Supplementary Information (SI) for Environmental Science: Nano.
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SUPPORTING INFORMATION

UV-B degradation affects nanoplastic toxicity and leads to release of small toxic substances

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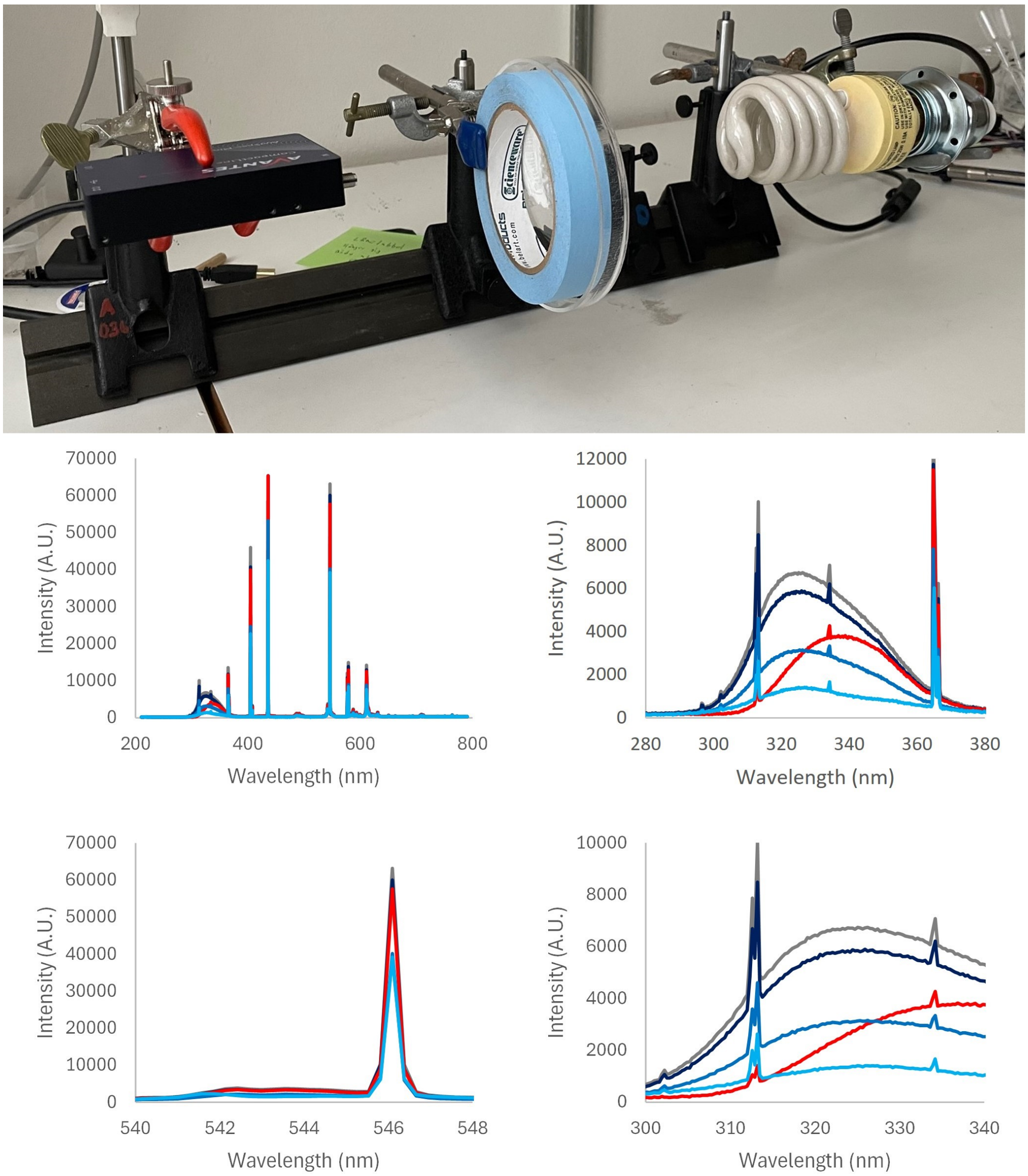
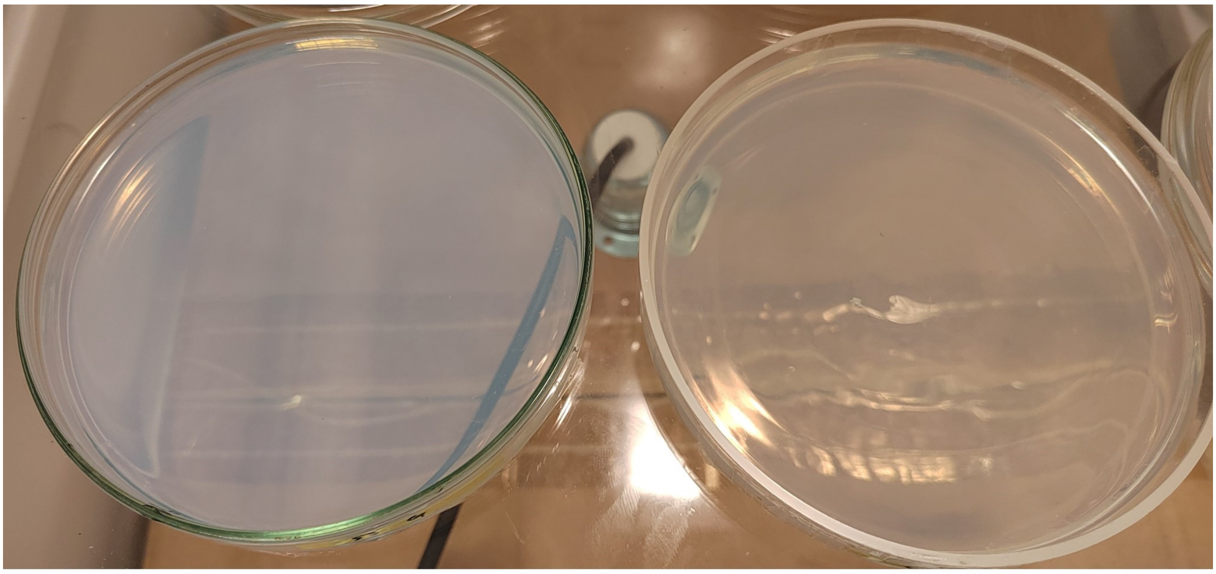


Figure S1: Top panel: setup for measuring the spectrum of the UV-B lamp. The middle-left panel shows the whole spectrum for different measurements, while the other panels display various parts of the entire spectrum. The spectrum from a new lamp with just air between the lamp and the detector is shown in grey. The spectrum from a new lamp with a quartz petri dish lid in the beamline is shown in dark blue. The spectrum from a new lamp with a glass petri dish lid in the beamline is shown in red. The spectrum from a lamp that had burned for 100 days with a quartz petri dish lid in the beamline is shown in blue. The spectrum from a lamp that had burned for around 150 days with a quartz petri dish lid in the beamline is shown in light blue.

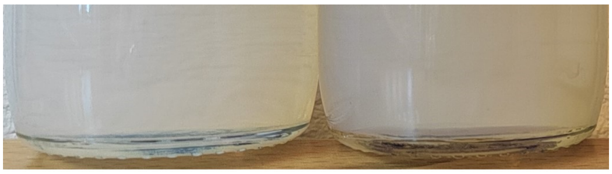
Figure S2. Three UV-B lamps were mounted in a cardboard. Ventilation slips were cut in the box. The box was placed on a shelf in a fridge. The temperature was stable at 22 °C when the three UV-B lamps were on. The samples were placed on the fridge shelf and covered with the box.



53 nm PS-NH_2
No UV-B

53 nm PS-NH_2
UV-B

Figure S3. Petri dishes, glass = no UV-B to the left and quartz = UV-B treatment to the right, with 53 nm.



53 nm PS-NH_2
No UV-B
UV-B

Figure S4. The solutions after transferred to 100 mL flasks after 100 days of treatment.

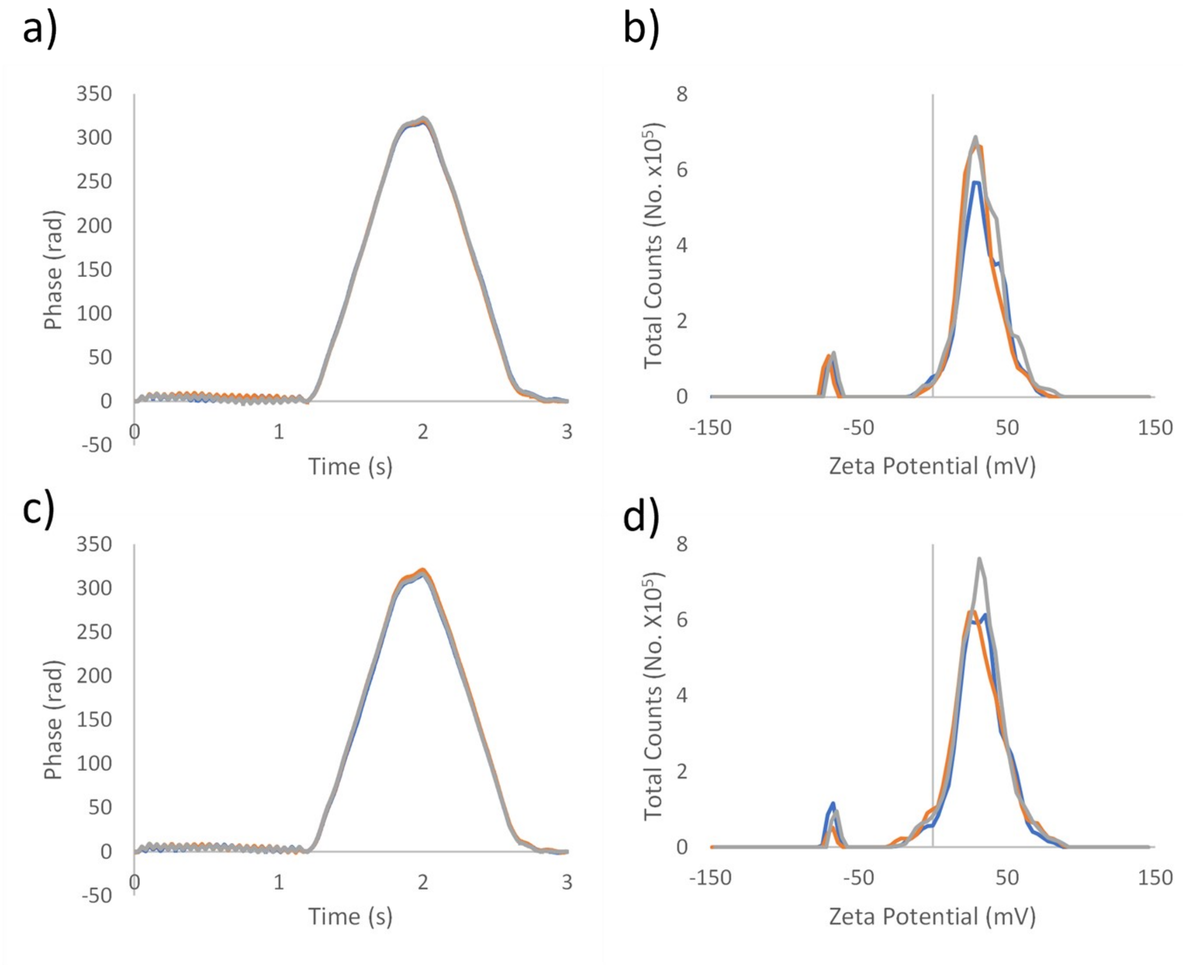


Figure S5. Zeta-potential for 53 nm PS-NH$_2$. Panel a) and b) show the Phase plot and Zeta potential for the not UV-B-treated sample, respectively. Panel c) and d) show the corresponding data for the UV-B-treated sample. Each graph shows the data from three repeated measurements of the samples.

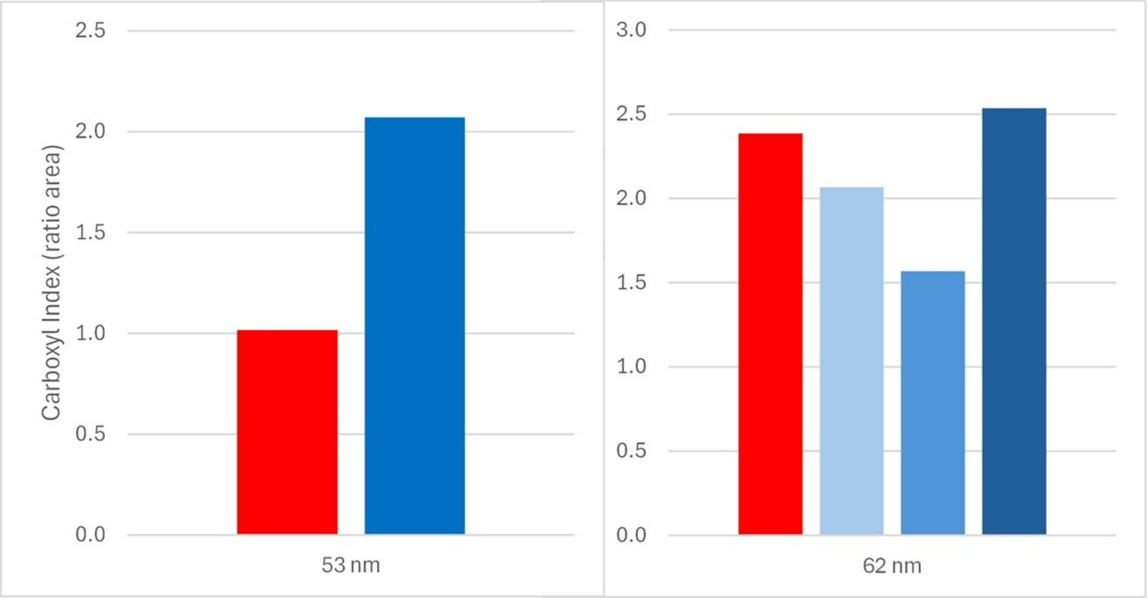


Figure S6 Carbonyl Index for control and UV-B treated samples. Carbonyl index is calculated as: the total area of the region between 1850 to 1650 cm^{-1} / the total area of the region between 1500 - 1420 cm^{-1} according to Almond et al (ref). Left panel shows The CI for the 53 nm amine-modified polystyrene particles. No UV-B exposure in red and after UV-B exposure in blue. Right panel shows the CI for the 62 nm carboxyl-modified polystyrene particles. No UV-B exposure in red and then 10, 25 and 32 days exposure in light blue, blue and dark blue respectively.

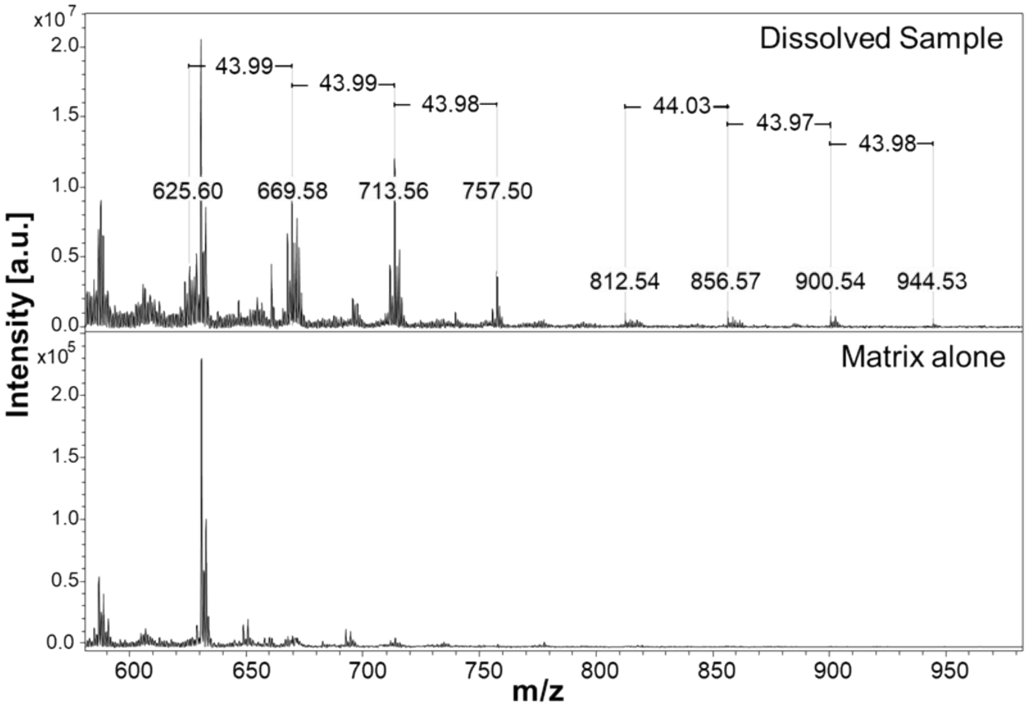
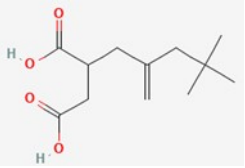
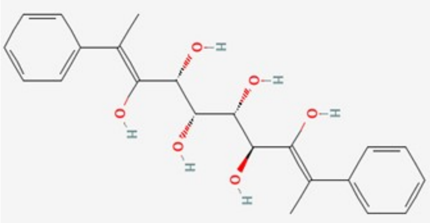
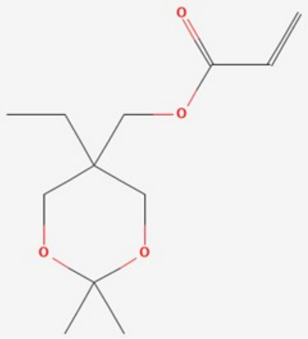
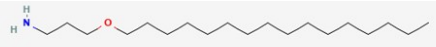
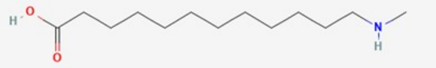
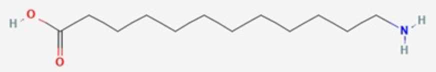
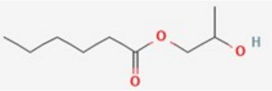
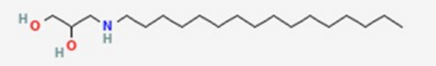


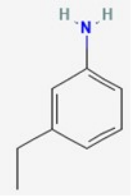
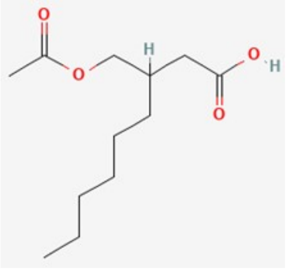
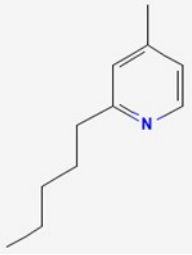
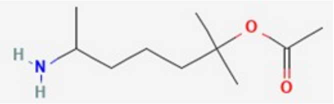
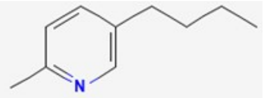
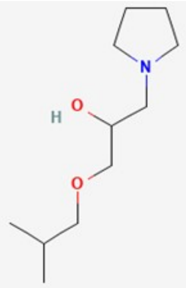
Figure S7 Mass spectrometry analysis of the dissolved fractions 10-11

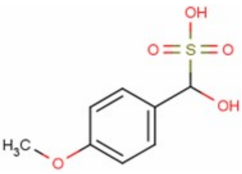
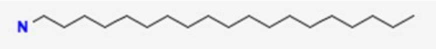
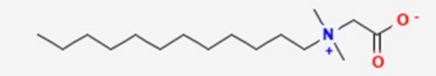
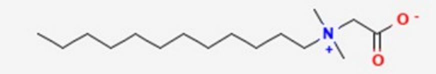
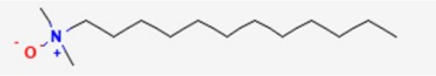
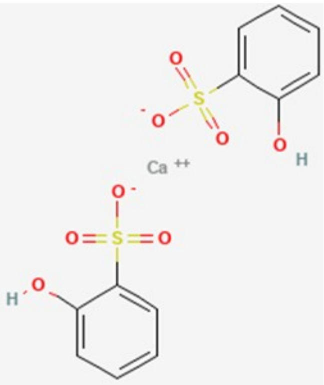
After the UV-B break down the aminated polystyrene the dissolved fractions 10-11 were separated and analysed.

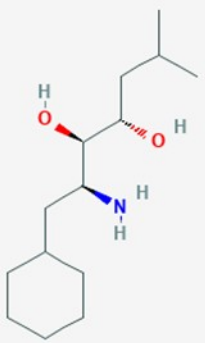
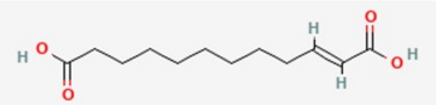
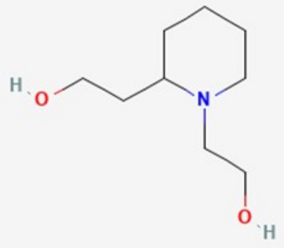
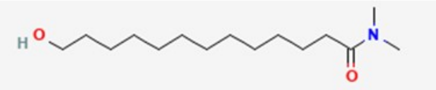
Table S1. Non-targeted analysis of the compounds in the dissolved fractions 10-11. After UV-B breakdown of the aminated polystyrene nanoparticles the dissolved molecules were separated from the remaining particle and analysed for the contents.

	Name	**Molecular Formula/Structure**	**Hazard**
1	(2-Neopentylallyl)succinic acid	$C_{12}H_{20}O_4$ 	
2	(2Z,4S,5S,6S,7R,8Z)-2,9-diphenyldeca-	$C_{22}H_{26}O_6$	

	2,8-diene-3,4,5,6,7,8-hexol		
3	(5-Ethyl-2,2-dimethyl-1,3-dioxan-5-yl)methyl acrylate	C12H20O4 	
4	1-Propanamine, 3-(hexadecyloxy)-	C19H41NO 	
5	12-(Methylamino)dodecanoic acid	C13H27NO2 	
6	12-Aminododecanoic acid	C12H25NO2 	Health
7	2-Hydroxypropyl hexanoate	C9H18O3 	
8	3-(Hexadecylamino)propane-1,2-diol	C19H41NO2 	
9	3-Ethylaniline	C8H11N	

			
10	3-[(Acetoxy)methyl]nonan-1-oic acid	$C_{12}H_{22}O_4$ 	
11	4-Methyl-2-pentylpyridine	$C_{11}H_{17}N$ 	Environmental
12	5-Amino-1,1-dimethylhexyl acetate	$C_{10}H_{21}NO_2$ 	
13	5-Butyl-2-methylpyridine	$C_{10}H_{15}N$ 	
14	A-[(2-methylpropoxy)methyl]pyrrolidine-1-ethanol	$C_{11}H_{23}NO_2$ 	

15	A-hydroxy-p-methoxytoluene-a-sulphonic acid	C8H10O5S 	
16	Amines, C16-22-alkyl	C19H41N 	Health Environmental
17	C13 Alkyl dimethyl betaine	C17H35NO2[1] 	
18	C15 Alkyl dimethyl betaine	C19H39NO2[1] 	
19	C17 Alkyl dimethyl amine oxide	C19H41NO[2] 	
20	Calcium bis(hydroxybenzenesulphonate)	C12H10CaO8S2 	

21	Cyclohexylmethyl-2,3-Dihydroxy-5-Methyl-Hexylamide	C14H29NO2 	
22	Dodec-2-enedioic acid	C12H20O4 	
23	Piperidine-1,2-diethanol	C9H19NO2 	
24	TRADECAMIDE	C15H31NO2 	

[1] Shows lauryldimethylbetaine with the chemical formula $C_{16}H_{33}NO_2$. In C13 and C15 the carbon chain is 1 and 3 carbons longer, respectively.

[2] Shows lauryldimethylamine oxide with chemical formula C14H31NO. In C19 the carbon chain is 5 carbons longer.

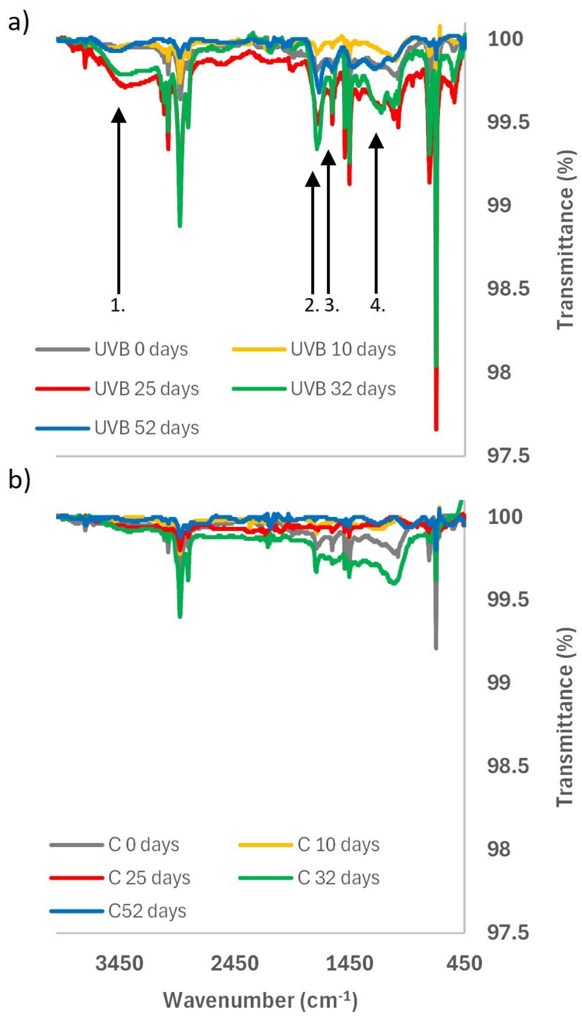


Figure S8. ATR-FTIR spectrum of the 62 nm carboxyl-modified polystyrene particles. Panel a) shows the UV-B exposed sample and panel b) the control sample. Samples are from experiment day 0, in grey, day 10, in orange, day 25, in red, day 32, in green, and day 52, in blue. The arrows in panel a) indicate areas in the spectra that change with time. Arrows 1, 2 and 4 indicate absorbance that are connected to C=O and C-O bonds and arrow 3 indicates the absorbance from conjugated C=C bonds. The samples were placed on the UATR-unit crystal, allowing the water to evaporate before recording the FTIR spectra. This process is not entirely reliable, as it is challenging to ensure that the same amount of material adheres to the UATR crystal each time. During drying, the particles sometimes tend to migrate to the edges of the crystal, forming a ring around it rather than a uniform layer on its surface. When this occurs, there may not be enough material left on the crystal to generate a strong UATR-FTIR spectrum. For some time points, it was impossible to retain any particles on the crystal, resulting in weak or absent FTIR spectra.