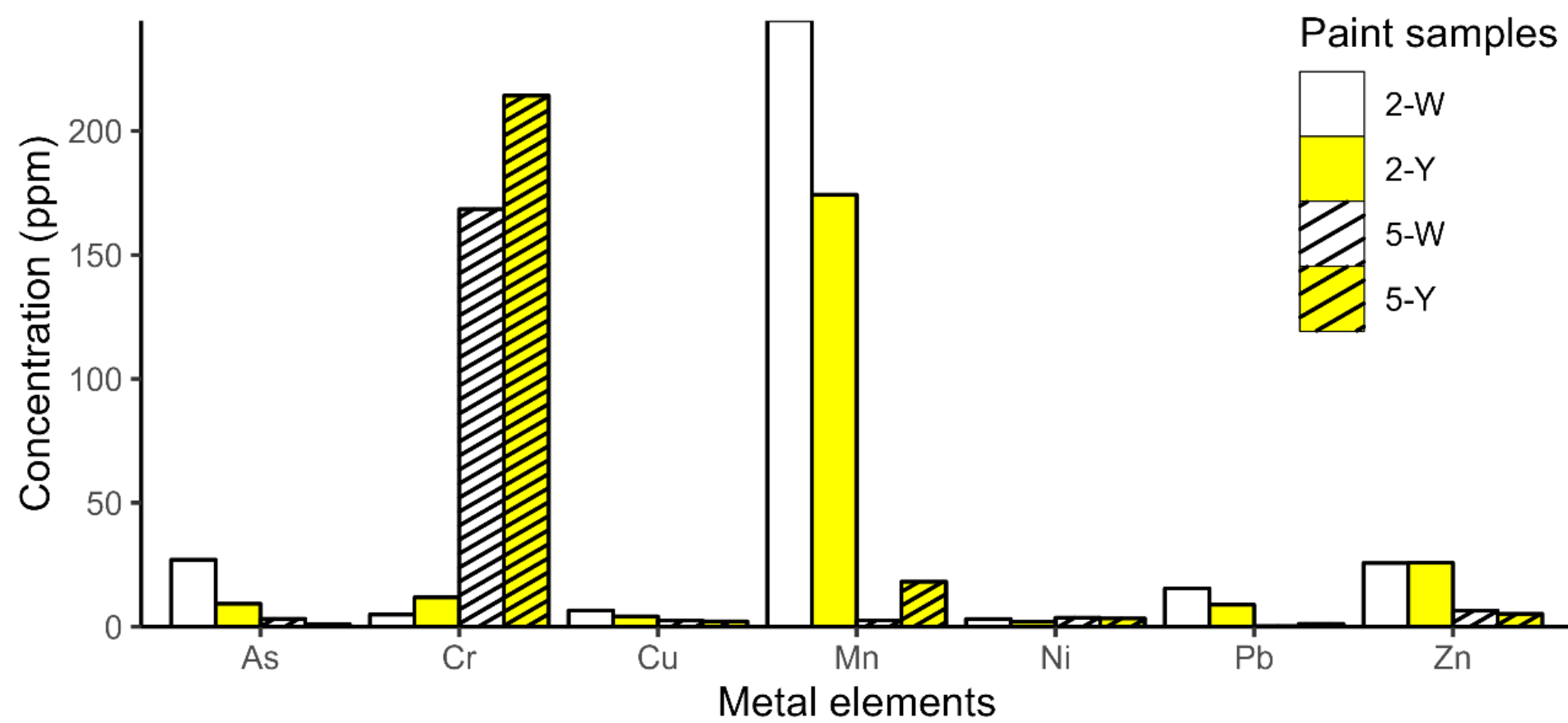


Figure 2. Metallic element contents of the four paint samples

- A large amount of chromium was detected in the 5-W and 5-Y paints. These paints may contain carcinogenic hexavalent chromium, necessitating further analysis.
- In the 2-W paint, the arsenic content was close to South Korea's soil contamination criteria (25 ppm).

Results

3. Identification of toxic organic additives

Figure 3. Toxic organic additives found in four road marking paint samples. Color of cell denotes the instrument that detected the compound. Peach: py-GC-MS, Yellow: py-GC-MS and GC-MS, Green: GC-MS, Cyan: LC-MS

Hazard	Compounds			
Aquatic toxicity	Lauryl Alcohol	1-Dodecanethiol	Dodecyl methyl sulfide	Butyl Acrylate
	1-Tetradecanol	Butylated Hydroxytoluene	Methanethiol	Isobornyl acrylate
Health hazard	Isophorone diisocyanate (Resp. Toxicity)	O-Anisidine (Carcinogen)	Dicyclohexyl phthalate (Repr. Toxicity, EDC)	Tetramethrin (Potential Carcinogen)
	Trimethylolpropane (Potential Repr. Toxicity)	p-Cresol (Potential Carcinogen)	1-Dodecene (Resp. Toxicity)	2,4-Dihydroxybenzophenone (Potential Repr. Toxicity)

- Different sets of compounds were detected using py-GC-MS, GC-MS, and LC-MS analyses, with some overlap between py-GC-MS and GC-MS.
- Highly toxic compounds, such as o-anisidine and dicyclohexyl phthalate, were identified.

Conclusion

- Comprehensive chemical analysis of road marking paints was conducted using multiple types of MS.
- The detection of toxic heavy metals and organic additives underscores the need for toxicological evaluation of road marking paint products.

Acknowledgements

- This research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2022R1A2C200595512).