



CHEMICAL RECYCLING PROJECT BNPetro (ECER) samples - Results

SAMPLE INFORMATION

Sample code	Date	Scale	Catalyst	Raw material	Description
BNP-001-	04/24/2019	Pilot	NA	Plastic waste + wood	Gasoline
BNP-006-	05/13/2019	Pilot	NA	Plastic waste + wood	Gas sample 1
BNP-007-	05/13/2019	Pilot	NA	Plastic waste + wood	Gas sample 2
BNP-008-	05/13/2019	Pilot	NA	Plastic waste + wood	Gas sample 3

PETROLEUM

PHYSICO-CHEMISTRY PROPERTIES AND PIONA

Type of Analysis	Standards	BNP-001-
IBP	ASTM D86-11a	93.4
FBP	ASTM D86-11a	-
Benzene (ppm)	ASTM D5134-98 (R08) E1	197609
Paraffins	ASTM D5134-98 (R08) E1	0.21%
Isoparaffins	ASTM D5134-98 (R08) E1	4.67%
Olefins	ASTM D5134-98 (R08) E1	0.61%
Naphtenes	ASTM D5134-98 (R08) E1	1.02%
Aromatics	ASTM D5134-98 (R08) E1	91.86%
Total C15+	ASTM D5134-98 (R08) E1	0.98%
Unkown	ASTM D5134-98 (R08) E1	0.65%
Total chlorides (organic) (ppm)	-	380
Relative density	ASTM D4052	0.9001
Average molecular weight	ASTM D5134-98 (R08) E1	99.2038
Sulphur total (ppm)		396.18
CS ₂ (ppm)	ASTM 5632	1.14
Mercaptans (ppm)	ASTM 5632	50.18
COS (ppm)	ASTM 5632	1.24
H ₂ S (ppm)	ASTM 5632	0.24
Saybolt Color	-	-
Flash point	ASTM D93-16a	-
Nitrogen content (mg/L)		-

PETROLEUM

Distillation profile	
Fração (%)	BNP-001- T (°C)
0	93.4
5	104.6
10	107.7
20	111
30	113.9
40	119.6
50	126.9
60	132
70	
80	
90	
95	

*For BNP-001- after fraction 60%

Petroleum

COMPOSITION LIQUIDS

	%mass
PIONA	BNP-001-
Paraffins	0.21%
Isoparaffins	4.67%
Olefins	0.61%
Naphthenes	1.02%
Aromatics	91.86%
Total C15+	0.98%
Unknowns	0.65%

Diene Components	
BNP-001-	
Components	(% mass)
No diene compound was detected in this sample.	

BNP-001-							
Totals by group type and carbon number (in % mass)							
Carbon Index	n-Paraffins	Isoparaffins	Olefins	Naphthenes	Aromatics	Unknown	Total
C1	0	0	0	0	0	0	0
C2	0	0	0	0	0	0	0
C3	0	0	0	0	0	0	0
C4	0	0	0	0	0	0	0
C5	0	0	0	0	0	0	0
C6	0	0	0	0	25.0961	0	25.0961
C7	0	0	0	0	24.5842	0	24.5842
C8	0	0	0.2103	0	35.8881	0	36.0984
C9	0	0.2635	0	0	2.1601	0	2.4236
C10	0	2.887	0	0.7213	6.5982	0	10.2065
C11	0	0.1892	0	0.0164	0.1983	0	0.4039
C12	0	0	0	0.0027	0.0536	0.0448	0.0563
C13	0.1075	0	0.1999	0	0	0	0.3074
C14	0.0051	0	0	0	0	0.3168	0.0051
Total:	0.1126	3.3397	0.4102	0.7404	94.5786	0.3616	99.1815
					TOTAL + Unknown		99.5431

Petroleum

Composition by GC-DHA	
BNP-001-	
Component	%mass
Benzene	19.7609
Toluene	22.8344
Ethylbenzene	6.1237
meta Xileno	0.7787
para Xileno	0.3874
Estireno	30.5262
orto Xileno	0.3406
2,4-dimethyloctane	0.513
beta-methylstyrene	0.1319
n-propylbenzene	0.1098
1,3-methylethylbenzene	0.1105
1,4-methylethylbenzene	0.0604
5-methylnonane	0.0117
1,3,5-trimethylbenzene	0.0383
3-methylnonane	2.9517
hexa hidro DCPD	0.0974
m vinil Tolueno (m metil Estireno)	0.3556
p vinil Tolueno (o metil Estireno)	0.0264
1,2,4-trimethylbenzene	0.0634
o vinil Tolueno (p metil Estireno)	0.1735
1,4-methyl-i-propylbenzene	0.0645
1,2,3-trimethylbenzene	0.0306
cyclopropylbenzene	0.2698
2-3-dihydroindene	0.0644
Indeno	2.2363
1,3-methyl-n-propylbenzene	0.0515
1,2-ethyl-i-propylbenzene	0.0594
methyl-DCPD-[3]	0.0685
1,2-methyl-n-butylbenzene	0.0346
1,2,3,5-tetramethylbenzene	0.035
terc-1-butyl-2-metilbenzeno	0.0258
4-methylindan	0.0164
1,2-ethyl-n-propylbenzene	0.0092
1,3-methyl-n-butylbenzene	0.127
dimethyl-DCPD	0.0168
s-pentylbenzene	0.018
n-pentylbenzene	0.0223
1t-M-2-(4-MP)cyclopentane	0.0046
naphtenic C11	0.0402
1,4-di-i-propylbenzene	0.006
naphthalene	8.2951
terc-1-butyl-4-etilbenzeno	0.0313
1,3,5-triethylbenzene	0.0253
tridecene-1	0.3674
n-tridecane	0.1998
C14+	0.0101
C15+ (Summarized)	0.9767
unknown	1.4976

Gaz

Composition by GC-DHA						
BNP-006-			BNP-007-		BNP-008-	
Component	%mol	Component	%mol	Component	%mol	
n-C6	3.264	n-C6	3.22	n-C6	3.43	
Methane	13.654	Methane	14.225	Methane	14.206	
Ethane	10.417	Ethane	10.179	Ethane	13.166	
Ethylene	19.027	Ethylene	18.232	Ethylene	16.643	
Propane	5.776	Propane	5.608	Propane	7.724	
Propylene	15.896	Propylene	15.634	Propylene	14.901	
Isobutane	0.453	Isobutane	0.595	Isobutane	0.258	
n-Butane	2.089	n-Butane	1.993	n-Butane	2.949	
Propadiene	0.004	Propadiene	0.007	trans-2-butene	0.856	
Acetylene	0.004	Acetylene	0.004	1-butene	4.606	
trans-2-butene	1.141	trans-2-butene	1.148	Isobutene	2.159	
1-butene	4.073	1-butene	3.802	cis-2-butene	0.624	
Isobutene	2.35	Isobutene	2.337	Isopentene	0.14	
cis-2-butene	0.853	cis-2-butene	0.851	n-pentane	2.048	
Isopentane	0.293	Isopentane	0.356	1,3-butadiene	0.995	
n-pentane	1.92	n-pentane	1.949	trans-2-pentene	0.132	
1,3-butadiene	1.813	1,3-butadiene	1.672	1-pentene	0.155	
trans-2-pentene	0.467	1,2-butadiene	0.094	2-methyl-butene	2.014	
1-pentene	0.241	trans-2-pentene	0.461	cis-2-pentene	0.179	
2-metil-2-butene	0.213	1-pentene	0.243	Vinilacetylene	0.061	
cis-2-pentene	0.244	2-metil-2-butene	0.214	Ethylacetylene	0.065	
Ethylacetylene	0.244	cis-2-pentene	0.256	CO2	0.366	
CO2	3.093	Vinilacetylene	0.193	Ar (O2)	1.061	
Ar (O2)	0.633	Ethylacetylene	0.078	N2	3.884	
N2	2.109	CO2	2.681	CO	0.348	
CO	0.568	Ar (O2)	0.604	H2	5.43	
H2	6.015	N2	2.048	Others C5 +	1.6	
Others C5 +		CO	0.446	C4	12.573	
C4		H2	7.829	C5	9.698	
C5		Others C5 +	3.041			
		C4	12.763			
		C5	9.74			