

Accepted Manuscript

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PII: S0960-8524(18)31352-X
DOI: <https://doi.org/10.1016/j.biortech.2018.09.099>
Reference: BITE 20515

To appear in: *Bioresource Technology*

Received Date: 27 August 2018
Revised Date: 17 September 2018
Accepted Date: 18 September 2018

Please cite this article as: Fu, P., Yi, W., Li, Z., Li, Y., Comparative study on fast pyrolysis of agricultural straw residues based on heat carrier circulation heating, *Bioresource Technology* (2018), doi: <https://doi.org/10.1016/j.biortech.2018.09.099>

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Comparative study on fast pyrolysis of agricultural straw residues based on heat carrier circulation heating

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Abstract

Fast pyrolysis of agricultural straw residues based on ceramic ball circulation heating was studied by using an originally developed V-shaped drop tube pyrolysis unit. The yields of bio-oil, bio-char and pyrolysis gas from these straw residues were in the range of 41-46, 26-30 and 26-29 wt.%, respectively, with maize straw giving the highest bio-oil yield. A quadratic model was developed to correlate the cellulose-to-lignin-ratio (CLR) and hemicellulose-to-lignin-ratio (HLR) with bio-oil yield. For a given HLR above 1.12, the bio-oil yield continued to increase as the CLR increased. However, when the HLR was between 0.86 and 1.12, it tended to decrease first and then increase with the increase of CLR. In contrast with CS, the proportions of acids and ketones in the bio-oils increased by 13.3% and 14.8% for MS and 9.2% and 30.5% for WS, respectively, while the proportion of phenols decreased by 9.9% and 14.3%.

Keywords: Agricultural straws; Fast pyrolysis; V-shaped drop tube reactor; heat carrier circulation heating

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