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Research Paper

E-Waste Cable Plastic Transforming Oil using Sodium Hydroxide with Activated Carbon

Science

KEYWORDS : E-waste, oil, cable, electronic and electrical equipment waste, thermal, transform, GC/MS

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ABSTRACT

Electrical product usages are increase every day all over the world. Electrical component has plastic part and after use all electrical product through as garbage and creating environmental problem. Some percentage of e-waste plastic can recycle and rest of percentage keep as a land fill. E-waste to oil production process performs with sodium hydroxide and activated carbon in laboratory scale batch process. Temperature range was 200-420 ºC and sodium hydroxide was added 5% and activated carbon was added 5% with e-waste plastic. Electronic waste plastic was use 75 gm by weight. Under labconco fume hood experiment was placed in presence of oxygen without vacuumed system. Produce oil density is 0.90 g/ml and fuel was analyzed with Gas Chromatography and Mass Spectrometer (GC/MS) and carbon chain detected C4 to C33. Electronic waste plastic to oil production conversion rate was 33.6 %, gas production rate was 16.53 % and left over residue 49.87%. Electrical waste plastic to produce fuel can be use petroleum refinery process for further modification to use able internal combustion engines.

Introduction

The recycling of WEEE foreseen in the new EU Directive on the waste of electrical and electronic equipment (WEEE Directive) is based on the experience of a few European Countries, where organizations managing voluntary take back systems on behalf of the EEE producers have been responsible for the collection and recycling of the WEEE. In order to comply with this directive, the existing national associations managing the WEEE take-back systems have set up a WEEE Executing Forum. This Forum, founded in April 2002, today includes associations from 6 countries: Austria, Belgium, The Netherlands, Norway, Sweden and Switzerland. The Dutch association has taken the lead in the European forum. This directive, which is currently been transposed into national legislation, contain a number of prescriptive requirements such as collection per capita, treatment standards and recovery targets. During the last couple of years these countries have already established individual targets rating from 4 to 8 kg WEEE per inhabitant per year. The targets set by the Directive can easily be met by recycling metal, glass and other materials, and therefore the plastic parts of the WEEE will not be an immediate issue in the coming years. However plastic treatment will be encouraged as a consequence of the implementation of both the landfill directive (ban on dumping high calorific valued waste-plastics) and the incineration directive, which encourages handling (incineration) high calorific waste for energy recovery [1].

The European Union disposed of around 0.73 million tons of plastic derived from waste electrical and electronic equipment (WEEE) in 2002; this figure is expected to increase by 20% in 2007[2]. Included in the category of waste electrical and electronic equipment are refrigerators, washing machines, personal computers, printers, mobile phones, radios, television sets, electrical drills, sewing machines, etc. Around 30% of WEEE plastics contain fire retardants,[3] which are mostly based on polybrominated aromatic compounds[4] Approximately 50% of waste WEEE plastics are high-impact polystyrenes, with the next largest fraction being acrylonitrile-butadiene-styrene (ABS) copolymer;[5] PVC is also present in WEEE plastics [6]. In view of the recycling requirements of the WEEE directive, which will be implemented by summer 2004, a technology for the bromine contained in electronic devices is required. To this end a European project with 10 European partners from industries, universities and research centers has developed a process called "Haloclean" pyrolysis procedure. The purpose of the Haloclean pyrolysis process [7] is to separate brominated additives from inert and valuable materials in electronic scrap. The low-grade use for mixed-plastic recycled materials has led to research in alternative processes for plastics recycling. For example, there has been research interest in the pyrolysis of waste plastic, in which the plastic is heated in an inert atmosphere to produce mainly a gas and an oil/wax product; for some plastics, a char product is also formed. The oil/wax can be used as a fuel or chemical feedstock, and the gas has sufficient calorific value to be used as a process fuel. The thermal recycling of waste plastics by pyrolysis represents an environmentally attractive route for recycling, by preserving valuable petroleum resources and diverting non-degradable waste away from waste landfill disposal [8]. From an energy recovery point of view, sufficient capacity exists to handle all plastics from WEEE FR plastics. In Germany, more than 60 modern incinerators exist, with a capacity of more than 13 million ton/y while only 37,000 tons of flame retarded plastic wastes are produced every year. In general the existing installed capacity is within a ratio of 100 to 1400 times more household waste produced compared to FR plastics waste produced. This means in general there is more than enough capacity today for adding up to 3% plastics containing 2-3% bromine and being within the safety margin of corrosion.

Materials and Method

Electronic waste plastic to oil production purpose e-waste plastic was collected from phone charger and computer charger. Phone charger and computer charger to separate copper portion manually using scissor and plastic portion cut into small pieces for experimental setup. Electrical charger cable portion, 5% NaOH and 5% activated carbon mixture transfer into reactor chamber for liquefaction process. 75 gm e-waste cable was use for experimental purpose and 3.75 gm sodium hydroxide with 3.75 gm activated carbon was added in the experiment. Pyrex glass reactor was use for experiment purpose and temperature range was 200-420 ºC. E-waste plastic with sodium hydroxide and activated carbon and glass reactor chamber placed into heat mental for liquefaction process. Before start experimental heat reactor temperature profile, condensation unite, collection tank, light gas cleaning device with solution, oil purification system, small pump and Teflon bag was setup properly. Experimental setup procedure was shown figure 1. All connection was connected properly to prevent gas loss during production process. Experimental setup was under fume hood and whole system was close. In this experiment main goal was electrical charge cable cover conversion into oil using NaOH and activated carbon. Electrical cable has chlorine compounds and chlorine compounds can react with sodium hydroxide and form as a sodium chloride and settle down as residue. Activated carbons are absorbing dye or color which was use as a additives during plastic production period. During plastic production period are using different type of additives such as Reinforcing fiber, Fillers, Coupling agent, Plasticizers, Colorants, Stabilizers (halogen stabilizers, antioxidants, ultraviolet absorbers and biological preservatives), Processing aids (lubricants, and flow control), Flame Retardants, Peroxide, Antistatic agent and so on. All additives are comes out as a residue after finished oil production. Electronics waste plastic to oil production start temperature was 200 ºC and temperature was increase gradually based on oil production quality. Some time temperature need to decrees and some time temperature need to increase based on reactor inside produce smoke because if smoke percentage is too much then whole portion was not condense then some portion come out as without condense. Electronic waste plastic to fuel or oil production period temperature increase 200 to 325 ºC then plastic melt and produce vapor, vapor travel through condenser unit at the end collected liquid oil. Experiment was continued until finished the whole process and final temperature was

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use 420 ºC. Experimental procedure period some percentage light gas was collected and light gas was cleaned with 0.5 N AgNO3 and 0.25 N NaHCO3 solutions. Light gas was put into Teflon bag using small pump system for analysis purpose. Produce oil was filtered for removed ash or oil sediment then transfer into final container and it calls final oil or fuel. Residue was taking out from reactor chamber manually after finish the experiment. Residues keep into separate container for analysis purpose. In mass balance calculation showed 75 gm initial raw materials conversion into 25.2 gm oil, light gas produce 12.4 gm and left over residue 37.4 gm. Total experiment time was required 3-4 hours and input electricity was 0.401KWh. Light gas and left over residue is under investigation.

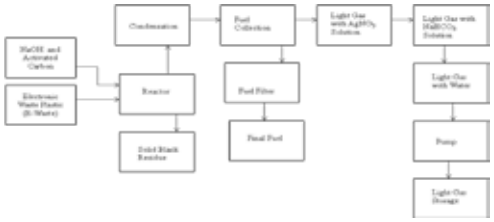

Figure 1: E-waste cable to oil production process diagram**Liquid Oil Analysis**

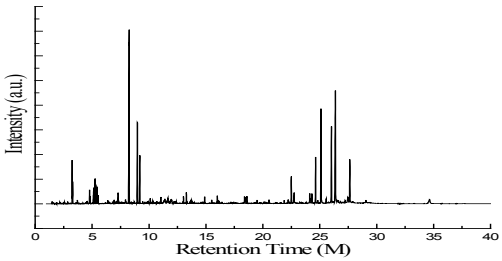

Figure 2: GC/MS Chromatogram of E-waste cable to Oil

Table 1: GC/MS Chromatogram Compound List of E-waste cable to Oil

Number of Peak	Retention Time (min.)	Trace Mass (m/z)	Compound Name	Compound Formula	Molecular Weight	Probability %	NIST Library Number
1	1.49	36	Hydrogen chloride	ClH	36	95.0	18847
2	1.61	43	Butane	C4H10	58	66.0	18940
3	1.63	41	1-Propene, 2-methyl-	C4H8	56	31.8	61293
4	1.75	55	Cyclopropane, 1,1-dimethyl-	C5H10	70	28.1	34618
5	1.81	43	Butane, 2-methyl-	C5H12	72	71.6	61287
6	1.87	42	Cyclopropane, ethyl-	C5H10	70	40.0	114410
7	1.91	43	Pentane	C5H12	72	81.6	114462
8	1.94	55	1-Butene, 3-methyl-	C5H10	70	21.5	114463
9	1.98	55	2-Pentene, (E)-	C5H10	70	16.1	291780
10	2.01	55	2-Methyl-1-butene	C5H10	70	15.5	229038
11	2.10	41	Allyl chloride	C3H5Cl	76	56.4	291300
12	2.17	57	Propane, 2-chloro-2-methyl-	C4H9Cl	92	76.3	107667
13	2.24	67	Cyclopentene	C5H8	68	22.1	19032
14	2.31	42	2(3H)-Furanone, dihydro-3,5-dimethyl-	C6H10O2	114	13.0	32337
15	2.42	56	Pentane, 3-methyl-	C6H14	86	21.1	565
16	2.48	41	1-Hexene	C6H12	84	31.1	500
17	2.56	57	Hexane	C6H14	86	84.8	61280
18	2.61	55	3-Hexene, (E)-	C6H12	84	47.9	19325
19	2.84	42	Furan, tetrahydro-	C4H8O	72	91.9	118704
20	2.92	55	(Chloromethyl)cyclopropane	C4H7Cl	90	30.9	135320
21	3.03	69	3-Methyl-3-chloro-1-butene	C5H9Cl	104	45.3	149639
22	3.11	56	Butane, 1-chloro-	C4H9Cl	92	64.0	291407
23	3.25	78	Benzene	C6H6	78	70.6	291514
24	3.30	71	Butane, 2-chloro-2-methyl-	C5H11Cl	106	96.0	227753
25	3.50	67	Cyclobutane, ethenyl-	C6H10	82	17.3	61253
26	3.59	41	1-Heptene	C7H14	98	37.0	107734
27	3.71	43	Heptane	C7H16	100	60.7	61276
28	3.76	41	3-Heptene	C7H14	98	26.2	113117
29	3.81	55	(Z)-3-Heptene	C7H14	98	18.8	113674
30	4.21	41	1-Butene, 2-(chloromethyl)-	C5H9Cl	104	50.0	1302
31	4.28	41	Cyclopentane, ethyl-	C7H14	98	39.2	940
32	4.45	55	1-Heptene, 3-methyl-	C8H16	112	21.7	60730
33	4.53	55	3-Heptene, 3-methyl-	C8H16	112	10.7	113088
34	4.57	69	1-Hexene, 3,3-dimethyl-	C8H16	112	15.0	113441
35	4.78	91	Toluene	C7H8	92	36.8	291301
36	4.83	43	Heptane, 3-methyl-	C8H18	114	41.1	34428

37	5.14	55	Cyclopentanone	C5H8O	84	66.1	233220
38	5.26	55	4-Octene, (Z)-	C8H16	112	21.8	227615
39	5.29	55	3-Octene, (E)-	C8H16	112	17.6	113893
40	5.37	55	2-Octene, (E)-	C8H16	112	21.0	107269
41	5.54	70	2-Heptene, 3-methyl-	C8H16	112	35.7	149374
42	5.51	55	2-Octene, (Z)-	C8H16	112	23.5	113889
43	5.88	41	1-Nonanol	C9H20O	144	6.07	249226
44	6.00	55	Cyclooctanone	C8H14O	126	9.48	28076
45	6.14	43	Bicyclo[3.1.1]heptan-3-ol, 2,6,6-trimethyl-, (1α,2β,3α,5α)-	C10H18O	154	7.24	249445
46	6.24	41	1-Methylpentyl cyclopropane	C9H18	126	9.35	113526
47	6.30	41	trans-2-Ethyl-2-hexen-1-ol	C8H16O	128	19.5	139523
48	6.38	91	Ethylbenzene	C8H10	106	58.7	158804
49	6.94	91	p-Xylene	C8H10	106	43.7	113952
50	6.99	43	Decane	C10H22	142	5.87	114147
51	7.06	57	1-Octene, 3,7-dimethyl-	C10H20	140	10.3	3653
52	7.18	55	Butane, 1,4-dichloro-	C4H8Cl2	126	63.5	70738
53	7.29	56	3-Chloro-2,2-dimethyl-1-propanol	C5H11ClO	122	94.0	108320
54	7.38	43	1-Octene, 2,6-dimethyl-	C10H20	140	2.88	150583
55	7.66	57	1-Octyn-3-ol, 4-ethyl-	C10H18O	154	6.10	5127
56	7.94	57	Hexanal, 2-ethyl-	C8H16O	128	69.0	160629
57	8.26	55	Heptane, 3-chloro-3-methyl-	C8H17Cl	148	70.2	114670
58	8.44	105	Benzene, 1-ethyl-3-methyl-	C9H12	120	29.2	228743
59	8.52	103	Methyl 3-hydroxytetradecanoate	C15H30O3	258	13.9	98742
60	8.56	41	1-Octene, 3,7-dimethyl-	C10H20	140	7.74	3653
61	8.98	57	Heptane, 3-(chloromethyl)-	C8H17Cl	148	66.4	4500
62	9.19	57	1-Hexanol, 2-ethyl-	C8H18O	130	65.9	288735
63	9.45	117	Benzene, 2-propenyl-	C9H10	118	13.4	114744
64	9.61	116	Indene	C9H8	116	22.6	228349
65	9.73	91	Benzene, butyl-	C10H14	134	18.8	228741
66	9.89	105	Acetophenone	C8H8O	120	27.1	98693
67	10.12	115	1,3-Dioxepane, 5-methyl-2-pentadecyl-	C21H42O2	326	46.0	36443
68	10.20	41	Trichloroacetic acid, 2-tridecyl ester	C15H27Cl3O2	344	4.50	282063
69	10.34	57	Undecane	C11H24	156	22.5	114185
70	10.66	57	Tetradecane, 1-chloro-	C14H29Cl	232	23.1	107511
71	10.71	43	Decane, 1-chloro-	C10H21Cl	176	18.7	232398
72	10.93	57	Dodecane, 1-chloro-	C12H25Cl	204	20.2	125095
73	11.04	43	Acetic acid, 2-ethylhexyl ester	C10H20O2	172	54.9	227968
74	11.14	117	Benzene, 4-ethenyl-1,2-dimethyl-	C10H12	132	30.0	2980
75	11.39	105	Decanediamide, N,N'-di-benzoyloxy-	C24H28N2O6	440	10.1	253262
76	11.47	105	E-2-Hexenyl benzoate	C13H16O2	204	17.1	131718
77	11.61	57	Hexadecane, 1-chloro-	C16H33Cl	260	11.4	107483
78	11.66	57	1-Chloroundecane	C11H23Cl	190	8.43	232531
79	11.93	128	Naphthalene	C10H8	128	38.3	114935
80	12.39	57	Propanoic acid, octyl ester	C11H22O2	186	8.06	162274
81	12.99	71	Propanoic acid, 2-methyl-, 2-ethylhexyl ester	C12H24O2	200	29.2	140018
82	13.29	86	3-Heptanone, 4-methyl-	C8H16O	128	28.1	2673
83	13.35	57	Tridecane	C13H28	184	21.0	114282
84	13.57	142	Benzocycloheptatriene	C11H10	142	24.4	151559
85	13.60	71	n-Butyric acid 2-ethylhexyl ester	C12H24O2	200	49.8	232050
86	13.69	104	1,2-Benzenedicarboxylic acid	C8H6O4	166	56.3	290999
87	13.81	142	1H-Indene, 1-ethylidene-	C11H10	142	24.2	55614
88	13.96	115	1,3-Dioxolane, 4-ethyl-4-methyl-2-pentadecyl-	C21H42O2	326	19.6	36460
89	14.09	129	Tricyclo[6.4.0.0(3,7)]dodeca-1,9,11-triene	C12H14	158	14.7	298964

90	14.20	57	2-Butenedioic acid (E)-, bis(2-ethylhexyl) ester	C20H36O4	340	14.3	15668
91	14.26	105	n-Octyl phenyl ketone	C15H22O	218	17.9	154379
92	14.38	105	Falcarinol	C17H24O	244	10.4	112661
93	14.54	73	2-t-Butyl-5-propyl-[1,3] dioxolan-4-one	C10H18O3	186	12.2	186630
94	14.61	41	1-Tetradecene	C14H28	196	6.29	69725
95	14.71	57	Tetradecane	C14H30	198	24.1	113925
96	14.89	85	Pentanoic acid, 2-ethylhexyl ester	C13H26O2	214	65.9	282344
97	15.51	73	2-t-Butyl-5-propyl-[1,3] dioxolan-4-one	C10H18O3	186	15.8	186630
98	15.90	41	7-Tetradecene	C14H28	196	5.08	70643
99	16.00	57	Pentadecane	C15H32	212	35.5	107761
100	16.12	70	Hexanoic acid, 2-ethylhexyl ester	C14H28O2	228	64.0	279277
101	17.29	70	Heptanoic acid, 4-octyl ester	C15H30O2	242	19.4	160117
102	17.41	165	Fluorene	C13H10	166	45.5	228672
103	17.53	57	Octanoic acid, 1-methyltridecyl ester	C22H44O2	340	4.79	30966
104	17.63	165	trans-1,2-Diphenylethylene oxide	C14H12O	196	28.2	115342
105	17.74	168	1-Isopropenylnaphthalene	C13H12	168	16.4	217205
106	18.39	57	Nonadecane	C19H40	268	13.8	114098
107	18.43	57	Octanoic acid, 2-ethylhexyl ester	C16H32O2	256	78.1	279521
108	18.60	105	Benzoic acid, 2-ethylhexyl ester	C15H22O2	234	81.6	236353
109	19.50	57	Decanoic acid, 2-ethylhexyl ester	C18H36O2	284	9.75	162293
110	20.28	57	9-Octadecanone	C18H36O	268	63.3	113053
111	20.49	105	10,13-Octadecadiynoic acid, methyl ester	C19H30O2	290	12.6	36061
112	21.88	69	Dodecanoic acid, isooctyl ester	C20H40O2	312	14.6	159938
113	21.98	149	Phthalic acid, butyl undecyl ester	C23H36O4	376	13.0	308912
114	22.23	129	Hexanedioic acid, bis(2-ethylhexyl) ester	C22H42O4	370	39.5	160799
115	22.50	57	Dodecanoic acid, isooctyl ester	C20H40O2	312	73.5	159938
116	22.76	149	1,2-Benzenedicarboxylic acid, mono(2-ethylhexyl) ester	C16H22O4	278	64.2	75949
117	24.12	70	1,2,4-Benzenetricarboxylic acid, cyclic 1,2-anhydride, nonyl ester	C18H22O5	318	51.2	48238
118	24.31	57	Myristic acid isobutyl ester	C18H36O2	284	32.2	233203
119	24.63	129	Hexanedioic acid, bis(2-ethylhexyl) ester	C22H42O4	370	30.9	160799
120	25.11	129	Hexanedioic acid, bis(2-ethylhexyl) ester	C22H42O4	370	67.9	291314
121	25.57	69	Hexadecanoic acid, butyl ester	C20H40O2	312	13.8	157188
122	26.03	57	Hexadecanoic acid, 2-methylpropyl ester	C20H40O2	312	16.9	232982
123	26.38	149	1,2-Benzenedicarboxylic acid, diisooctyl ester	C24H38O4	390	34.6	113206
124	27.64	57	Octadecanoic acid, octyl ester	C26H52O2	396	50.9	163918
125	29.06	57	1-Dodecanol, 3,7,11-trimethyl-	C15H32O	228	5.68	22776
126	34.65	305	tri(2-Ethylhexyl) trimellitate	C33H54O6	546	95.5	291285

Electrical waste plastic to oil (figure 2 and table 1) was analysis by Perkin Elmer GC/MS and compounds were traced from GC/MS chromatogram based on compounds fragmentation retention time (t) and trace mass (m/z). Electronic waste plastic has chlorine compound and others types of additives. In experimental process was added sodium hydroxide and activated carbon to removed chlorine content and additives color from produce oil. GC/MS chromatogram analysis result indicates that produce oil is acidic because produce oil has Hydrogen chloride compound. Electronic plastic was made PVC category plastics and PVC has 56% chlorine component and present oil has halogenated compounds. Oil analysis result showed different types of compounds are present in the oil. Hydrocarbon compounds, nitrogen containing compounds, aromatics group, halogenated compounds, oxygen containing compounds and alcoholic compounds are present analysis oil. Hydrocarbon chain showed C4 to C33 with different retention and different trace mass. In this analysis section some compounds are elaborated from table 1 based on retention time, trace mass, molecular weight and compounds probability percentage and compounds are such as Butane (C4H10) (t=1.61, 43) compound molecular weight is 58 and compound probability percentage is 66.0 %, 2-methyl- Butane (C5H12) (t=1.8 , m/z=43) compound molecular weight is 72 and compound probability percentage is 71.6 %, 2-Methyl-1-butene (C5H10) (t=2.01, m/z=55) compound molecular weight is 70 and compound probability percentage is 15.5%, 3-methyl- Pentane (C6H14) (t=2.42, m/z=56) compound molecular weight is 86 and compound probability percentage is 21.1%, (E)-3-Hexene (C6H12) (t=2.61, m/z=55) compound molecular weight is 84 and compound probability percentage is

47.9 %, 1-chloro- Butane (C4H9Cl) (t=3.11, m/z=56) compound molecular weight is 92 and compound probability percentage is 64 %, Benzene (C6H6) (t=3.25, m/z=78) compound molecular weight is 78 and compound probability percentage is 70.6 %, Heptane (C7H16) (t=3.71, m/z=43) compound molecular weight is 100 and compound probability percentage is 60.7%, 2-(chloromethyl)- 1-Butene (C5H9Cl) (t=4.21, m/z=41) compound molecular weight is 104 and compound probability percentage is 50.0%, Toluene (C7H8) (t=4.78, m/z=91) compound molecular weight is 92 and compound probability percentage is 36.8 %, (E)- 2-Octene (C8H16) (t=5.37, m/z=55) compound molecular weight is 112 and compound probability percentage is 21.0%, Cyclooctanone (C8H14O) (t=6.00, m/z=55) compound molecular weight is 126 and compound probability percentage is 9.48%, 1-Methylpentyl cyclopropane (C9H18) (t=6.24, m/z=41) compound molecular weight is 126 and compound probability percentage is 9.35 %, Ethylbenzene (C8H10) (t=6.38, m/z=91) compound molecular weight is 106 and compound probability percentage is 58.7 %, p-Xylene (C8H10) (t=6.94, m/z=91) compound molecular weight is 106 and compound probability percentage is 43.7 %, 4-ethyl-1-Octyn-3-ol (C10H18O) (t=7.66, m/z=57) compound molecular weight is 154 and compound probability percentage is 6.10%, 3,7-dimethyl-1-Octene (C10H20) (t=8.56, m/z=41) compound molecular weight is 140 and compound probability percentage is 7.74%, Indene (C9H8) (t=9.61, m/z=116) compound molecular weight is 116 and compound probability percentage is 22.6 %, Undecane (C11H24) (t=10.34, m/z=57) compound molecular weight is 156 and compound probability percentage is 22.5%, 1-chloro-Dodecane (C12H25Cl) (t=10.93, m/z=57) compound molecular weight is 204 and compound probability percentage is 20.2 %, E-2-Hexenyl benzoate (C13H16O2) (t=11.47, m/z=105) compound molecular weight is 204 and compound probability percentage is 17.1%, Naphthalene (C10H8) (t=11.93,l m/z=128) compound molecular weight is 128 and compound probability percentage is 38.3 %, Tridecane (C13H28) (t=13.35, m/z=57) compound molecular weight is 184 and compound probability percentage is 21.0%, 1-ethylidene-1H-Indene (C11H10) (t=13.81, m/z=142) compound molecular weight is 142 and compound probability percentage is 24.2 %, 2-t-Butyl-5-propyl-[1,3]dioxolan-4-one (C10H18O3) (t=14.54, m/z=73) compound molecular weight is 186 and compound probability percentage is 12.2 %, Pentadecane (C15H32) (t=16.00, m/z=57) compound molecular weight is 212 and compound probability percentage is 35.5%, trans-1,2-Diphenylethylene oxide (C14H12O) (t=17.63, m/z=165) compound molecular weight is 196 and compound probability percentage is 28.2 %, 2-ethylhexyl ester Octanoic acid (C16H32O2) (t=18.43, m/z=57) compound molecular weight is 256 and compound probability percentage is 78.1%, 9-Octadecanone (C18H36O) (t=20.28, m/z=57) compound molecular weight is 268 and compound probability percentage is 63.3%, butyl undecyl ester Phthalic acid (C23H36O4) (t=21.98, m/z=149) compound molecular weight is 376 and compound probability percentage is 13.0 %, 1,2,4-Benzenetricarboxylic acid, cyclic 1,2-anhydride, nonyl ester (C18H22O5) (t=24.12, m/z=70) compound molecular weight is 318 and compound probability percentage is 51.2 %, bis(2-ethylhexyl) ester Hexanedioic acid (C22H42O4) (t=25.11, m/z=129) compound molecular weight is 370 and compound probability percentage is 67.9 %, 1,2-Benzenedicarboxylic acid, diisooctyl ester (C24H38O4) (t=26.38, m/z=149) compound molecular weight is 390 and compound probability percentage is 34.6%, Octadecanoic acid, octyl ester (C26H52O2) (t=27.64, m/z=57) compound molecular weight is 396 and compound probability percentage is 50.9 %, tri(2-Ethylhexyl) trimellitate (C33H54O6) (t=34.65, m/z=305) compound molecular weight is 546 and compound probability percentage is 95.5 % respectively. In the analysis result showed produce fuel has also dihydro-3,5-dimethyl-2(3H)-Furanone (C6H10O2), tetrahydro-Furan (C4H8O) and this types of compounds need to remove by using refinery process and useable for internal combustion engines. Fuel can be use power plant and petroleum refinery for feed stock. Oil has benzene derivative and its can increase fuel efficiency similar to commercial oil.

Conclusion

Electronic waste plastic to oil production process sodium hydroxide and activated carbon mixture removed some percentage chlorine content and produce high efficiency oil for refinery application. Temperature was use 200-420 ºC and conversion rate was 50.13% including light gas and solid black residue was 49.87%. Oil density is 0.90 g/ml and oil color was light brown and oil thick. GC/MS analysis result indicates that Oil has lots of benzene and chlorinated compounds. Benzene groups are Benzene, Toluene, Ethylbenzene, p-Xylene, 1-ethyl-3-methyl-Benzene, 2-propenyl-Benzene, Indene, butyl-Benzene, Acetophenone, 4-ethenyl-1,2-dimethyl-Benzene, Naphthalene, Benzocycloheptatriene etc. and chlorinated compounds are Allyl chloride, 2-chloro-2-methyl-Propane, 3-Methyl-3-chloro-1-butene, 2-(chloromethyl)-1-Butene, 1,4-dichloro-Butane, 1-chloro-Decane, 1-Chloroundecane. Analysis results showed also some ester group compounds such as 2-ethylhexyl ester Pentanoic acid, 2-ethylhexyl ester Benzoic acid, isooctyl ester Dodecanoic acid, butyl ester Hexadecanoic acid, diisooctyl ester 1,2-Benzenedicarboxylic acid, Octadecanoic acid, octyl ester etc. and before this oil any internal combustion engine oil need modified by using refinery process. By using this technology all electronics waste plastic (e-waste) can convert into oil using sodium hydroxide and activated carbon. E-waste plastic convert into oil can save environmental pollution problem and save the world for next generation as well as production potential energy for internal combustion engines.

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