Supporting Information

Materials and Energy Recovery from E-Waste Plastics

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Table S1. Impurities found in NMP solvent

Retention Time, min	**Best NIST Library Match**	**CAS#**	**Formula**	**Molecular Mass**	**CI M+1 Ion?**
10.21	Phenol, 4-(1-methyl-1-phenylethyl)-	599-64-4	$C_{15}H_{16}O$	212	Yes
11.17	Styrene, 2-nitro-3'-[4-methylphenyloxy]-	None	$C_{15}H_{13}NO_3$	255	No
11.51	2-(4'-Hydroxyphenyl)-2-(4'-methoxyphenyl)propane	16530-58-8	$C_{16}H_{18}O_2$	242	Yes
11.84	Phenol, 4,4'-(1-methylethylidene)bis-	80-05-7	$C_{15}H_{16}O_2$	228	Yes
12.36	2,2,6,6-Tetramethyl-1,5-dioxa-2,6-disila-3,4:7,8-dibenzocyclooctane	39533-13-6	$C_{16}H_{20}O_2Si_2$	300	No
12.68	Ether, α,α-dimethylbenzyl bis(trifluoromethyl)methyl	None	$C_{12}H_{12}F_6O$	286	No
13.50	15-Hydroxy-7-oxodehydroabietic acid, methyl ester	60188-95-6	$C_21H_{28}O_4$	344	No

Estimation of Energy based on Heat of Combustion

Heat of combustion method is a quick method to estimate the net energy required for pyrolysis process. The difference between the heat of combustion of the plastic and the heat of combustion of products formed from the plastic pyrolysis represents the net energy required for pyrolysis. The **heat of combustion** (**ΔH_c**) is the energy released as heat when a substance undergoes complete combustion in presence of oxygen.

Table S2. Heat of combustion of common polymers

S. No	Polymer Material	Gross Heat of Combustion MJ/Kg	Net Heat of Combustion MJ/Kg
1	Polyethylene (PE)	47.74	44.6
2	Polypropylene (PP)	45.8	42.66
3	Polystyrene (PS)	43.65	41.96
4	Polyacrylonitrilebutadiene-styrene (Poly-ABS)	29.38	28.38
5	Polycarbonate (PC)	31.53	30.32
6	Polyethylene Terephthalate (PET)	24.13	23.22
7	Polymethyl Methacrylate (PMMA)	27.75	24.99
8	Polytetrafluoroethylene (PTFE)	6.68	6.68
9	Polyamideimide (PAI)	24.97	24.31
10	Polyetheretherketone (PEEK)	31.5	30.57

Net heat of combustion is gross heat of combustion minus the latent heat of vaporization of the water produced during the reaction. The gross heat of combustion measured is corrected for the heat of vaporization of the water formed during the combustion to give the net heat of combustion.

Table S3. Heat of combustion of common fuels

S. No	Fuels	Gross Heat of Combustion MJ/Kg	Net Heat of Combustion MJ/Kg
1	Hydrogen	141.8	121
2	Methane	55.5	50
3	Ethane	51.9	47.8
4	Propane	50.35	46.35
5	Butane	49.5	45.75
6	Pentane		45.35
7	Gasoline	47.3	44.4
8	Paraffin	46	41.5
9	Kerosene	46.2	43
10	Diesel	44.8	43

11	Residual Oil	-	42.3

For the product distribution summarized in Table 5 in the manuscript, the net heat of combustion is approximately equal to 30.646 and 29.22 MJ/Kg PC and PC mixtures, respectively, calculated using the equation:

$$Q_p = \sum W_i Q_i$$

where Q_p is the net heat of combustion from the products, w_i is the percentage of product i, which can be propane, gasoline, diesel or wax and Q_i is the heat of combustion of product i. In the current study, gaseous fraction was not collected and analyzed and the heat value was not included. Thus the net energy gain could be much higher. The difference in the energy is then 390 KJ/kg and 1950 KJ/Kg for PP and PE respectively (Table 4) calculated using the formula:

$$Q_{net} = Q_p - Q_r$$

Where Q_{net} is the net energy required for pyrolysis, Q_r is the heat of combustion of reactants

Table S4. Calculations of net energy for heat of combustion

	PC	PC mixture
Fractions	MJ/kg	
<35C- Light hydrocarbons	0	1.39
35-185-Motor Gasoline	17.316	10.2
185-350 Diesel	9.89	12.04
>350C- Vacuum Gas Oil	3.44	5.59
Sum (Qnet)	30.646	29.22
Qp-Qnet	0.884	2.31

Table S5. TGA results on various plastic samples present in cellphone plastic waste

Sample	Temp 1% mass loss (°C)	Temp 50% mass loss (°C)	Peak Temp dTGA (°C)	Char weight% 600°C
Cell Phone Plastic #1 (Run 1)	155	N/A	390	55.80%
Cell Phone Plastic #1 (Run 2)	244	N/A	390	56.70%
Cell Phone Plastic #2 (Run 1)	406	507	506	25.60%
Cell Phone Plastic #2 (Run 2)	370	509	507	25.60%
Cell Phone Plastic #4 (Run 1)	316	502	502	24.20%
Cell Phone Plastic #4 (Run 2)	317	505	505	24.00%
Cell Phone Plastic #5 (Run 1)	301	481	473	34.40%
Cell Phone Plastic #5 (Run 2)	341	486	477	35.80%
Cell Phone Plastic #6 (Run 1)	340	499	499	23.30%
Cell Phone Plastic #6 (Run 2)	368	500	499	23.70%
Cell Phone Plastic #7 (Run 1)	283	487	490	20.20%
Cell Phone Plastic #7 (Run 2)	299	491	493	20.90%
Cell Phone Plastic #8 (Run 1)	289	487	490	20.40%
Cell Phone Plastic #8(Run 2)	353	492	496	21.60%
Cell Phone Plastic #9 (Run 1)	308	507	505	23.60%
Cell Phone Plastic #11 (Run 1)	399	487	479	36.90%
Cell Phone Plastic #11 (Run 2)	393	488	480	36.70%
Cell Phone Plastic #12 (Run 1)	333	482	472	36.20%
Cell Phone Plastic #12 (Run 2)	324	480	471	34.90%
Cell Phone Plastic #13 (Run 1)	307	500	499	23.20%
Cell Phone Plastic #13 (Run 2)	357	502	502	24.30%
Cell Phone Plastic #14 (Run 1)	319	475	446	42.80%
Cell Phone Plastic #14 (Run 2)	348	472	442	41.80%
Cell Phone Plastic #15 (Run 1)	328	497	494	28.60%
Cell Phone Plastic #15 (Run 2)	399	495	492	29.00%
Cell Phone Plastic #16 (Run 1)	276	459	457	18.10%
Cell Phone Plastic #16 (Run 2)	264	470	478	18.90%
Cell Phone Plastic #17 (Run 1)	351	489	490	21.30%
Cell Phone Plastic #17 (Run 2)	320	497	498	22.00%
Cell Phone Plastic #18 (Run 1)	288	488	489	21.30%
Cell Phone Plastic #18 (Run 2)	232	475	481	19.40%
Cell Phone Plastic # 19 (Run 1)	228	360	362	0.40%
Cell Phone Plastic #19 (Run 2)	275	361	362	0.70%
Cell Phone Plastic #20 (Run 1)	350	477	476	20.20%
Cell Phone Plastic #20 (Run 2)	318	483	487	20.80%

Cell Phone Plastic #21 (Run 1)	332	494	490	29.50%
Cell Phone Plastic #21 (Run 2)	303	495	494	29.50%
Cell Phone Plastic #22 (Run 1)	324	495	495	24.70%
Cell Phone Plastic #22 (Run 2)	281	501	500	25.40%
Cell Phone Plastic #23 (Run 1)	343	498	499	23.70%
Cell Phone Plastic #23 (Run 2)	411	502	502	24.10%
Cell Phone Plastic #24 (Run 1)	343	486	488	21.40%
Cell Phone Plastic #24 (Run 2)	292	499	499	22.10%
Cell Phone Plastic #24 (Run 1)	315	488	490	21.10%
Cell Phone Plastic #24 (Run 2)	340	490	492	21.60%

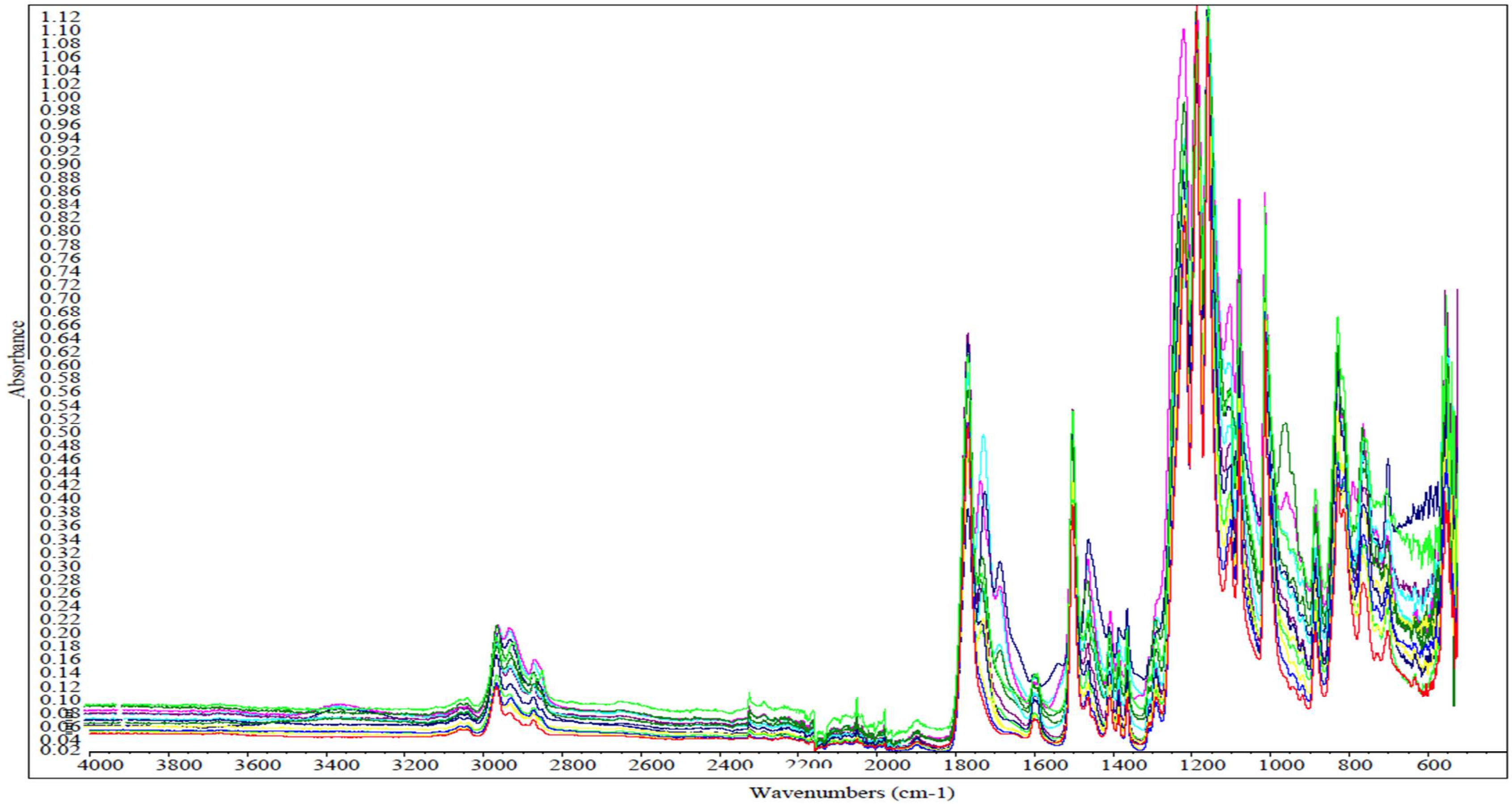

Figure S1. FTIR Spectra of 23 cellphone plastic materials received from HOBI

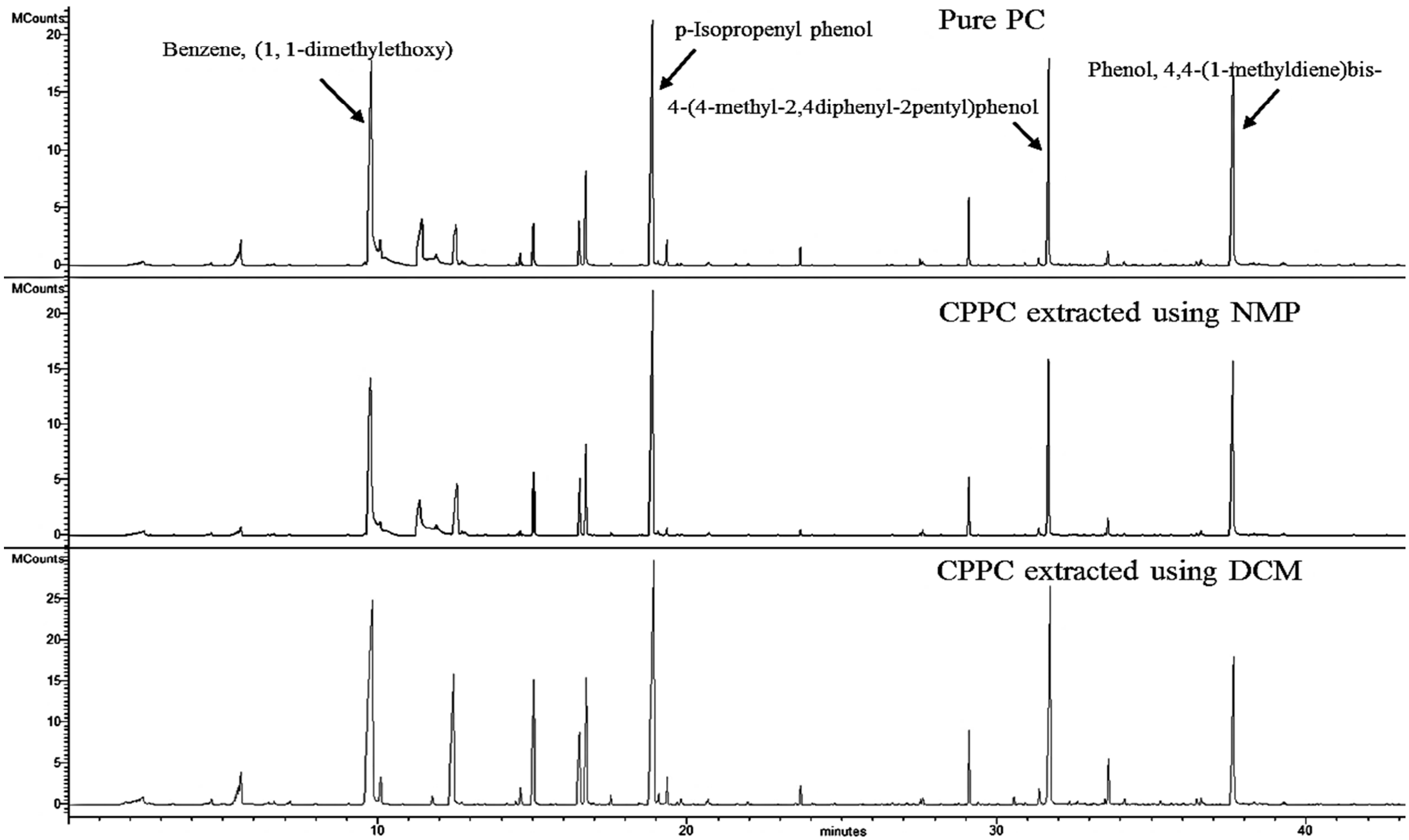

Figure S2. Comparison of pyrograms obtained from pygc-ms of PPC, CPPC recovered with NMP, and CPPC recovered with DCM

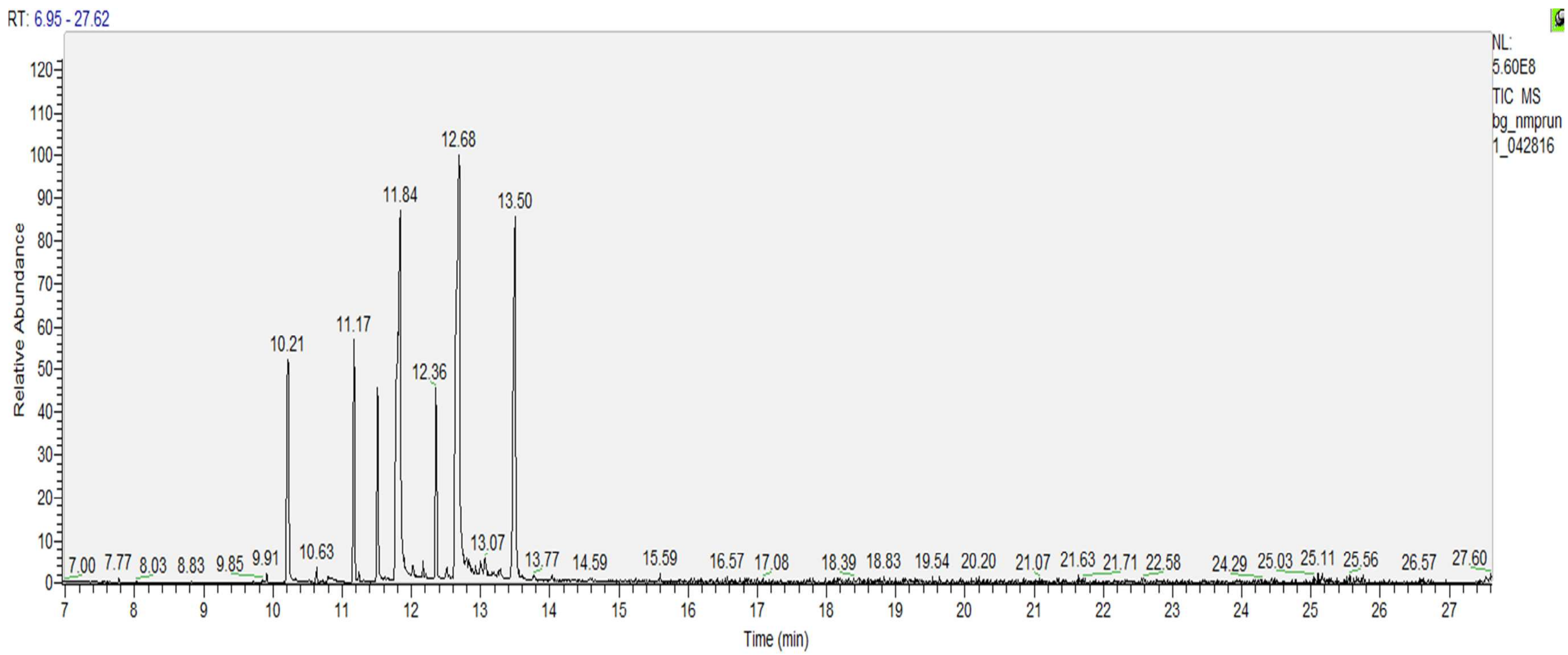

Figure S3. Chromatograms of the impurities

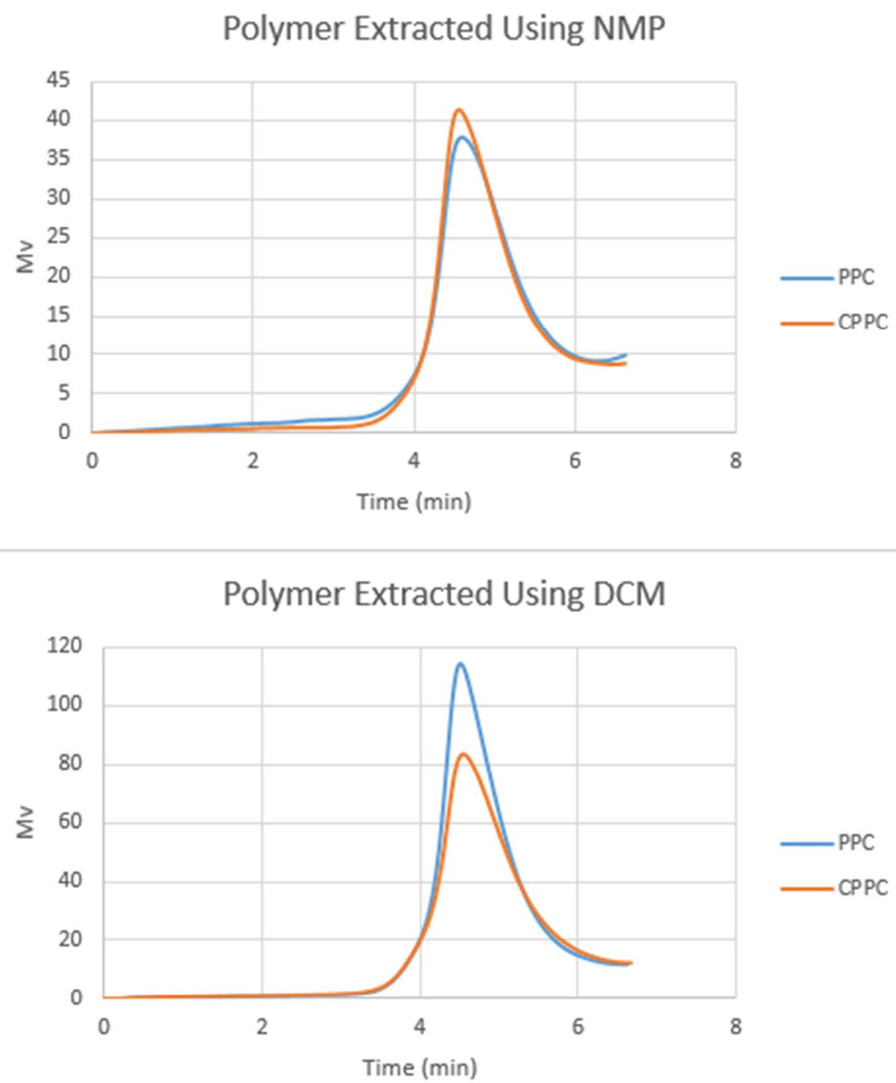

Figure S4. GPC Chromatograms of Polycarbonates extracted from NMP and DCM

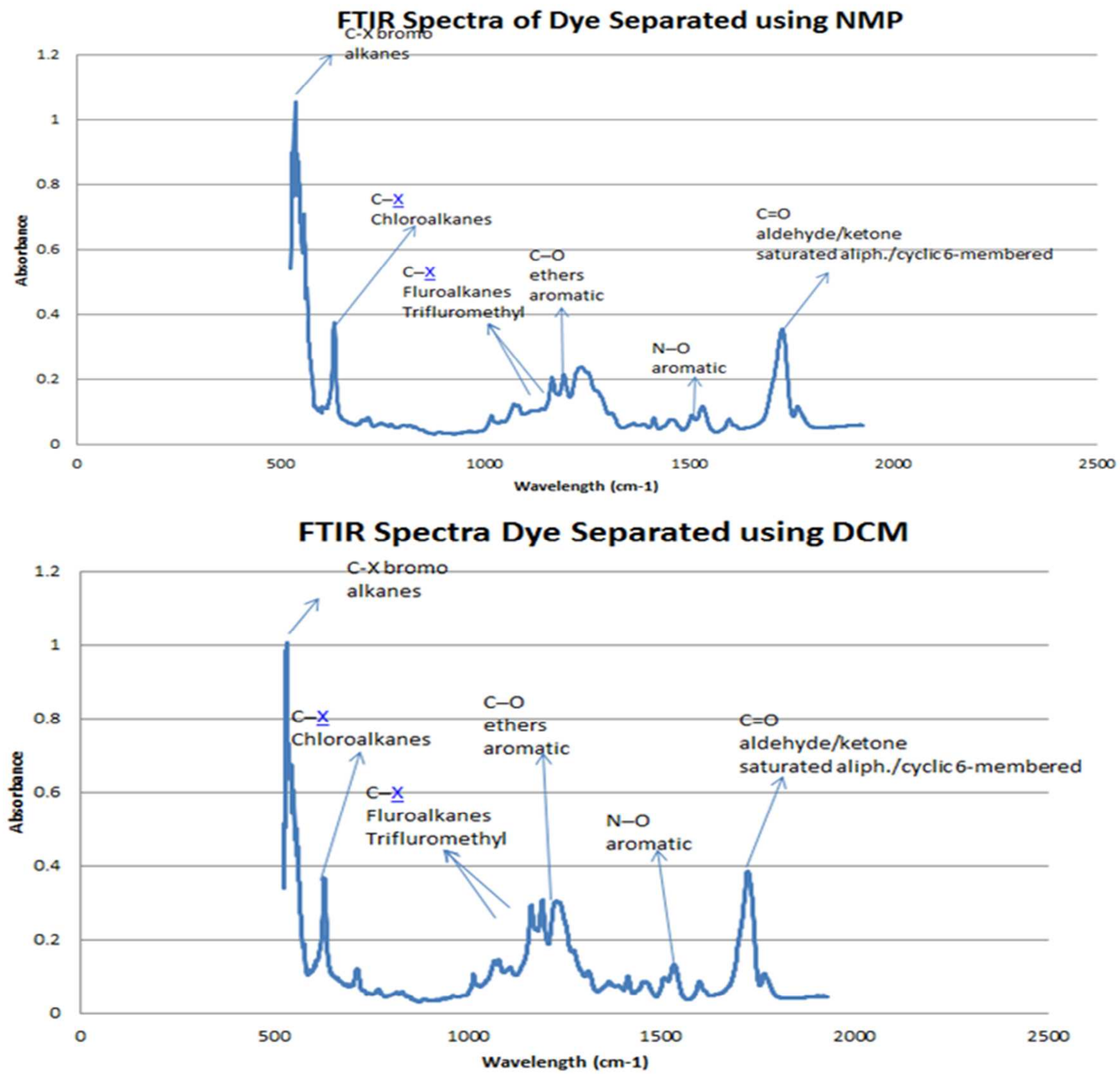

Figure S5. FTIR spectra of the dye

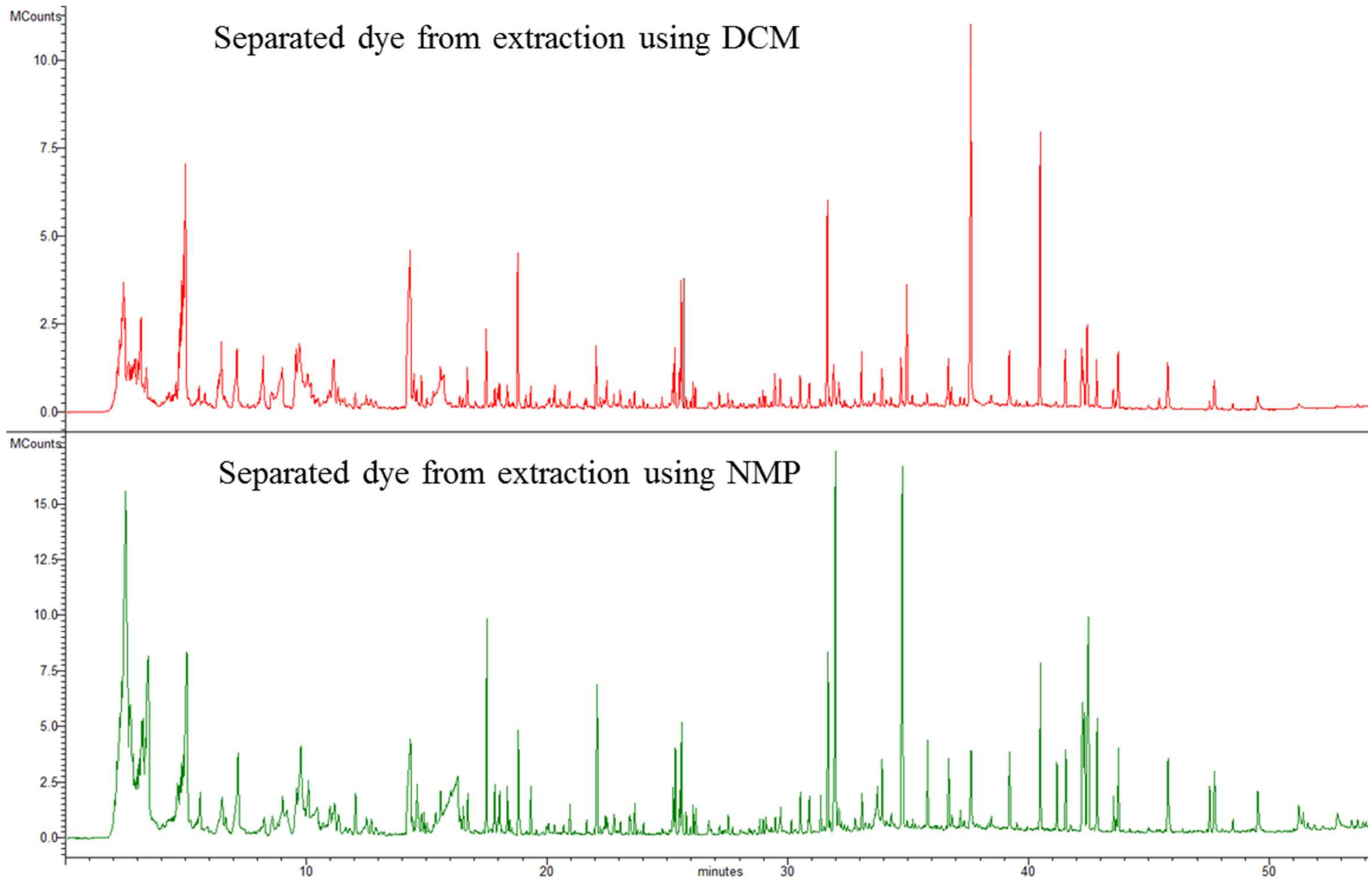

Figure S6. Pygcms spectra of the dye

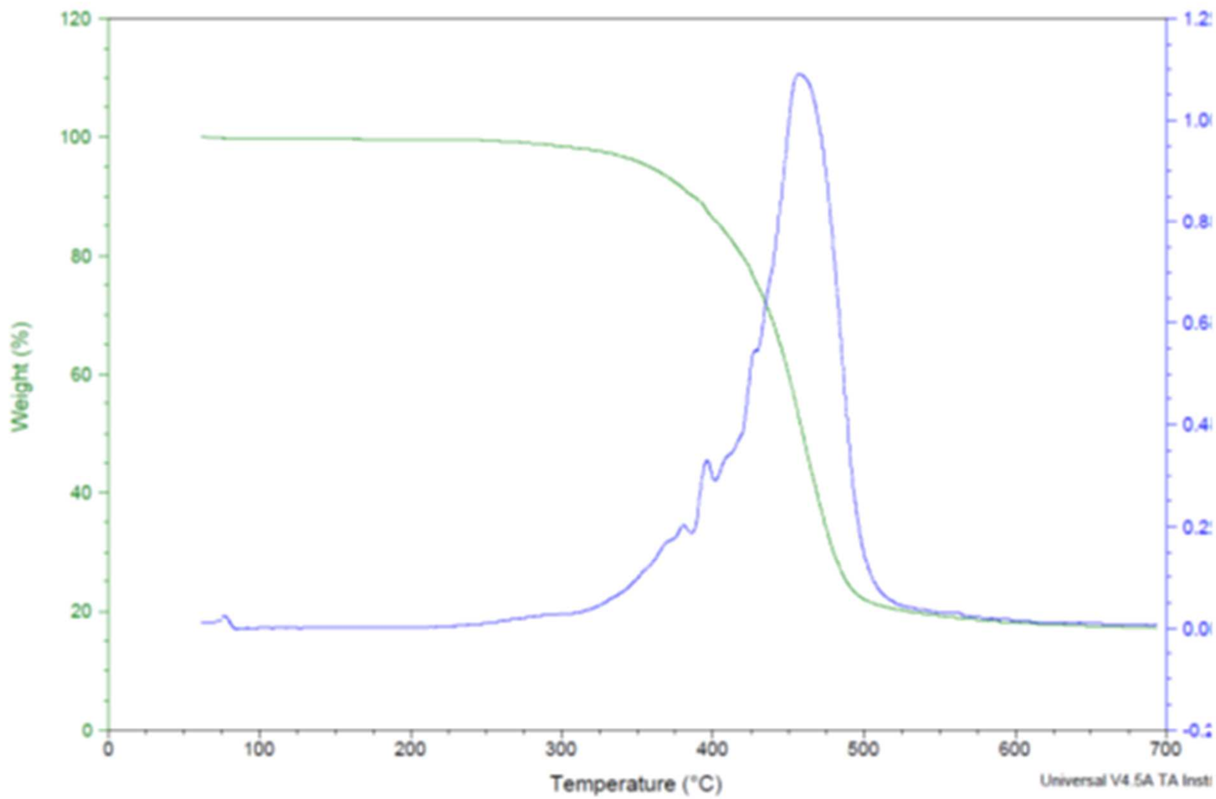

Figure S7. Typical thermogram of cellphone plastic (model for sample # 19)