Influence of the temperature in the pyrolysis of wheat straw pellets in the auger reactor

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Abstract (300 word limit)

Pyrolysis is attractive due to the flexibility in feedstocks possible. As part of the GreenCarbon project [1], there are two feedstocks for the project, and the influence of the key parameters is being studied. One of the feedstocks selected is wheat straw from Belgium. In the proximate analysis, the moisture was 7.59wt%; ash content, volatile matter and fixed carbon were measured on a dry basis and the values were 4.57wt%, 80. 93wt% and 14.40wt%, respectively. The results obtained from the ultimate analysis show that the Higher Heating Value is 17.22 MJ/Kg, with 0.63 wt% of Nitrogen, 44.65wt% of Carbon and 6.88 wt% of Hydrogen. In order to establish relationships between the conditions, the feedstocks and the products, the starting point is to study the influence of temperature on the product distribution.

The system used for this study is an auger reactor system [2] where the reactor includes a screw and is heated externally. The biomass is fed after a valve that prevents the oxygen from entering into the system. After the reactor, the char is collected , the vapours are cooled down to recover and collect the condensable liquids and the non-condensable gases go through a cotton filter and are measured and analysed.

The conditions of the pyrolysis experiments were kept constant, except for the temperature – varied between 300-600 ˚C . The mass balance closure of the experiments is higher than 93%. For the experiments conducted at 300˚C, torrefaction was expected [3]. However, some pellets at 400˚C were torrefied within the system. The yield of liquid has to be studied but the early results obtained are supported by literature [4, 5] for similar feedstocks where the peak for oil-production in the same system was found at 500˚C.

Image

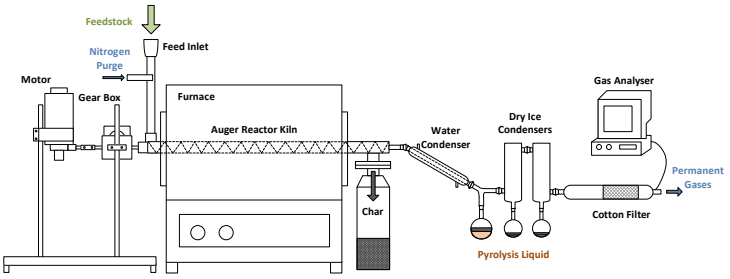


Figure 1: Auger Reactor System [2]

Temperature (˚C)	Gas (wt%)	Liquid (wt%)	Solid (wt%)	Closure (%)
300	8.4	32.0	55.2	95.6
400	12.2	50.2	33.5	95.9
500	14.2	52.0	26.9	93.0
600	21.3	49.4	25.2	95.8

Table 1: Products Yields

Recent Publications (minimum 5)

1. http://greencarbon-etn.eu/ (accessed 26th January 2018)
2. Yang, Y., et al. (2014). "Intermediate pyrolysis of biomass energy pellets for producing sustainable liquid, gaseous and solid fuels." Bioresour Technol 169: 794-799.
3. Sadaka, S. and S. Negi (2009). Improvements of Biomass Physical and Thermochemical Characteristics via Torrefaction Process.
4. Yu, Y., et al. (2016). "Pyrolysis of Rice Husk and Corn Stalk in Auger Reactor. 1. Characterization of Char and Gas at Various Temperatures." Energy & Fuels 30(12): 10568-10574.
5. Basu, P. (2013). Biomass gasification, pyrolysis, and torrefaction: practical design and theory, London, UK: Elsevier : Academic Press, 2013. Second edition.



Biography (150 word limit)

Jorge Lopez Ordovas is a PhD student at Aston University. He completed his studies in chemical engineering at University of Zaragoza, participating in the Erasmus program to go to University of Oulu in Finland in the course 2013/14. Back in Spain, he did an internship in Enagas in the R&D department and he completed the studies with his Final degree project called “Catalyst characterization by non-steady reaction techniques for methane dry reforming” in March 2015. He did an internship in SAICA working in a laboratory and in CIRCE as project manager assistant to write proposals for H2020 program. Lately, he studied a Master in Project Management while he was in DHL. Finally, he moved to United Kingdom in April 2017 to do the PhD as part of the GreenCarbon project.

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Notes/Comments: