

## **In-situ upgrading of Napier grass pyrolysis vapour over microporous and hierarchical mesoporous zeolites**

MOHAMMED1, Isah Yakub, ABAKR, Yousif Abdalla and KABIR KAZI, Feroz  
<<http://orcid.org/0000-0002-3121-9086>>

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

<https://shura.shu.ac.uk/15575/>

---

This document is the Supplemental Material

### **Citation:**

MOHAMMED1, Isah Yakub, ABAKR, Yousif Abdalla and KABIR KAZI, Feroz (2018). In-situ upgrading of Napier grass pyrolysis vapour over microporous and hierarchical mesoporous zeolites. *Waste and Biomass Valorization*, 9 (8), 1415-1428. [Article]

---

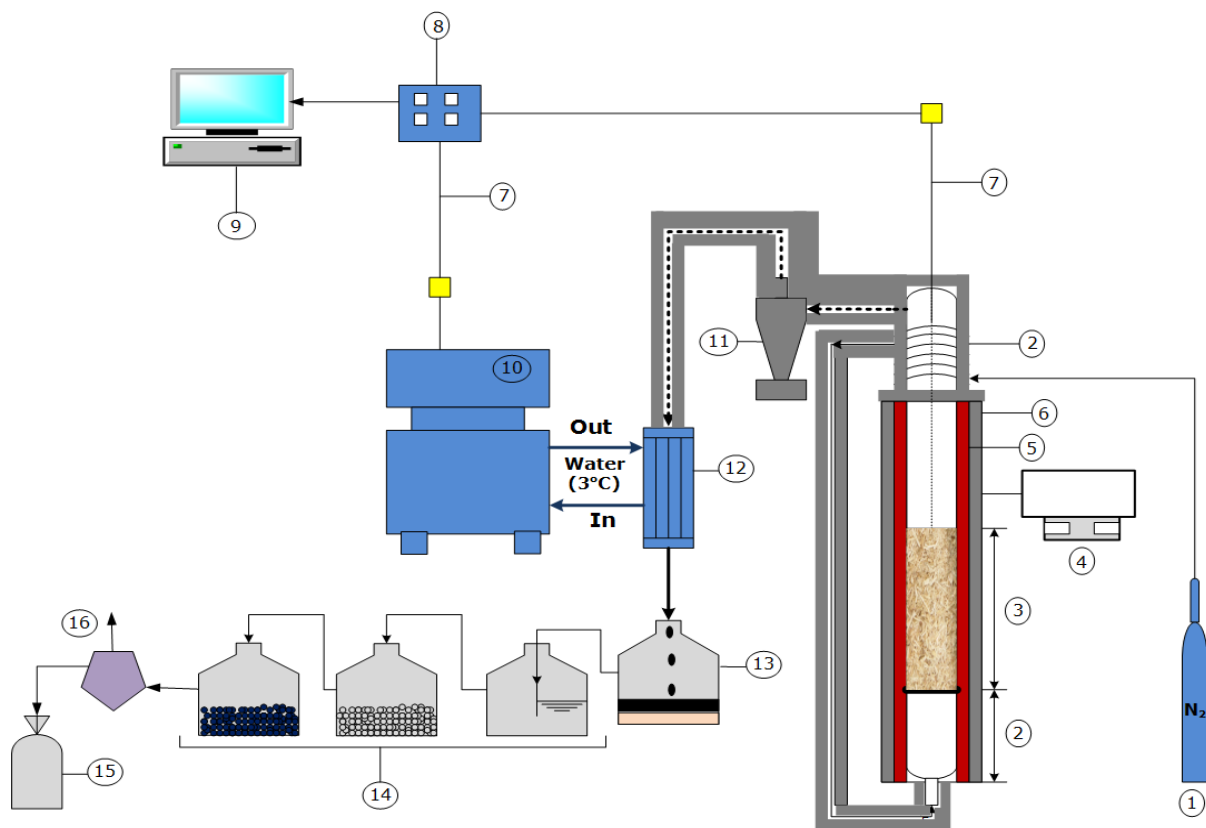
### **Copyright and re-use policy**

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

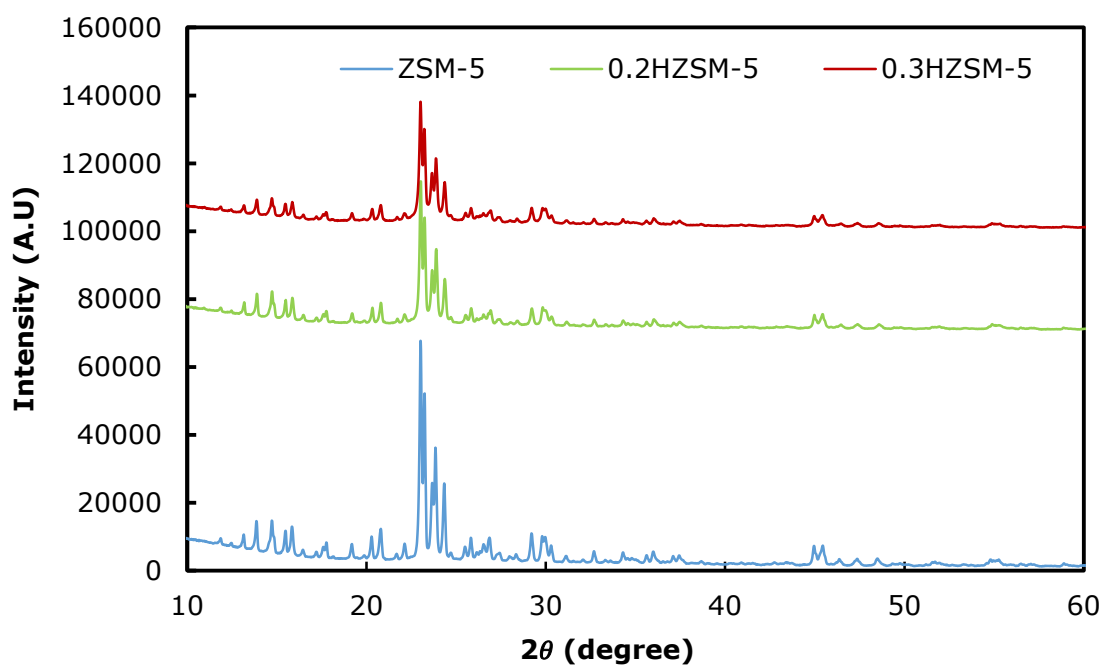
## List of Figures



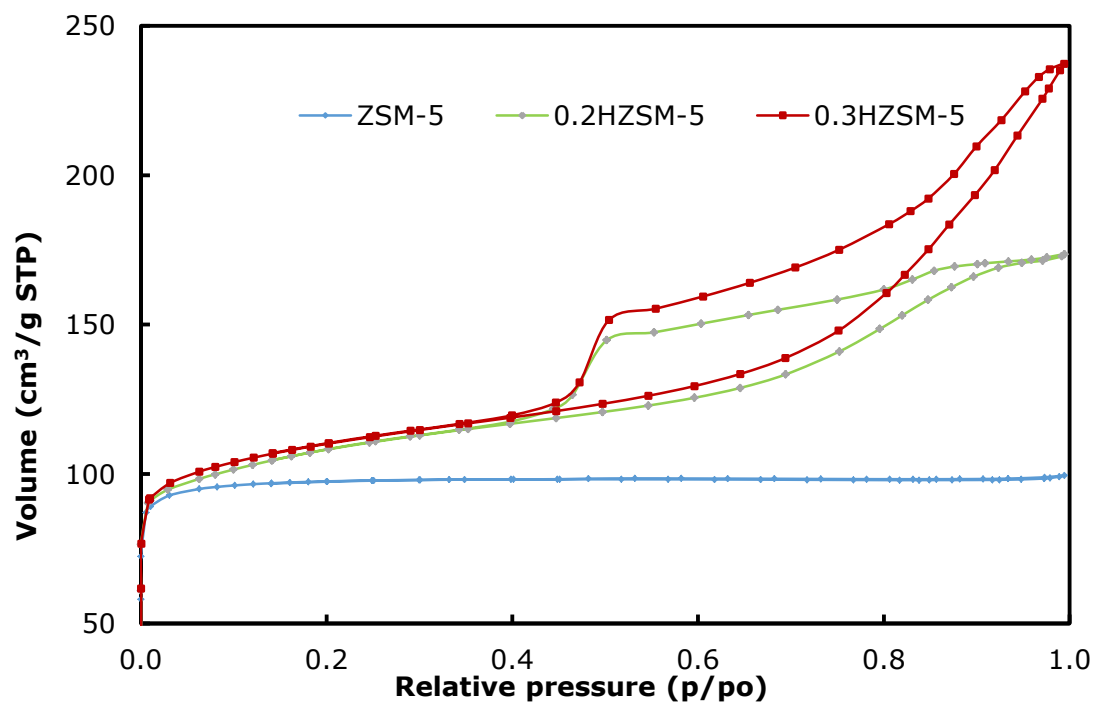
**Figure 1:** Pre-processing of Napier grass. (1) Napier grass on the field (2) chopped Napier grass stem (NGS) in the dryer (3) Rotor beater mill (4) Ground Napier grass biomass



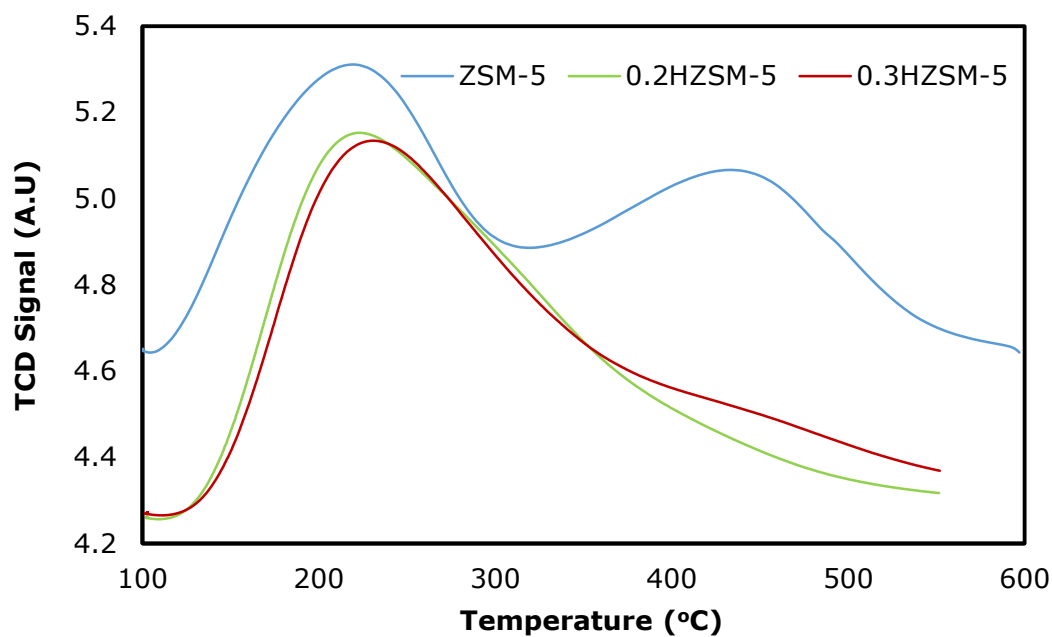
**Figure 112:** Pyrolysis system. (a) Vertical pyrolysis rig; (b) horizontal pyrolysis set-up. (1) Nitrogen cylinder, (2) nitrogen preheating sections, (3) pyrolysis section, (4) furnace controller, (5) heater, (6) insulator, (7) thermocouples, (8) data logger, (9) computer, (10) water chiller, (11) cyclone, (12) condenser, (13) bio-oil collector, (14) gas scrubber, (15) gas sampling bag, (16) gas venting



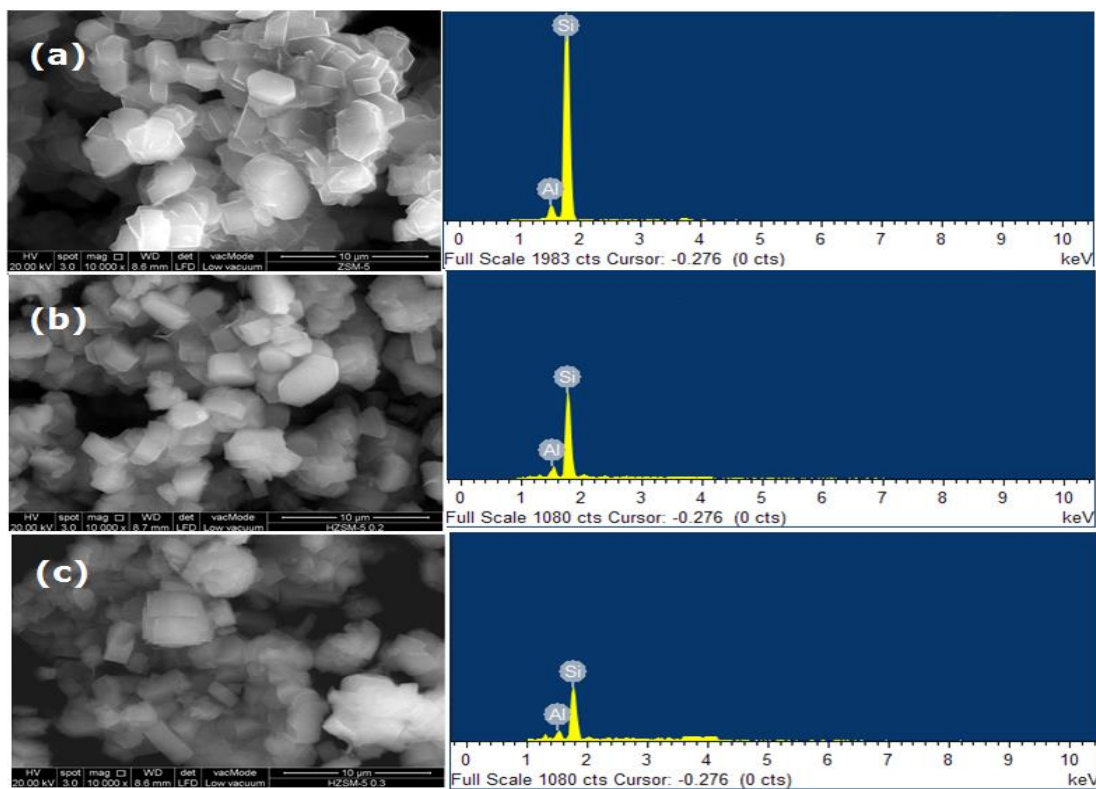
**Figure 223:** XRD Diffractogram of parent and modified ZSM-5



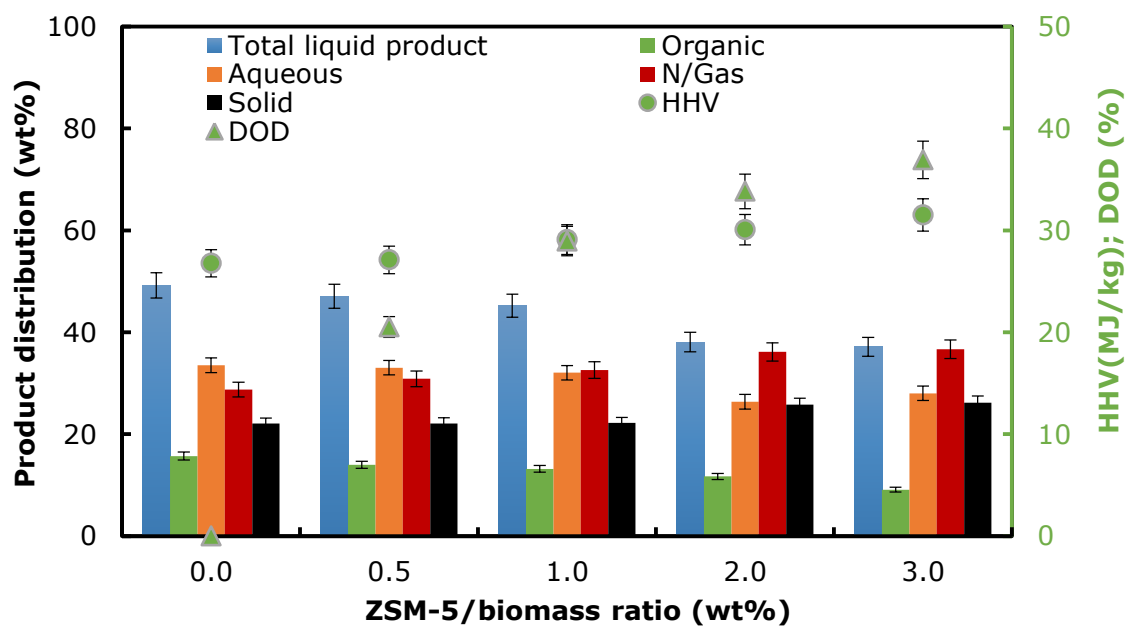
**Figure 334:** Isotherms of N<sub>2</sub> adsorption/desorption of the catalysts



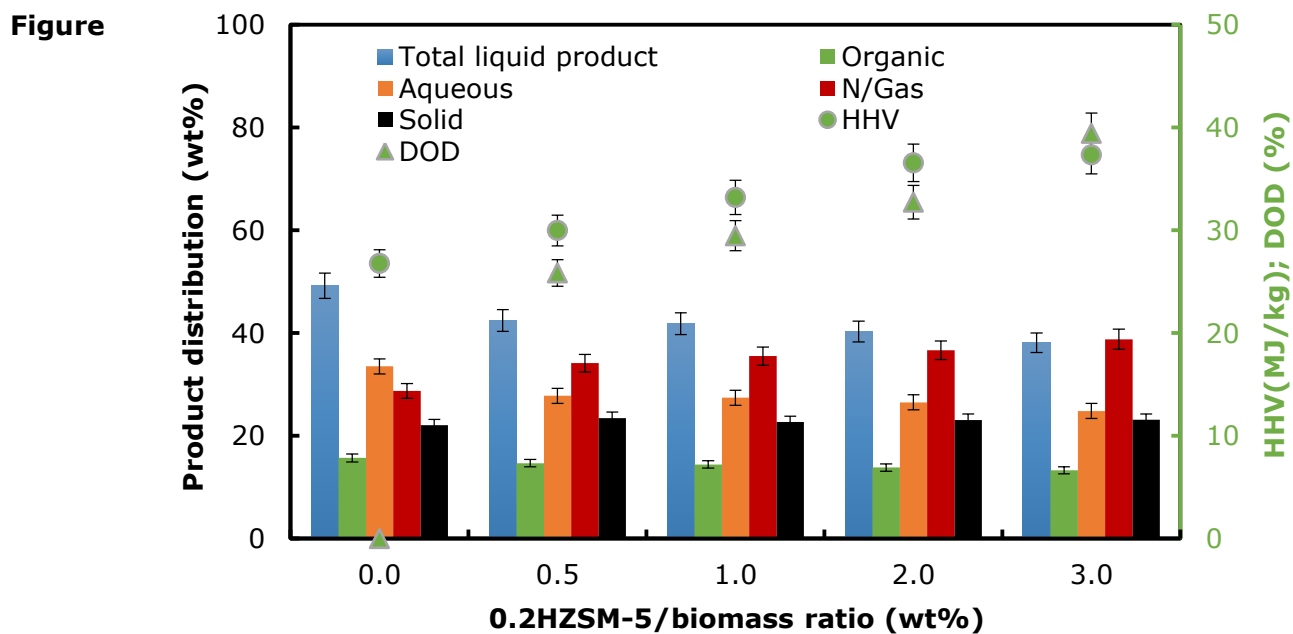
**Figure 445:** NH<sub>3</sub>-TPD temperature-programmed desorption curves



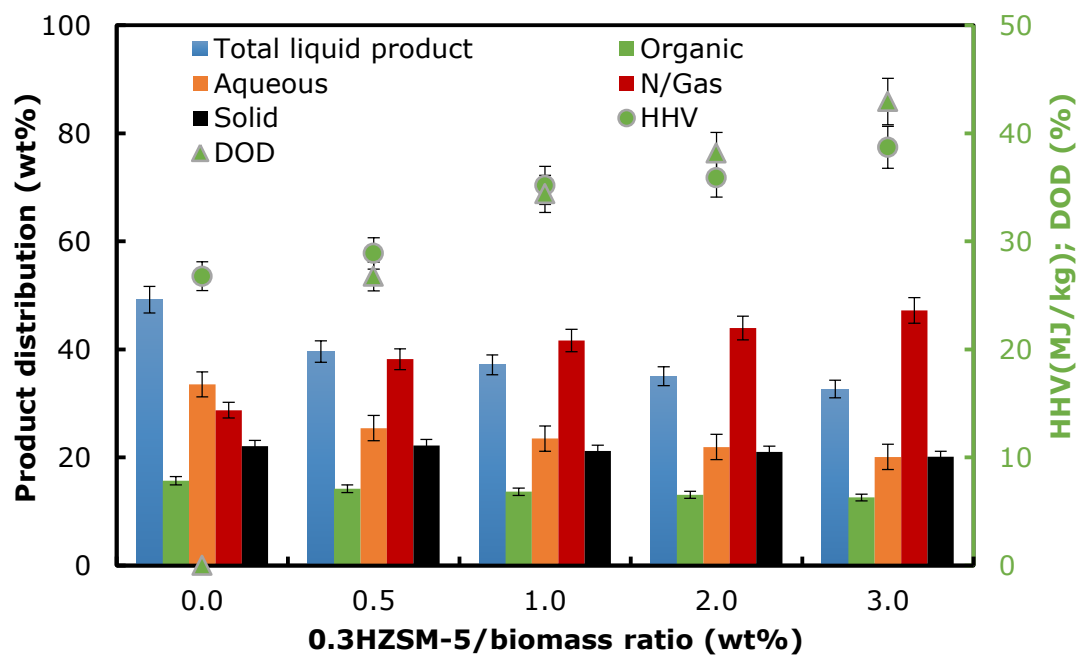
**Figure 556 :** SEM-EDX images of (a) ZSM-5, (b) 0.2HZSM-5 and (c) 0.3HZSM-5



**Figure 667:** Effect of ZSM-5/biomass ratio on pyrolysis product distribution, degree of deoxygenation (DOD) and higher heating value (HHV). N/gas: non-condensable gas. Solid: coke and char. Values are the means (n =3)



2HZSM-5/biomass ratio on pyrolysis product distribution, degree of deoxygenation (DOD) and higher heating value (HHV). N/gas: non-condensable gas. Solid: coke and char. Values are the means (n =3)



**Figure 889:** Effect of 0.3HZSM-5/biomass ratio on pyrolysis product distribution, degree of deoxygenation (DOD) and higher heating value (HHV). Solid: coke and char. Values are the means (n =3)