

Supplementary information:

Simultaneous Sampling for Microplastics and Environmental Contaminants from Artificial Turf - Development of a new integrated Microplastics Eluate Lysimeter

Maria Kittner^{1,*}, Bianca Coesfeld¹, Thomas Werischak¹, Sven Schlau¹, Korinna Altmann¹ and Ute Kalbe¹

¹Bundesanstalt für Materialforschung und -prüfung (BAM), Unter den Eichen 87, 12205 Berlin, Germany

* Corresponding author: maria.kittner@bam.de

SI-Tab. 1: MEL column packaging of the individual turf components of the analysed artificial turf scenarios expressed in mean values. As the rubber and sand infills cannot be separated after mechanical stress exposure, all infill-mixture masses of the aged artificial turf scenarios containing rubber infill are presented together. A hyphen indicates that the component was not used in the artificial turf scenario. * The artificial turf mass of oTurf¹ was higher due to EPDM/sand residues that were clumped together in the turf and could not be removed.

Artificial turf scenario	Ageing status	Artificial turf component mass in g				
		rubber infill	sand infill	artificial turf	elastic layer	unbound base layer
Past: oTurf	real-time aged: oTurf ¹	626		216*	528	10,505
	real-time aged: oTurf ²	634		71	562	10,510
Present: fTurf	fabric-new	158	471	79	557	10,511
	accelerated aged	630		74	551	10,511
Future: rTurf	fabric-new	-	471	81	542	10,523
	accelerated aged	-	471	77	545	10,508

SI-Tab. 2: Element compositions of all analysed artificial turf scenarios at liquid to solid ratio (l/s) of 2 L/kg. Shown are the mean concentrations of the past scenario represented by real-time aged old turf with synthetic infill (oTurf¹/oTurf²), the present by fossil-based turf with EPDM infill (fTurf), the future scenario with turf using recycled grass fibres (rTurf) and the mean blank measurements results. For comparison, fTurf and rTurf results are presented both in the unaged (new) and accelerated aged state (aged). < LOQ means that the signal was below the specific limit of quantification (LOQ).

Element name	Element symbol	LOQ in µg/L	Concentration in µg/L eluate at l/s 2 L/kg						
			Past: oTurf		Present: fTurf		Future: rTurf		Blank
			oTurf ¹	oTurf ²	new	aged	new	aged	
Antimony	Sb	8.77	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Arsenic	As	3.27	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Barium	Ba	0.52	8.79	4.74	4.85	12.46	1.51	3.97	< LOQ
Cadmium	Cd	0.87	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Chromium	Cr	0.93	4.58	4.91	6.40	3.83	2.76	6.18	< LOQ
Cobalt	Co	4.71	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Copper	Cu	10.81	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Iron	Fe	0.08	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Lead	Pb	2.96	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Manganese	Mn	1.10	2.37	5.06	3.39	2.55	1.38	3.28	< LOQ
Mercury	Hg	2.56	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Molybdenum	Mo	0.83	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Nickel	Ni	2.68	< LOQ	< LOQ	2.78	< LOQ	< LOQ	4.49	20.46
Selenium	Se	23.41	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Strontium	Sr	0.45	24.73	10.25	16.07	18.34	3.72	6.77	1.86
Sulphur	S	153.65	< LOQ	< LOQ	301.94	210.61	< LOQ	< LOQ	602.03
Thallium	Tl	11.44	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Tin	Sn	3.63	3.69	4.15	< LOQ	< LOQ	< LOQ	3.63	< LOQ
Titanium	Ti	9,182.27	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Vanadium	V	1.39	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Zinc	Zn	16.37	< LOQ	90.18	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ

SI-Tab. 3: Polycyclic aromatic hydrocarbons (PAH) results of all analysed artificial turf scenarios at the liquid to solid ratio (l/s) of 2 L/kg. Shown are the mean concentration of the past scenario represented by real-time aged old turf with synthetic infill (oTurf¹/oTurf²), the present by fossil-based turf with EPDM infill (fTurf), the future scenario with recycled grass fibres (rTurf) and the mean blank measurements results. For comparison, fTurf and rTurf PAH results are presented both in the unaged (new) and accelerated aged state (aged). < LOQ means that the signal was below the PAH-specific limit of quantification (LOQ).

Polycyclic aromatic hydrocarbon	LOQ in µg/L	Concentration in µg/L eluate at l/s 2 L/kg						Blank
		Past: oTurf		Present: fTurf		Future: rTurf		
		oTurf ¹	oTurf ²	new	aged	new	aged	
Naphthalene	0.001	0.097	0.021	0.677	0.095	1.054	0.098	0.051
Acenaphthylene	0.001	0.022	0.004	0.026	0.027	0.029	0.023	0.006
Acenaphthene	0.001	0.005	0.004	0.034	0.019	0.141	0.026	0.003
Fluorene	0.001	0.003	0.003	0.012	0.012	0.023	0.016	< LOQ
Phenantrene	0.001	0.016	0.015	0.017	0.068	0.045	0.113	0.003
Anthracene	0.001	0.001	0.001	0.001	0.004	0.003	0.006	< LOQ
Fluoranthene	0.001	0.004	0.007	0.005	0.012	0.006	0.015	0.001
Pyrene	0.001	0.006	0.012	0.006	0.009	0.009	0.010	0.001
Benz[a]anthracene	0.001	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	0.001
Chrysene	0.001	< LOQ	0.002	< LOQ	< LOQ	< LOQ	< LOQ	0.002
Benzo[b]fluoranthene	0.001	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	0.001
Benzo[k]fluoranthene	0.001	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	0.001
Benzo[a]pyrene	0.001	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	0.001
Indeno[1.2.3-cd]pyrene	0.002	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Dibenz[a,h]anthracene	0.002	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Benzo[ghi]perylene	0.002	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ	< LOQ
Σ ¹⁶ PAH	-	0.154	0.164	0.781	0.247	1.311	0.308	0.071

SI-Tab. 4: Overview of the polymer marker compounds used for MP detection by TED-GC/MS with their corresponding retention times (t_R) and characteristic fragment ions (m/z). The asterisks describe diastereomers of the respective substances whose peaks are chromatographically separated. Polymer markers of EPDM and PU newly added by this work are shown in italics. The markers used for quantification and LOQ determination, m/z and t_R are underlined.

Polymer	Compound	Compound name	t_R in min	Characteristic fragment ions
EPDM	EPDM-1	2-Methyl-1-nonene	9.6	56, 41, 69, 140
	EPDM-2	2-Methyl-1-decene	12.4	56, 41, 69, 154
	<i>EPDM-3</i>	<i>2-Methyl-1-undecene</i>	<i>15.3</i>	<i>56</i> , 41, 69, 169
	EPDM-4	2-Methyl-1-dodecene	18.1	56, 41, 69, 182
	EPDM-5	2-Methyl-1-tridecene	20.7	56, 41, 69, 196
	EPDM-6	2-Methyl-1-tetradecene	23.2	56, 41, 69, 210
	EPDM-7	2-Methyl-1-pentadecene	25.6	56, 43, 69, 224
PE	PE-1	1.10-Undecadiene	12.6	81, 55, 95, 109
	PE-2	1.11-Dodecadiene	15.4	81, 55, 95, 109
	PE-3	1.12-Tridecadiene	18.1	81, 55, 95, 109
	PE-4	1.13-Tetradecadiene	20.8	81, 55, 95, 109
	<i>PE-5</i>	<i>1.14-Pentadecadiene</i>	<i>23.4</i>	<i>81</i> , 55, 95, 109
	PE-6	1.15-Hexadecadiene	25.7	81, 55, 95, 109
PP	PP-1	2.4-Dimethylhept-1-ene	5.7	70, 111, 83, 126
	PP-2	2.4.6-Trimethylnon-1-ene	12.3	69, 168, 111, 125
	PP-2*	2.4.6-Trimethylnon-1-ene	12.4	69, 168, 111, 125
	<i>PP-3</i>	<i>2.4.6.8-Tetramethylundec-10-ene</i>	<i>18.8</i>	<i>111</i> , 69, 154, 210
	PP-3*	2.4.6.8-Tetramethylundec-10-ene	19.0	111, 69, 154, 210
	PP-3**	2.4.6.8-Tetramethylundec-10-ene	19.2	111, 69, 154, 210
PU	<i>PU-1</i>	<i>1.1'-Oxydi-2-propanol</i>	<i>11.0</i>	<i>89</i> , 45, 49, 42
	PU-2	Diethoxymethane	11.5	59, 103, 45, 41
	PU-2*	Diethoxymethane	11.7	59, 103, 45, 41
SBR	<i>SBR-2</i>	<i>2-Phenylcyclohexene</i>	<i>19.4</i>	104, <i>158</i> , 129, 115
	SBR-3	Cyclopentylbenzene	16.5	117, 104, 146, 91
PET	PET-1	Vinylbenzoate	14.0	105, 77, 51
	<i>PET-2</i>	<i>Ethylbenzoate</i>	<i>15.0</i>	<i>105</i> , 77, 122, 150
	PET-3	Benzoic acid	15.2	105, 122, 77, 51
	PET-5	Divinyl terephthalate	25.3	175, 104, 132, 147
	PET-6	Terephthalic acid monoethyl vinyl ester	27.0	149, 121, 65, 175

38 **SI-Tab. 5:** Summary of MP emissions of all analysed artificial turf scenarios of different ageing states expressed in µg/L. Since
 39 duplicate determinations were carried out, the polymer mass contents are shown with their value ranges. A hyphen indicates that
 40 no microplastic content above the limit of quantification was detected.

Polymer type	Artificial turf component	Microplastics masses of artificial turf scenarios in µg/L					
		Past: oTurf real-time aged oTurf ¹	real-time aged oTurf ²	Present: fTurf fabric- new	accelerated aged	Future: rTurf fabric-new	accelerated aged
EPDM	rubber infill	10.00	-	0 - 0.02	0.30 - 0.44	-	-
TPE	rubber infill	-	20.43	-	-	-	-
PE	grass fibres	2.68	4.12	-	0.23 - 0.33	0 - 0.03	0.26 - 1.07
PP	backing	0.28	0.20	-	-	-	0.16 - 0.22
PET	winding yarn	-	-	-	-	0 - 0.01	0 - 0.01
SBR	elastic layer/ backing glue	-	2.07	-	0 - 0.05	-	0 - 0.02
PS	backing glue	6.36	-	-	-	-	-
PU	backing glue	-	-	0.01 - 0.08	-	0.06 - 0.08	-
ΣMP in µg/L		19.32	26.82	0.01 - 0.10	0.53 - 0.82	0.09	0.56 - 1.32

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