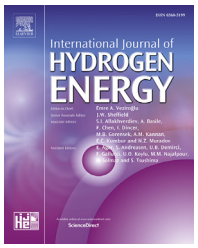
Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/he



Effect of Fe/Ca-based composite conditioners on syngas production during different sludge gasification stages: Devolatilization, volatiles homogeneous reforming and heterogeneous catalyzing

Qiang Zhang [a], Huan Liu [a,b,**], Xiuju Zhang [a], Geng Lu [a], Jiaxing Wang [a], Hongyun Hu [a], Aijun Li [a], Hong Yao [a,b,*]

[a] State Key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

[b] Department of New Energy Science and Engineering, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan 430074, China

ARTICLE INFO

Article history:
Received 27 June 2017
Received in revised form
23 September 2017
Accepted 13 October 2017
Available online 4 November 2017

Keywords:
Decoupling gasification
Sludge conditioners
Interaction
Catalysis
Syngas

ABSTRACT

The process of sewage sludge steam gasification can be divided into three stages: devolatilization, volatiles homogeneous reforming and heterogeneous catalyzing. This study investigated the direct and indirect impacts of Fe/Ca-based conditioners on syngas generation at different stages using a special decoupling reactor. The results show that the highest H_2 production for raw sludge gasification was 190 mL/g at 1273 K. The maximum promotion of H_2 yield was 51.2% for Fenton's reagent (Fe^{2+}+H_2O_2) addition at 1273 K and 132.5% for CaO addition at 1073 K. Among that, 52.8% and 62.9% of H_2 increment was attributed to the catalytic effect on devolatilization stage respectively. Fenton oxidation was conducive to the conversion and fixation of protein structure while the corresponding organic matter in CaO-conditioned sludge was aromatics. The catalysis of volatile reforming was proven an important process, thus reusing char/ash as bed material or cracking catalysts maybe a promising method for hydrogen energy production.

© 2017 Hydrogen Energy Publications LLC. Published by Elsevier Ltd. All rights reserved.

* *Corresponding author*. State Key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan 430074, China.

** *Corresponding author*. State Key Laboratory of Coal Combustion, School of Energy and Power Engineering, Huazhong University of Science and Technology, Wuhan 430074, China.

E-mail addresses: huanliu@hust.edu.cn (H. Liu), hyao@mail.hust.edu.cn (H. Yao).

https://doi.org/10.1016/j.ijhydene.2017.10.090

0360-3199/© 2017 Hydrogen Energy Publications LLC. Published by Elsevier Ltd. All rights reserved.