

## Supplementary information

### Occurrence and characteristics of microplastics in South African beverages

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**Table S1. Data and characteristics of beverage samples**

Sample code	Brand number	Beverage type	Number of particles	Sample volume (L)	Concentration (particles/L)
AB (Aluminium) 1	ABB1	lager	12	1.98	6.1
AB (Aluminium) 2	ABB2	Lager	15	2.00	7.5
AB (Aluminium) 3	ABB3	Lager	19	1.80	11
AB (Aluminium) 4	ABB4	Cider	57	2.00	29
AB (Aluminium) 5	ABB5	Pilsener	23	1.80	13
AB (Aluminium) 6	ABB6	Lager	28	2.64	11
AB (Aluminium) 7	ABB7	Cider	46	2.64	17
AB (Aluminium) 8	ABB8	Cider	29	1.80	16

Sample code	Brand number	Beverage type	Number of particles	Sample volume (L)	Concentration (particles/L)
AB (Glass) 1	ABB1	lager	58	1.98	29
AB (Glass) 2	ABB2	lager	38	1.98	19
AB (Glass) 3	ABB3	lager	15	2.00	7.5
AB (Glass) 4	ABB4	Cider	43	1.98	22
AB (Glass) 5	ABB5	Pilsener	17	1.98	8.6
AB (Glass) 6	ABB6	lager	40	1.98	20
AB (Glass) 7	ABB7	Cider	42	2.64	16
AB (Glass) 8	ABB8	Cider	18	1.98	9.1
AB (Glass) 9	ABB9	Spitzer	29	1.65	18
AB (Glass) 10	ABB10	Lager	32	1.98	16
AB (Glass) 11	ABB11	White wine	12	0.75	16
AB (Glass) 12	ABB12	Red wine	21	0.75	28
AB (Glass) 13	ABB13	Lager	10	1.98	5.1
AB (Glass) 14	ABB14	Vodka	10	1.65	6.1
AB (Glass) 15	ABB15	Cider	8.0	1.98	4.0
NAB (Aluminium) 1	NABB1	Carbonated	9.0	2.00	4.5
NAB (Aluminium) 2	NABB2	Carbonated	38	1.80	21
NAB (Aluminium) 3	NABB3	Carbonated	69	1.80	38
NAB (Aluminium) 4	NABB4	Carbonated	15	1.80	8.3

Sample code	Brand number	Beverage type	Number of particles	Sample volume (L)	Concentration (particles/L)
NAB (Aluminium) 5	NABB5	Carbonated	14	1.80	7.8
NAB (PET) 1	NABB1	Carbonated	3.0	1.50	2.0
NAB (PET) 2	NABB2	Carbonated	18	1.50	12
NAB (PET) 3	NABB3	Carbonated	69	1.50	46
NAB (PET) 4	NABB4	Carbonated	15	1.50	10
NAB (PET) 5	NABB5	Carbonated	11	1.50	7.3
NAB (PET) 6	NABB6	Carbonated	12	2.00	6.0
NAB (PET) 7	NABB7	Carbonated	5.0	1.50	3.3
NAB (PET) 8	NABB8	Carbonated	17	1.50	11
NAB (PET) 9	NABB9	Soft drink	15	1.30	12
NAB (PET) 10	NABB10	Iced tea	38	3.00	13
NAB (PET) 11	NABB11	Carbonated	12	2.00	6.0
NAB (PET) 12	NABB12	Carbonated	5.0	2.00	2.5
NAB (PET) 13	NABB13	Carbonated	5.0	2.00	2.5
NAB (PET) 14	NABB14	Carbonated	20	1.50	13
NAB (PET) 15	NABB15	Carbonated	19	1.50	13

**Table S2. Comparison of characteristics of non-alcoholic beverages**

Country	Sample type (Packaging material)	Number of samples (brands)	Mean and median* concentration (particles/L)	Shapes	Size range ( $\mu\text{m}$ )	Polymer types	Colours	Reference
South Korea	Soft drinks (NA)	3 (1)	2.25*	NA	20–300, >300	PP, PE, PET, and etc	NA	Pham et al. (2023)
Türkiye	soft drinks (PET and Tetra Pak)	30 (10)	8.9	Fragment, fiber, and film	10–1000	PA, PET, and PE	Transparent, blue, grey, green, and yellow	Altunışık. (2023)
Italy	Soft drinks (PET)	11 (11)	9.94 $\pm$ 0.33	Fiber and fragment	36–2228	NA		Crosta et al. (2023)
Mexico	Energy drinks (PET and Glass)	8 (2)	14 $\pm$ 5.79	Fiber	100–3000	PA, PEA, and ABS	Blue and red	Shruti et al. (2020)

Country	Sample type (Packaging material)	Number of samples (brands)	Mean and median* concentration (particles/L)	Shapes	Size range (µm)	Polymer types	Colours	Reference
Spain	Soft drinks (Can, Glass, and PET)	15 (9)	22.5 ± 18.7	Fibers, films, foams, and tangles	45–5000	Cellulosic, PES, PE, Acr, PE: Acr, and PEVA	Transparent, blue, red, green, orange	Socas-Hernández et al. (2024)
Spain	Assorted drinks (Can, Glass, PET, and Brik)	13 (6)	24.8 ± 27.3	Fibers, films, tangles, and foams	45–5000	Cellulosic, PES, PE, PP, PE: Acr, PVC, POM, and PVL	Transparent, blue, black, red, grey, green	Socas-Hernández et al. (2024)
Ecuador	(PET and Tetra Pak)	NA	32 ± 12	Fiber and fragment	5.47–2224.25	PP, PE, and PAAm	Red, green, violet, yellow, and blue	Diaz-Basantes et al. (2020)
South Korea	Fruit drinks (NA)	3 (1)	29.3*	NA	20–300, >300	PP, PS, PET, and PA	NA	Pham et al. (2023)

Country	Sample type (Packaging material)	Number of samples (brands)	Mean and median* concentration (particles/L)	Shapes	Size range (µm)	Polymer types	Colours	Reference
Mexico	Soft drinks (PET and Glass)	19 (10)	40 ± 24.53	Fiber	100–3000	PA and PEA	Blue, red, and brown	Shruti et al. (2020)
South Africa	Soft drinks (PET and Aluminium)	20 (15)	9.5 ± 8.5	Fiber, fragment, pellet, and film	20–5000	PP, PE, PU, and PET	Black, blue, brown, green, grey, purple, red, white, and yellow	This study

NA = Not available; etc = other materials; PVC = polyvinyl chloride; POM = polyacetal; PEVA = polyethylene vinyl acetate; Acr = acrylic; PE:

Acr = polyethene-acrylic; PVL = polyvinyl laurate; PA= Polyamide; PET = Poly(ethylene terephthalate); PEA = Poly(ester amide); ABS =

Acrylonitrile butadiene styrene; PAAm = Polyacrylamide; PBT = Polybutylene terephthalate; PES = polyester+ Poly(ethylene terephthalate);

and PU = Polyurethane.

**Table S3. Comparison of characteristics of alcoholic beverages**

Country	Sample type (Packaging material)	Number of samples	Mean concentration (particles/L)	Shapes	Size range ( $\mu\text{m}$ )	Polymer types	Colours	Reference
USA	(Glass and Aluminium can)	12 (12)	$4.05 \pm 1.76$	Fiber and fragment	100–5000	NA	Black, blue, transparent, purple, red/pink, multicolour, and brown	Kosuth et al. (2018)
South Korea	Beer (Aluminium can, Glass, and PET)	18 (NA)	9.00*	NA	20–300, >300	PP, PE, PS, PET, and ETC	NA	Pham et al. (2023)
Germany	Beer (NA)	24 (24)	22.6	Fiber, fragment, and granule	36–2228	NA	Whitish, yellow, transparent, blue, black, and green	Liebezeit and Liebezeit (2014)

Country	Sample type (Packaging material)	Number of samples	Mean concentration (particles/L)	Shapes	Size range ( $\mu\text{m}$ )	Polymer types	Colours	Reference
Ecuador	Craft beer (Glass)	7 (NA)	32	Fiber and fragment	3.505–1740.24	PP, PE, and PAAm	Red, green, violet, yellow, and blue	Diaz-Basantes et al. (2020)
Ecuador	Industrial beer (Glass)	8 (NA)	47	Fiber and fragment	5.47–2224.25	PP, PE, and PAAm	Red, green, violet, yellow, and blue	Diaz-Basantes et al. (2020)
Spain	Wine (Can, Glass, PET, and Brik)	15 (8)	$56.7 \pm 73.5$	Fibers, films, tangles, and foams	45–5000	Cellulosic, PE, and Acr	Colourless, blue, red, black, pink, green	Socas-Hernández et al. (2024)
Spain	Beer (Can and Glass)	15 (11)	$95.2 \pm 91.8$	Fibers, films, foams, and tangles	45–5000, > 5000	Cellulosic, PES, PE, Acr, PE: Acr, and PEVA	Colourless, blue, red, green, orange	Socas-Hernández et al. (2024)

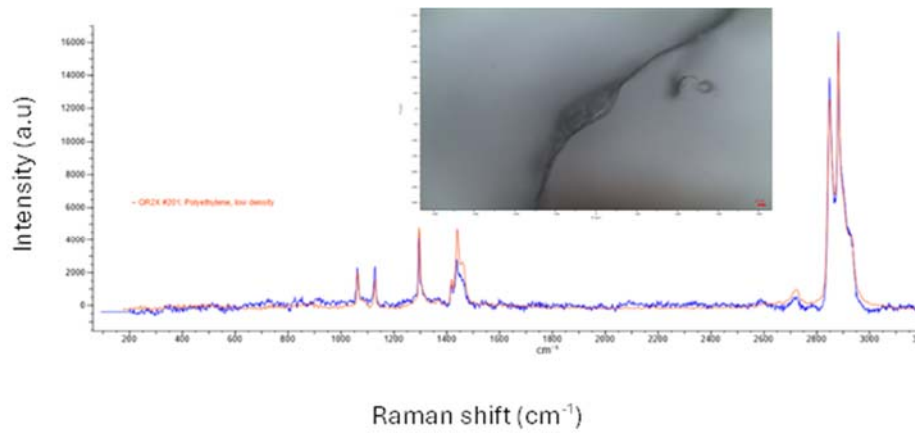


Country	Sample type (Packaging material)	Number of samples	Mean concentration (particles/L)	Shapes	Size range ( $\mu\text{m}$ )	Polymer types	Colours	Reference
Mexico	Beer	26 (19)	$152 \pm 50.97$	Fiber and fragment	100–3000	PA, PES, and PET	Blue, red, brown, green and black	Shruti et al. (2020)
Italy	White wine (Glass)	26 (6) and 6 not labelled	$183 \pm 123$	NA	7–475	PE	NA	Prata et al. (2020)
China	Spirit (PET)	6 (6)	872	Fiber and fragment	45–5000	Cellulose, PA, PET, PP, PVC, and PE.	NA	Zhou et al. (2023)
South Africa	Beer (Glass & Aluminium can)	23 (15)	$15 \pm 7.6$	Fiber, fragment, pellet, and film	20–5000	PP, PE, PA, PET, and PBT	Black, blue, brown, green, grey, purple, red, white, and yellow	This study

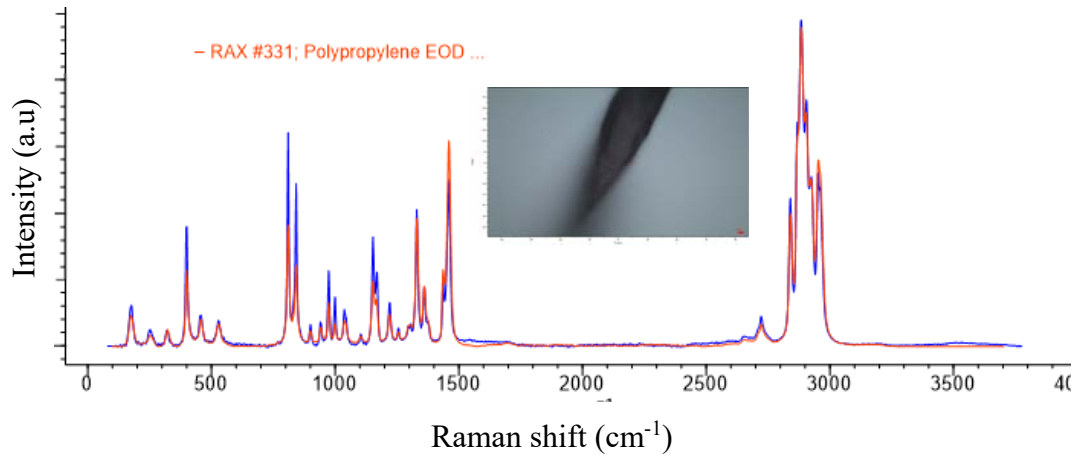
NA = Not available; etc = other materials; POM = polyacetal; PEVA = polyethylene vinyl acetate; Acr = acrylic; PE:Acr = polyethylene-acrylic;

PA= Polyamide; PES = Polyester; PET = Poly(ethylene terephthalate); PAAm = Polyacrylamide; and PBT = Polybutylene terephthalate

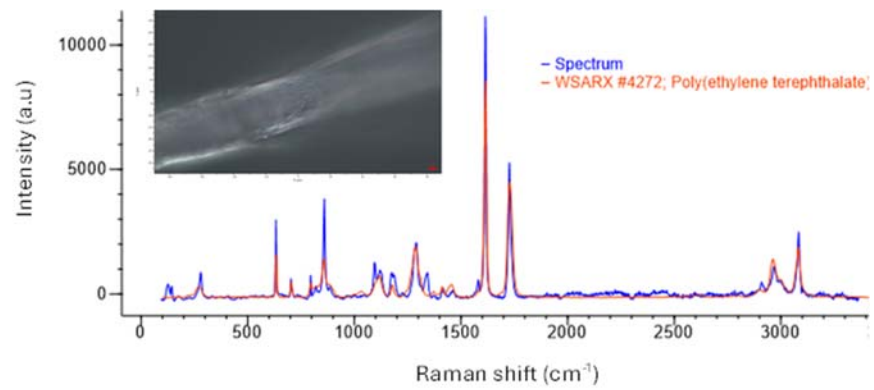
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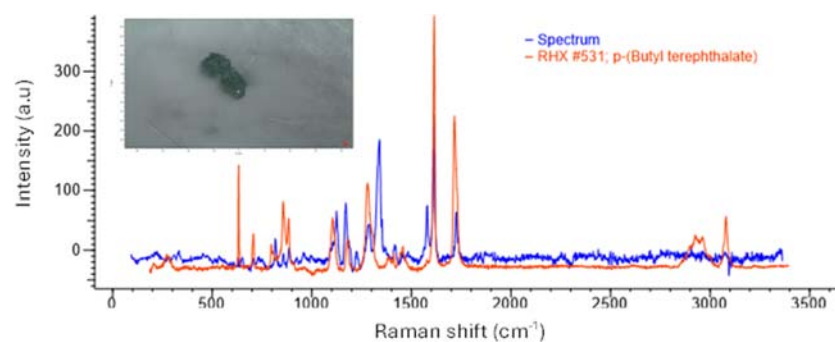
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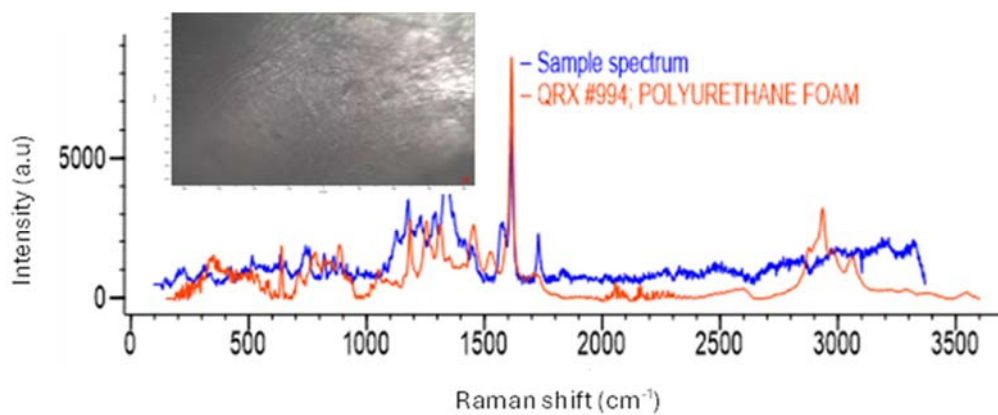
c)



d)



e)



f)

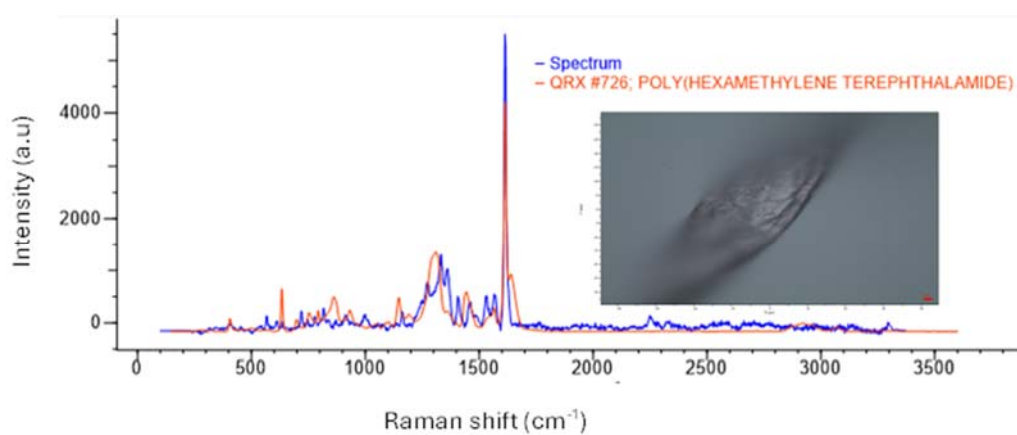


Figure S1 Micrograph, sample and reference spectra of a) PE, b) PP, c) PET, d) PBT, e) PU, and f) PA