Environmental impact of different scenarios for the pyrolysis of contaminated mixed plastic waste

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Supplementary Material

Table S1. Composition of the gas, % m/m

	Scenarios 1, 2 and 3
Hydrogen	7.3%
Oxygen	0%
Nitrogen	0%
Methane	49.6%
Carbon monoxide	2.3%
Ethane	11.4%
Ethylene	8.1%

Carbon dioxide	6.0%
Acetylene	13.1%
Propane	0%
Methylacetylene	2.3%

Table S2. Composition of the oil

		Scenarios 1, 2 and 3
Elemental analysis, %	C	84.1
	H	13.4
	N	0,0
	O	2.5
Light Naphtha		2.2
Medium naphtha		3.8
Heavy naphtha		33.9
Kerosene		16.6
Distillate Fuel Oil		13.9
Light Vacuum Gas Oil		19.4
Heavy Vacuum Oil		10.2

Table S3. Characteristics of the char

	Scenario 1	**Scenario 2**	**Scenario 3**

% N	0.86	1.23	0.61
% C	35.62	51.17	48.96
% H	2.23	0.78	0.50
% O	15.08	4.75	13.71
% Moisture	3.16	1.80	7.20
% Volatile	27.89	8.22	9.28
% Ash	46.21	42.07	36.22
% Fixed Carbon	20.81	47.91	47.30
S_{BET} ($m^2\ g^{-1}$)	14.7	100.0	939.40
S_{MP} ($m^2\ g^{-1}$)	0.8	22.6	821.80
V_T ($cm^3\ g^{-1}$)	0.025	0.209	0.65
V_{MP} ($cm^3\ g^{-1}$)	0.0	0.011	0.40
HHV, MJ kg^{-1}	15.11	18.43	17.29

Table S4. Elemental analysis and Brunauer-Emmett-Teller (BET) area of the commercial activated carbons

	CARBOSORB NC 1240[1]	Granular CAC[2]
% C	92.6	83.17
% H	0.35	1.32
% N	0.05	n.d.
% S	1.88	0.07
% Others	7	15.51
S_{BET}, $m^2\ g^{-1}$	1127	1241

Table S5. Life-cycle inventory for 20 g of mixed plastic waste

Flow name	Scenario 1	Scenario 2	Scenario 3	Unit
Plastic waste	20	20	20	g
Gas	7.34	7.34	7.34	g
Oil	11.34	11.34	11.34	g
Char 1	1.32	0	0	g
Char 2	0	1.32	1.32	g
Air 1	127.5	127.5	127.5	g
Combustion gases 1	37.09	37.09	37.09	g
Carbon dioxide 1	18.81	18.81	18.81	g
Water vapour 1	18.28	18.28	18.28	g
Diesel	11.16	11.16	11.16	g
Air 2	6.89	0	0	g
Combustion gases 2	2.43	0	0	g
Carbon dioxide 2	2.37	0	0	g
Water vapour 2	0.06	0	0	g
Water	0	0	26.4	g
Activating carbon dioxide	0	7.4	0	L
Spent carbon dioxide	0	7.4	0	L
Potassium hydroxide	0	0	0.46	g
Wastewater	0	0	26.9	g
Activated carbon	0	0.46	0.46	g
Electricity 1	0.006	0.006	0.006	kWh
Electricity 2	0	0.007	0.007	kWh

Heat 1	0.13	0.13	0.13	MJ
Heat 2	0.20	0.20	0.20	MJ
Heat 3	0.21	0.21	0.21	MJ
Heat 4	0.00	0.005	0.005	MJ

Table S6. Products and processes selected from ecoinvent. Note: unit products (U) were used instead of system products (S) to undertake the uncertainty analysis

Product or process	**Compartment**	**Data entry in ecoinvent**
Diesel	Known outputs to technosphere. Avoided products	Diesel {Europe without Switzerland}| market for | Cut-off, S
Activated carbon	Known outputs to technosphere. Avoided products	Activated carbon, granular {GLO}| market for activated carbon, granular | Cut-off, S
Air	Known inputs from nature (resources)	Air
Water	Known inputs from nature (resources)	Water, unspecified natural origin, ES
Potassium hydroxide	Known inputs from technosphere (materials/fuels)	Potassium hydroxide {GLO}| market for | Cut-off, S
Activating carbon dioxide	Known inputs from technosphere	Carbon dioxide, liquid {RER}| market for | Cut-off, S

	(materials/fuels)	
Electricity	Known inputs from technosphere (electricity/heat)	Electricity, low voltage {ES}| market for | Cut-off, S
Heat	Known inputs from technosphere (electricity/heat)	Heat, central or small-scale, natural gas {Europe without Switzerland}| market for heat, central or small-scale, natural gas | Cut-off, S
Carbon dioxide, Spent carbon dioxide	Emissions to air	Carbon dioxide
Water vapour	Emissions to air	Water
Wastewater	Emissions to water	Water, ES
Landfill	Outputs to technosphere: Waste treatment	Waste polypropylene {RoW}| treatment of waste polypropylene, sanitary landfill | Cut-off, S
Electricity (for sensitivity analysis)	Known inputs from technosphere (electricity/heat)	Electricity, low voltage {ES}| electricity production, photovoltaic, 570kWp open ground installation, multi-Si | Cut-off, S

References

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