

NAWTEC17-2340

RESEARCH ON FEASIBILITY OF DIFFERENT INCINERATION SYSTEMS FOR PAPER SLUDGE

Zhixiao Zhang

School of Mechanical
Engineering, Hangzhou Dianzi
University, Hangzhou 310018,
China

Jiade Ma

Zhejiang Hanjie Energy &
Environmental Engineering Co.
Ltd, Hangzhou 310012, China

Weimin Cai

Hangzhou Urban Construction
Design & Research Institute,
Hangzhou 310001, China

ABSTRACT

A large amount of paper is recycled in China, that generates a significant amount of sludge and residue during the paper production process. Energy recovery by means of combustion in Waste-to-Energy (WTE) plants can be a possible candidate for sludge elimination. Currently, two incineration methods, distinguished as either direct incineration of partially dewatered sludge (generally 80% water content) or dried sludge incineration (dried to about 40% water content), are available. Research on comparison of fixed cost, operating cost and pollutant emissions between the two systems is presented. Fixed cost and steam consumption increase for the dried sludge incineration system though this method possesses many advantages, these include the decrease in consumption of auxiliary coal, service power and flue gas purificants. Moreover, main pollutant emission, such as SO₂ and NO_x, is significantly reduced. Chinese WTE managing regulations recommend no less than a 4:1 weight ratio of waste to auxiliary fuel fed into the incinerator. For a partially dewatered sludge direct incineration system, this weight ratio is about 5:1. However it reduces to 3.6:1 in a dried sludge incineration system. This is offset by a decrease in consumption of auxiliary coal and the overall weight ratio based on the entire plant increases to 7.5:1. The result suggests not only the technical and economic feasibility of a dried sludge incineration method, but also the feasibility of adopting the weight ratio of waste to auxiliary fuel based on entire WTE plant in the future regulation in China.

1. INTRODUCTION

Paper recycling is the process of recovering waste paper and reproducing it into new paper products. More and more recycled paper has been used in China in recent years. During the recycled paper production process, significant amounts of

paper sludge and residue are generated. Paper sludge and residue mainly contain plastic, adhesive tape, packing tape, steel wire, fibre, etc. The moisture content of paper sludge and residue is very high, generally 60% to 80%. Landfilling has been the most common method for paper sludge and residue disposal in China. However, adverse impacts occur because of leachate and the high content of non-biodegradable and hazardous substances in paper sludge and residue.

Waste-to-Energy (WTE) application of paper sludge and residue, such as incineration, is usually preferable to landfilling since useful energy (for example heat and electricity) is generated with significant volume, mass and toxicity reduction. Paper sludge and residue incineration with power generation and heat recovery has been used in China in recent years. In order to encourage and supervise the WTE application, a regulation named "Managed Regulation of Ratifying Resource Integrated Utilization Encouraged by state" was issued by National Development and Reform Commission of China in 2006^[1]. This regulation suggests a no less than 4:1 weight ratio of waste to auxiliary fuel based on the use of a fluidized bed incinerator. WTE power plants complying with this regulation can obtain preferential tax rate and higher electricity sell price than fossil-fuel power plants.

Currently, two incineration methods, distinguished as either direct incineration of partially dewatered sludge (generally 80% water content) or dried sludge incineration (dried to about 40% water content), are available. Generally, the volume flow rate of the flue gas, auxiliary coal consumption and related operating costs associated with direct incineration of partially dewatered paper sludge method are higher than those of the dried sludge incineration method because of the high moisture content and low heating value of partially dewatered paper sludge. However additional equipment, construction and operating costs when using a