

**Upgrading of Napier grass pyrolytic oil using microporous and hierarchical mesoporous zeolites: products distribution, composition and reaction pathways**

MOHAMMED, Isah Yakub, ABAKR, Yousif Abdalla, YUSUP, Suzana, ALABA, Peter Adeniyi, MORRIS, Kenobi Isima, SANI, Yahaya Muhammad and KABIR, Feroz Kabir <<http://orcid.org/0000-0002-3121-9086>>

Available from Sheffield Hallam University Research Archive (SHURA) at:

<http://shura.shu.ac.uk/15937/>

---

This document is the author deposited version. You are advised to consult the publisher's version if you wish to cite from it.

**Published version**

MOHAMMED, Isah Yakub, ABAKR, Yousif Abdalla, YUSUP, Suzana, ALABA, Peter Adeniyi, MORRIS, Kenobi Isima, SANI, Yahaya Muhammad and KABIR, Feroz Kabir (2017). Upgrading of Napier grass pyrolytic oil using microporous and hierarchical mesoporous zeolites: products distribution, composition and reaction pathways. *Journal of Cleaner Production*, 162, 817-829.

---

**Copyright and re-use policy**

See <http://shura.shu.ac.uk/information.html>

**Table S 1:** Composition of the aqueous phase from thermal and catalytic cracking of Napier grass pyrolytic oil over Zeolite

Reaction condition: 400 °C, 60 min and 2.0 wt% Catalyst loading

Compound	% Peak area
<b>Thermal Cracking</b>	
Cyclopentanol, 1-[3-(methylthio)-2-propenyl]-	5.94
1-Cyclohexene, 1-ethynyl-	4.82
1-Cyclohexene-1-acetonitrile	4.07
Cyclohexanone, 2-ethyl-, oxime	4.78
(2-Methyl-cyclohex-2-enylidene)-acetaldehyde	4.02
5-Methyl-2-nitrobenzyl alcohol	4.27
Phenol, 2,6-dimethyl-	3.78
Tricyclo[3.3.0.0(2,8)]octane-3,7-dione, 4-methyl-4-(propan-2-on-1-yl)-	3.79
1,3-Cyclohexadiene-1-methanol, 4-(1-methylethyl)-	4.79
1,5-Bis(4-nitrophenyl)carbazine	4.15
1,3-Benzenediol, 2-methyl-	6.56
2,3-Dimethoxyphenethylamine	3.60
2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-1-methoxy-	4.38
Benzenemethanol, 3-hydroxy-5-methoxy-	7.57
2,4-Dimethoxybenzeneethanamine	7.07
Benzaldehyde, 2,3-dimethoxy-	3.50
Cyclopentaneacetaldehyde, 2-formyl-3-methyl-à-methylene-	9.29
9-Ethoxy-10-oxatricyclo[7.2.1.0(1,6)]dodecan-11-one	6.12
2(3H)-Naphthalenone, 4,4a,5,6,7,8-hexahydro-1-methoxy-	3.77
Bicyclo[4.3.0]nonan-7-one, 1-(2-methoxyvinyl)-	3.74
<b>ZSM-5</b>	
1,2,3,4,5-Cyclopentanepentol	3.26
Butanoic acid, 4-hydroxy-	2.53
2(1H)-Pyridinone, 1-ethenyl-	1.77
2,4-Hexadiyne-1,6-diol	12.01
2-Cyclopenten-1-one, 3,4-dimethyl-	2.51
Benzyl alcohol	6.78
Phenol, 2-methyl-	9.08
Phenol, 4-ethyl	1.78
Phenol, 2,4-dimethyl-	4.07
Phenol, 2,6-dimethyl-	9.53
2,4-Hexadiyne-1,6-diol	11.70
Phenol, 2-ethyl-6-methyl-	1.80
1,3-Benzenediol, 2-methyl-	4.72
Resorcinol	4.38
1,3-Benzenediol, 2-methyl-	6.73
1,4-Benzenediol, 2-methyl-	5.14
1,4-Benzenediol, 2,6-dimethyl-	2.18
4-Ethylcatechol	5.27
1,3-Benzenediol, 4-propyl-	2.44
Cyclopentan-1-al, 4-isopropylidene-2-methyl-	2.32

---

**0.2HZSM-5**

---

D-Valine	4.15
Butane, 2-ethoxy-2-methyl-	4.46
1,4-Cyclohexanediol, cis-	3.99
Pyridine, 3-methyl-	3.38
2(3H)-Furanone, 5-ethoxydihydro-	5.03
Bicyclo[2.2.0]hexane-1-carboxaldehyde	10.19
2,4-Cyclopentadiene-1-ethanamine	8.79
1-Cyclohexene, 1-ethynyl-	6.81
2-Cyclopenten-1-one, 2,3,4-trimethyl-	4.25
Phenol, 2,3-dimethyl-	4.21
3-Caren-10-al	6.66
Phenol, 2,6-dimethyl-	6.74
3,6,10,10-Tetramethyl-1-oxa-spiro[4.5]deca-3,6-dien-2-one	3.00
Phenol, 3,4,5-trimethyl-	4.38
1,3-Benzenediol, 2-methyl-	4.74
1,4-Benzenediol, 2,5-dimethyl-	3.31
2,3-Dimethylhydroquinone	4.12
2-Cyclopenten-1-one, 4-hydroxy-3-methyl-2-(2-propenyl)-	3.98
Benzoic acid, 2,5-bis(trimethylsiloxy)-, trimethylsilyl ester	3.30
Benzoic acid, 2,5-bis(trimethylsiloxy)-, trimethylsilyl ester	4.48

---

**0.3HZSM-5**

---

L-Glucose, 6-deoxy-3-O-methyl-	4.81
3,4-Dihydroxy-5-methyl-dihydrofuran-2-one	4.06
Methyl 4-hydroxybutanoate	6.36
2-Cyclopenten-1-one, 2,3-dimethyl-	3.42
2,4-Heptadien-6-yn-1-ol, (E,E)-	8.23
Benzeneethanamine, 4-methoxy-	5.85
Spirohexan-4-one, 5,5-dimethyl-	5.70
Spiro[4.4]non-3-en-2-one, 4-methyl-3-(1H-tetrazol-5-yl)-1-oxa-	5.57
Benzyl alcohol, p-hydroxy-à-[(methylamino)methyl]-	4.59
Phenol, 2,6-dimethyl-	3.87
Cyclopentanone, 2-cyclopentylidene-	3.47
(2-Methyl-cyclohex-2-enylidene)-acetaldehyde	3.69
2-Cyclopenten-1-one, 4-hydroxy-3-methyl-2-(2-propenyl)-	5.10
1,3-Benzenediol, 2-methyl-	5.32
Cyclohexene, 1-(2-nitro-2-propenyl)-	4.23
2,3-Dimethylhydroquinone	3.79
1-Cyclohexene-1-ethanol, 2,6,6-trimethyl-	3.82
3-Cyclohexene-1-carboxaldehyde, 1,3,4-trimethyl-	3.34
Cyclohexene, 4-isopropenyl-1-methoxymethoxymethyl-	11.23
1,4-Benzenediol, 2,3,5-trimethyl-	3.58

---