



Short communication

Novel utilization of conditioner CaO for gas pollutants control during co-combustion of sludge and coal

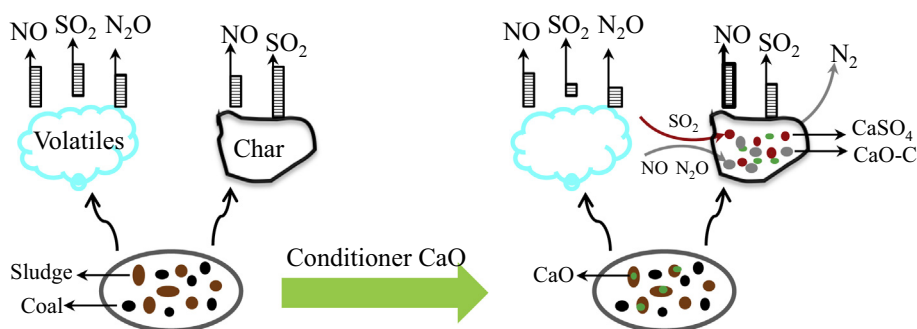


Qiang Zhang^a, Huan Liu^{a,b,*}, Xiuju Zhang^a, Haoxuan Xing^a, Hongyun Hu^a, Hong Yao^{a,b,*}

^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

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:

Received 3 March 2017

Received in revised form 8 June 2017

Accepted 9 June 2017

Keywords:

Co-combustion

Sludge

Coal

Conditioner CaO

Gas pollutants emission

ABSTRACT

CaO is a traditional desulfurizer used in coal combustion, and it is also a widely applied chemical conditioner in sewage sludge dewatering. In this study, the feasibility of co-combustion of CaO-conditioned sludge (Sc-CaO) and coal was discussed, including combustion characteristics and gas pollutants emission. The results show that adding 30% Sc-CaO into co-combustion strengthened the procedure of devolatilization and volatiles combustion (220–380 °C). But the main combustion performance (430–600 °C) was still similar to that of coal. Conditioner CaO could capture almost all the SO₂ during sludge mono-combustion and 15.8–48.4% of SO₂ during co-combustion. Meanwhile, conditioner CaO also contributed to N₂O catalytic reduction and mitigated the NO increase caused by the co-effect of raw sludge and coal at 900 °C. Compared with physical additive CaO, conditioner CaO distributed evenly in sludge matrix and partially bonded to carbon, which was benefit to SO₂ adsorption and N₂O reduction. At the same time, the increase of NO was more mild than that caused by physical additive CaO. This study shows that co-combustion of Sc-CaO and coal is a suitable and promising technology for clean disposal of sewage sludge.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

The safe disposal of sewage sludge is a challenge for developing countries. Combustion is regarded as an effective and clean

technology to reduce sludge volume, and simultaneously destroy the toxic organic constituents and recover energy [1]. However, it is difficult for sludge mono-combustion because of its complicated composition and low heating value. To keep the stable combustion of sludge, some high heat density auxiliary fuel such as coal is necessary to add for incineration [2]. Besides, the proportion of sewage sludge was limited to a relatively low level during co-combustion.

The combustion characteristics between sludge and coal were different. Compared with coal, sludge contained high volatile

* Corresponding authors at: 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).