

**Electronic Supplementary Information (ESI)**

**An approach for extraction, characterization and quantitation of microplastics in natural marine snow using Raman microscopy**

Shiye Y. Zhao,<sup>a,b</sup> Meghan Danley,<sup>c</sup> J. Evan Ward,<sup>d</sup> Daoji Li<sup>a</sup> and Tracy J. Mincer<sup>\*b</sup>

<sup>a</sup> State Key Laboratory of Estuarine and Coastal Research, East China Normal University, 3663 North Zhongshan Road, Shanghai 200062, China

<sup>b</sup> Marine Chemistry & Geochemistry, Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, Massachusetts 02543, United States.

<sup>c</sup> Marine Biology, University of New England, 11 Hills Beach Rd, Biddeford, Maine 04005, United States.

<sup>d</sup> Department of Marine Science, University of Connecticut, 1080 Shennecossett Road., Groton, Connecticut 06340, United States.

\*Corresponding author: Tracy J. Mincer; E-mail: tmincer@whoi.edu. Marine Chemistry & Geochemistry, Woods Hole Oceanographic Institution, 266 Woods Hole Road, Woods Hole, Massachusetts 02543, United States. Fax: 508-457-2075.

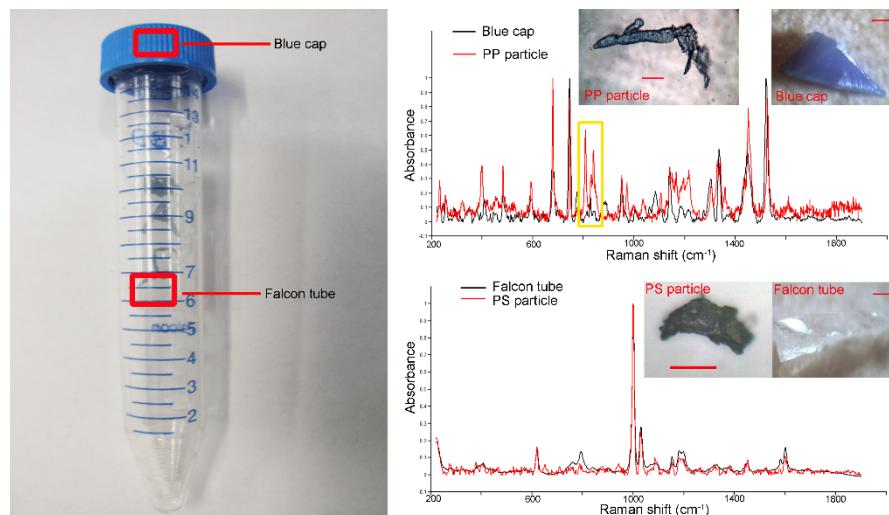


Fig. S1 Comparison between scrapings sampled from a Falcon tube and extracted particles from marine snow (PP: polypropylene; PS: polystyrene)

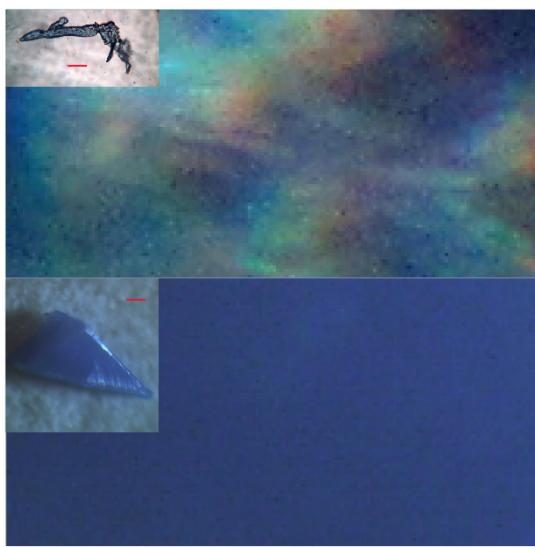


Fig.S2 Variant surface color appearances of the blue plastic particle extracted from marine snow and the scraping sampled from a Falcon tube cap using 8X digital zoom.

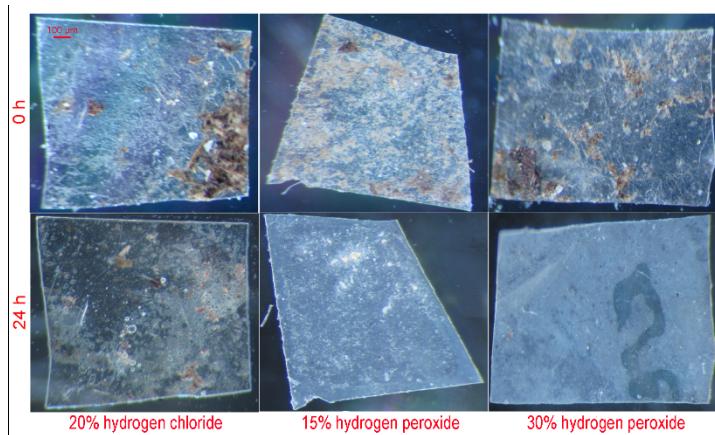


Fig. S3 Efficiency of hydrogen peroxide (15%, 30%) and hydrochloric acid (20%) to remove organic of biological origin within 24 h incubations. Note similarity among the 15% and 30% hydrogen peroxide treatments.

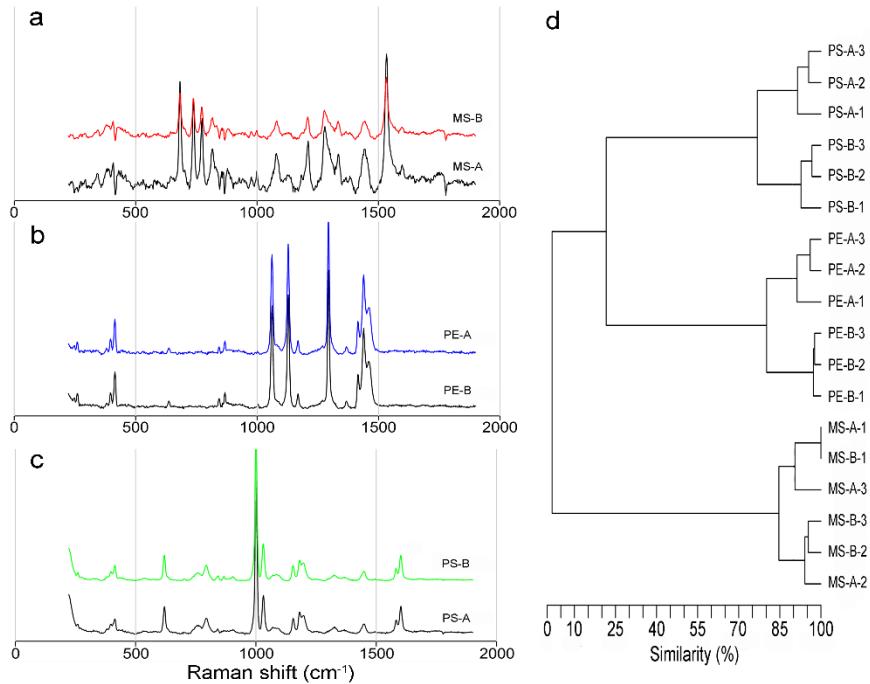


Fig. S4 Averaged Raman spectra of microspheres (a, MS: fluorescent green, polyethylene microspheres), polyethylene fragments (b, PE) and polypropylene fragments (c, PP) before (-B) and after (-A) 15% H<sub>2</sub>O<sub>2</sub> treatment; Cluster analysis of the Raman spectra (MS, PE, PP) based on a Euclidean similarity matrix (d).

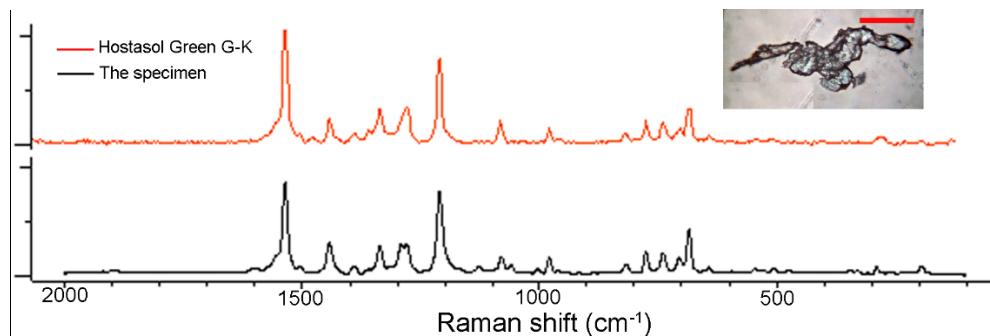


Fig. S5 Raman spectrum of the additive Hostasol Green (red trace) and a spectrum of a fragment extracted from marine snow (black trace), illustrating how this colorant could possibly mask the base polymer spectrum (scale bar: 100 μm).

Table S1: Particles were classified into two groups: **fragments** (e.g., **hard and flexible pieces**), **fibers**. Colors of MP were recorded and identified as one of three color tone types: light (white, yellow, yellow-brown); mid (green, red, blue, etc.); dark (grey, black, dark

Visual Identification								Confirmed by Raman								No spectra										
Sample	Volume (ml)	total particle	Shape		Color		Shape		Color		Shape		Color		Shape		Color		Shape		Color		mid		dark	
			Fiber	fragment	light	mid	dark	Fiber	fragment	light	mid	dark	Fiber	fragment	light	mid	dark	Fiber	fragment	light	mid	dark				
A	13	8	3	5	1	6	1	2	3	1	4	0	1	2	0	2	1	A	1	2	0	2	1			
A2	14	13	3	10	4	6	3	1	4	3	1	1	2	6	1	3	4	A2	2	6	1	3	4			
B	14	15	5	10	3	9	3	1	9	3	7	0	4	1	0	2	3	B	4	1	0	2	3			
B2	14	14	2	12	4	9	1	1	12	4	8	1	1	0	0	1	0	B2	1	0	0	1	0			
C	13.5	9	2	7	2	6	1	0	6	0	6	0	2	1	1	0	2	C	2	1	1	0	2			
C2	14	10	1	9	1	9	0	0	9	0	9	0	1	0	1	0	0	C2	1	0	1	0	0			
D	13.75	8	1	7	0	8	0	0	6	0	6	0	1	1	0	1	1	D	1	1	0	1	1			
D2	14	7	4	3	3	4	0	3	2	2	3	0	1	1	1	1	0	D2	1	1	1	1	0			

**Table S2: Classification of fragments according to size (in micrometers, um) and shape. Text in red refers to fragments that did not have sufficient Raman spectral signature to positively identify.**

A-size	A2-size	B-size	B2-size	C-size	C2-size	D-size	D2-size
406	224.6	249.1	351.5	500.3	1018.8	562.2	403.6
344.6	693.1	209.2	283.4	450.9	481.9	276.3	170.6
803.5	378.5	319.4	70	313.1	528.4	363.8	803.3
717	232.6	513.1	275.7	315.9	584.4	243.8	185.4
1482.1	508.8	342.9	172.5	113.5	1556.3	356.5	243.6
347.4	371.8	888.4	593.8	461.6	475.9	209.7	165
449.1	1192.9	370.9	578.4	271.6	491.9	64	181.6
115.1	1045.5	347.5	341.6	303.4	633.4	267.2	
	468.8	245.2	364.4	84.8	461.9		
	395.4	517.9	479.4		426.6		
	270.6	246.8	275				
	345.7	395.9	286.6				
	325.7	502.2	167.7				
		722.4	212				
		309.1					

Table S3. Particles identified in this study with corresponding Raman spectra for each identified fragment.

Panel	Image	Peak list	Peak list	Spectra (Raman and Raman enhanced)	Note
1		100	100		100
2		100	100		100
3		100	100		100
4		100	100		100
5		100	100		100
6		100	100		100
7		100	100		100
8		100	100		100
9		100	100		100
10		100	100		100
11		100	100		100
12		100	100		100
13		100	100		100
14		100	100		100
15		100	100		100
16		100	100		100
17		100	100		100
18		100	100		100
19		100	100		100
20		100	100		100
21		100	100		100
22		100	100		100
23		100	100		100
24		100	100		100
25		100	100		100
26		100	100		100
27		100	100		100
28		100	100		100
29		100	100		100
30		100	100		100
31		100	100		100
32		100	100		100
33		100	100		100
34		100	100		100
35		100	100		100
36		100	100		100
37		100	100		100
38		100	100		100
39		100	100		100
40		100	100		100
41		100	100		100
42		100	100		100
43		100	100		100
44		100	100		100
45		100	100		100
46		100	100		100
47		100	100		100
48		100	100		100
49		100	100		100
50		100	100		100
51		100	100		100
52		100	100		100
53		100	100		100
54		100	100		100
55		100	100		100
56		100	100		100
57		100	100		100
58		100	100		100
59		100	100		100
60		100	100		100
61		100	100		100
62		100	100		100
63		100	100		100
64		100	100		100
65		100	100		100
66		100	100		100
67		100	100		100
68		100	100		100
69		100	100		100
70		100	100		100
71		100	100		100
72		100	100		100
73		100	100		100
74		100	100		100
75		100	100		100
76		100	100		100
77		100	100		100
78		100	100		100
79		100	100		100
80		100	100		100
81		100	100		100
82		100	100		100
83		100	100		100
84		100	100		100
85		100	100		100
86		100	100		100
87		100	100		100
88		100	100		100
89		100	100		100
90		100	100		100
91		100	100		100
92		100	100		100
93		100	100		100
94		100	100		100
95		100	100		100
96		100	100		100
97		100	100		100
98		100	100		100
99		100	100		100
100		100	100		100

