Supplementary Information

Microplastic Types in the Wastewater System

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A comparison of material flow-based source estimates and the measurement-based load to a wastewater treatment plant

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Table S1: Overview of microplastic sources to wastewater and stormwater

*Table S1: Overview of potential sources of microplastics to urban wastewater and stormwater that was considered in this study. *considered negligible or too uncertain to estimate. #not detected with the analytical method deployed.*

Source	Sub-source	Process	References
Households			
	Synthetic textiles	Laundry	Belzagui et al. (2019); Browne et al. (2011); Carney-Almroth et al. (2018); Cesa et al. (2020); Dalla Fontana et al. (2020); De Falco et al. (2018a); De Falco et al. (2018b); Galvão et al., 2020; Hernandez et al. (2017); Jönsson et al. (2018); Kelly et al. (2019); Napper & Thompson (2016) Yang et al. (2019).
	Personal care products	Personal hygiene	Chang (2015); Conkle et al. (2018); Napper et al. (2015)
	Cleaning products	Wet cleaning	Swedish Chemicals Agency (2018)
	Paint	Washing equipment	Swedish Chemicals Agency (2018)
	Glue	Washing equipment	Swedish Chemicals Agency (2018)
	Dust	Wet cleaning	Dris et al. (2017)
Enterprises			
• Laundries	Synthetic textiles	Laundry	Jeppsson (2017)
• Plastic industry*		Production spill	Karlsson et al. (2018)
• Cosmetic industry*		Production spill	Jeppsson (2017)
• Public baths*	Swimwear	Release of textile fibres from swimwear	Jeppsson (2017)
• Car washes*	Brushes	Release of fibres from brushes	Jeppsson (2017)
• Workshops	Soap	Personal hygiene	Observation
• Pharmaceutical industry*	Polymer in coatings	Production spill	Magnusson et al. (2016)
• Landfills*		Leachate	He et al. (2019); Sun et al. (2021); van Praagh et al. (2018)
Stormwater			
	Road traffic#	Wear and tear of tyres and roads	Kole et al. (2017)

	Artificial turfs[#]	Removal by use, maintenance, or rain event	Kole et al. (2017)
	Litter - Cigarette filters	Removal with rain event	Keep Sweden Tidy Foundation, (2017); Register (2000)
	Paint	Wear and removal of painted surfaces	Verschoor et al. (2016).
	Road markings	Wear on road surfaces	Magnusson et al. (2016); Sundt et al. (2014)
	Atmospheric deposition[*]	Wet and dry deposition	Dris et al. (2016); Magnusson et al (2020); Wright et al. (2020)

Table S2 Estimated releases from the identified sources and polymer distributions.

Table S2: Sources, theoretical contribution, and distribution among polymers that may enter Sjölunda WWTP. For laundry, the polymer distribution displays the synthetic share of the net production and import of textiles in Sweden, which is approximately 30% of the total textile volumes. [¤] is a mixture of polymers and as the distribution within this product is not known it was excluded. [*]is not a polymer and is therefore not included. [#]the polymer is not detected with the analytical method deployed.

Source	**Sub-source**	**Estimated release (kg/year)**	**Polymer distribution**	**Reference**
Households	Laundry	743–12 166	Polyester (9%) PP (5%) Acrylic (4%) PA, PU, PVC (3%) PE (2%)	Swedish Chemicals Agency (2007)
	Personal care products	Rinse-off: 473–525	PU (62%) PE (38%) PLA (0.25%) PA (0.16%) Cellulose acetate (0.11%)	Amec Foster Wheeler (2017)
		Leave-on: 358–742	Distribution not known	
	Cleaning products	97–103	PU (91%) PE (unknown) Rheology modifiers (0.04%) Mix of polyester, PA, Acrylic, Polymethyl methacrylate (PMMA), PET (8.48%)[¤]	Amec Foster Wheeler (2017)

	Dust	0.2–462	See laundry households	
	Paint	7774	Distribution not known	
	Glue	685	Distribution not known	
Enterprises	Laundries	30–372	See laundry households	
	Workshops/manufacturing	2.8–6.3	PU	EnvoMap
		0.1–0.8	PE	EnvoMap
		11–42	Epoxy	EnvoMap; OECD, 2009
	Landfill leachate	0.0024–0.0708		van Praagh et al. (2018)
		0.318–0.366		Sun et al. (2021)
Stormwater	Cigarette filters	499	Cellulose acetate	Register (2000)
	Wear and removal of painted surfaces	194–462	Distribution not known	Verschoor et al. (2016)
		551–1076	Distribution not known	Magnusson et al. (2016)
	Paint in road markings	223–519	AM (35%)* SIS (27%)# EVA (21%) PA (18%)	Magnusson et al. (2016)

Table S3: Summary of source estimates divided by source type.

Table S3: Summary of the source estimates divided by source type when only considering the sources where the distribution among polymers is known and only the polymers that can be detected with the applied analytical method.

Source	Min (kg/year)	Max (kg/year)	Min (%)	Max (%)
Households				
Laundry	743	12 166		
PCPs	473	525		
Dust	0.19	462		
Cleaning	89	94		
Total	1306	13 247	68%	92%
Enterprises				
Products	14	51		
Laundry	30	372		
Total	44	423	2%	3%
Stormwater				
Cigarette filters	499	499		
Road marking	84	200		
Total	583	699	30%	5%
SUM	1933	14 369		

Table S4: Summary of source estimates divided by microplastic types.

Table S4: Summary of the source estimates divided by microplastic types when only considering the sources where the distribution among polymers is known and only the polymers that can be detected with the applied analytical method.

Microplastic type	Source	Min (kg/year)	Max (kg/year)	Min (%)	Max (%)	Min (%) excl. cellulose acetate	Max (%) excl. cellulose acetate
Acrylic	Laundry-Household	102.55	1678.10				
Acrylic	Laundry-Enterprise	4.18	51.29				
Acrylic	Dust	0.03	51.72				
Acrylic	Total:	106.76	1781.11	6%	12%	7%	13%
Cellulose acetate	PCPs - Household	0.53	0.59				
Cellulose acetate	Cigarette filters	498.62	498.62				
Cellulose acetate	Total:	499.15	499.21	26%	3%		
Epoxy	Manufacturing	11.19	41.96	1%	0.3%	1%	0.3%
EVA	Road markings	45.01	107.16	2%	1%	3%	1%
PA	PCPs - Household	0.75	0.83				
PA	Laundry-Household	76.91	1258.57				
PA	Laundry-Enterprise	3.14	38.47				
PA	Road markings	38.95	92.73				
PA	Dust	0.02	36.00				
PA	Total:	119.77	1426.60	6%	10%	8%	10%
PE	PCPs - Household	179.05	198.86				
PE	PCPs-Enterprise	0.14	0.79				
PE	Laundry-Household	51.27	839.05				
PE	Laundry-Enterprise	2.09	25.64				
PE	Dust	0.01	20.28				
PE	Total:	232.56	1084.62	12%	8%	16%	8%
PLA	PCPs	1.20	1.34	0.1%	0.01%	0.1%	0.01%

Polyester	Laundry-Household	230.73	3775.72				
Polyester	Laundry-Enterprise	9.40	115.41				
Polyester	Dust	0.06	214.13				
Polyester	Total:	240.19	4105.26	12%	29%	17%	30%
PP	Laundry-Household	128.18	2097.62				
PP	Laundry-Enterprise	5.22	64.12				
PP	Dust	0.03	47.58				
PP	Total:	133.43	2209.32	7%	15%	9%	16%
PU	PCPs - Household	291.65	323.91				
PU	PCPs-Enterprise	2.78	7.78				
PU	Laundry-Household	76.91	1258.57				
PU	Laundry-Enterprise	3.13	38.47				
PU	Cleaning	89.20	93.89				
PU	Dust	0.02	43.45				
PU	Total:	463.69	1766,07	24%	12%	32%	13%
PVC	Laundry-Household	76.91	1258.57				
PVC	Laundry-Enterprise	3.14	38.47				
PVC	Dust	0.02	49.03				
PVC	Total:	80.07	1346.07	4%	9%	6%	10%
	SUM:	1933.02	14368.72				
	SUM excluding cellulose acetate	1433.87	13869.51				

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