Supplementary Information

Event-based Variations in Microplastic Pollution in a Small Agricultural River during Rainfall

Widyastuti Kusuma Wardhani [1,*], Kuriko Yokota [1], Teuku Mahlil [2], Nguyen Minh Ngoc [1] and Takanobu Inoue [1] *

Text S1

The two sampling approaches are explicitly described in Methods Section 2.2. Preliminary validation tests (n=3 triplicates per method, 1000 L filtered volume, Table S1), conducted at the study sites under sunny conditions, confirmed no significant differences in microplastic abundance (Kruskal–Wallis, $p = 0.534 > 0.05$) or characteristics ($p = 0.936 > 0.05$) between methods.

Table S1. Preliminary data on validation of sampling methods.

	Plankton net	Stainless steel bucket
Volume filtered (L)	1000	1000
Replication	3	3
Microplastic abundance (particles/m^3) (cross-site mean)	2,67	3,67
Standard deviation	1,52	1,63
Characteristic	Film, white, PE/PP	Film, white, PE/PP
Kruskal–Wallis test (p-value)	0.534	0.936

Text S2

Criteria used for polymer identification are based on [1], [2] and [3] and described below:

(a) Polyethylene (PE): High C-H stretching vibration is observed at 2845 and 2915 cm^{-1} , and CH_2 rolling vibration peaks are observed near 717 and 730 cm^{-1}. For high-density polyethylene (HDPE), peaks are observed near 1462 and 1472 cm^{-1}, and for low-density polyethylene (LOPE), CH_2 variable angle vibration is observed near 1462 and 1467 cm^{-1}. As for C-H stretching vibration around 2845 and 2915 cm^{-1}, many natural objects display corresponding peaks, so it is important to check for CH_2 rolling vibrations and angular vibration peaks as well. PE is easily oxidized by acid and heat. For oxidized PE, absorption peaks derived from functional groups and bonds indicating oxidation, such as C=O, C-O, etc., are observed around 1700 cm^{-1} and 1200 cm^{-1} .

(b) Polypropylene (PP): Four characteristic C-H stretching vibration peaks are observed around 3000 cm^{-1}. In addition, relatively high CH_2 angular vibration peaks are observed near 1455 and 1377 cm^{-1}.

(c) Polyethylene terephthalate (PET): Out-of-plane angular vibration on the aromatic ring C-H is observed near 720 cm^{-1}, C-O stretching vibration is observed near 1094 and 1241 cm^{-1}, and characteristic peaks for C=O stretching vibration are observed near 1713 cm^{-1}.

(d) Polyvinyl chloride (PVC) shows characteristic CH_2 bending vibration around 1425 cm^{-1}, CH_2 rocking near 959 cm^{-1}, and C–Cl stretching bands in the low-wavenumber region, typically around 610–712 cm^{-1}. In this study, the authors used the absorption band near 712 cm^{-1} as a key diagnostic peak for identifying PVC microplastics in mixtures, together with other PVC bands and the overall spectral pattern.

(e) In polyurethane (PU), two strong adjacent carbonyl stretching bands are observed: a urethane C=O stretching band around 1711–1717 cm^{-1} and a second band near 1686–1690 cm^{-1} attributed to urea/oligo-uret network carbonyls. N–H stretching appears as a broad band in the 3200–3400 cm^{-1} region, while N–H bending (amide II) is typically observed around 1530–1550 cm^{-1}. C–O–C stretching vibrations from the soft-segment ether groups and urethane linkages produce a characteristic "triple-peak" pattern in the 1000–1300 cm^{-1} region, often with strong bands near about 1220–1260 and 1070–1130 cm^{-1}. CH_2/CH_3 stretching bands from the aliphatic segments occur between 2800 and 3000 cm^{-1}, complementing the diagnostic carbonyl, N–H, and C–O–C features that collectively confirm the presence of polyurethane.

Text S3

Potential contamination was controlled using several types of blanks during sorting and processing. During sampling events, triplicate 5 L of rainwater was collected in a stainless steel bucket and analyzed as an environmental blank to assess background contamination. Airborne contamination was evaluated by placing triplicate open glass Petri dishes (ϕ 91 mm) and filling them with purified water on laboratory tables for one day during sample handling, while a 10 L sample of the purified water used in laboratory procedures was processed to check for waterborne contamination. All blanks were treated with the same extraction procedures as previously mentioned, and no microplastics were detected, indicating that contamination from rainfall, laboratory air, and laboratory water was negligible.



Figure S1. Location of the Hamamichi hydrological station (data provided by Aichi Prefectural Government) and the Umeda (UM) sampling point (source: Google Earth).

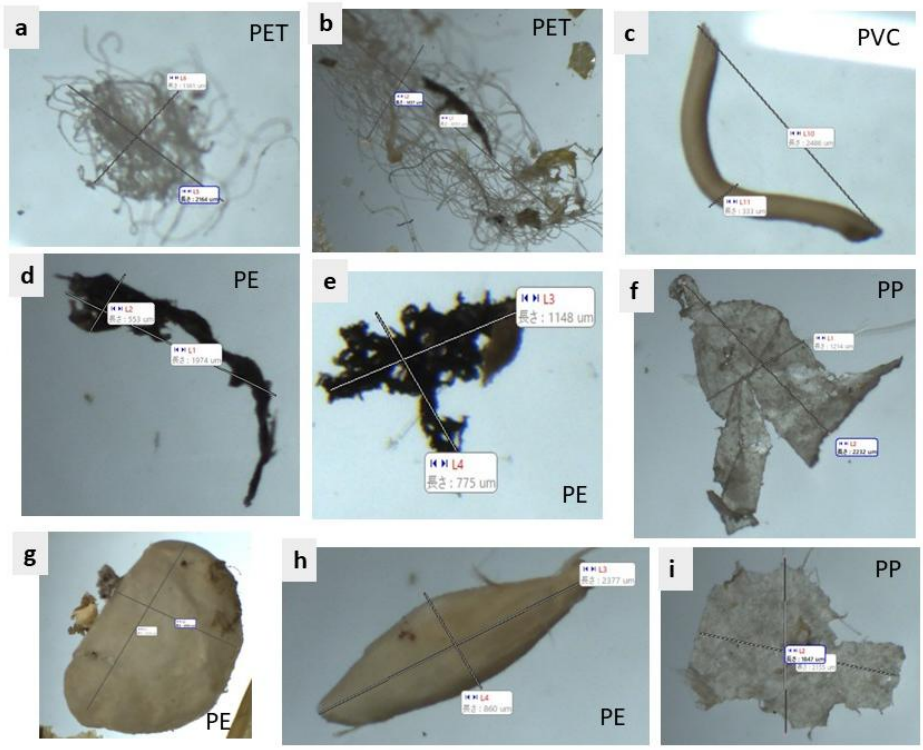


Figure S2. Representative microplastic photos with different shapes: (a,b) fiber clusters, (c) fragment, (d)–(f) films, (g,h) sphere, and (i) film.

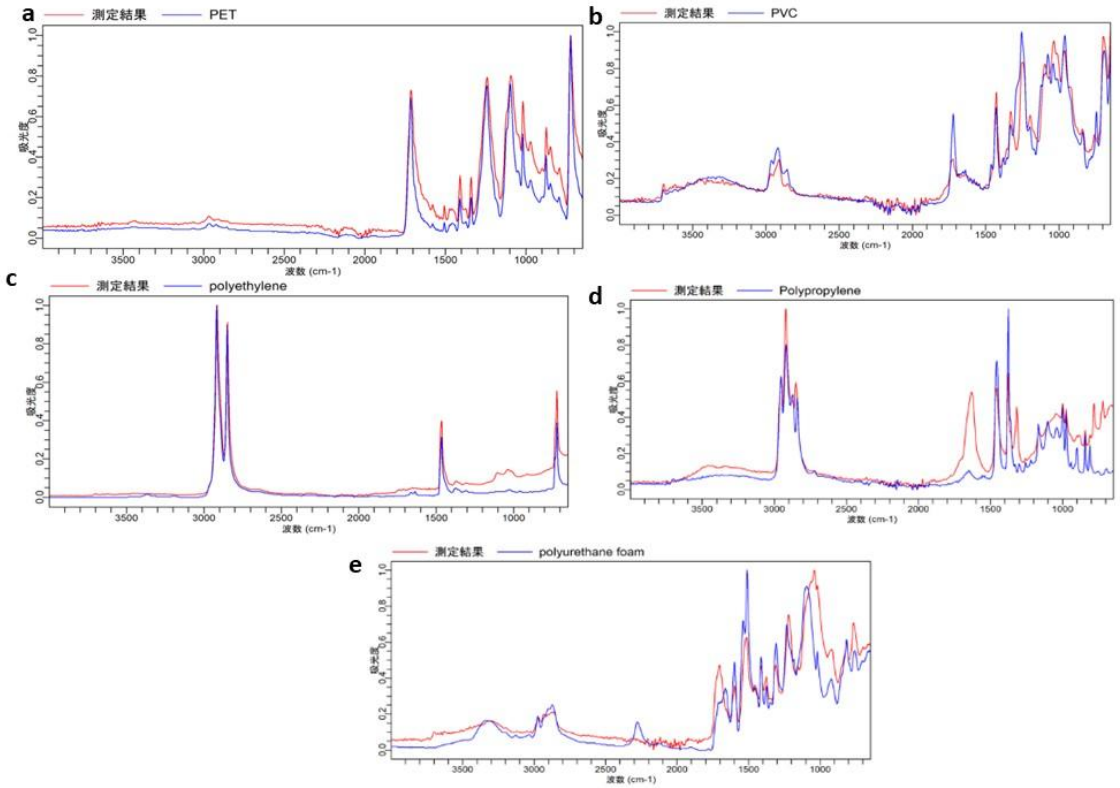


Figure S3. FTIR spectra of microplastics identified in the study area: (a) polyethylene terephthalate (PET), (b) polyvinyl chloride (PVC), (c) polyethylene (PE), (d) polypropylene (PP), and (e) polyurethane.