THE ENERGETIC REVALUATION, BY BURNING, OF THE COMBUSTIBLE SLUDGE RESULTED FROM THE PAPER PRODUCING INDUSTRY

Manuela Elena GEORGESCU[1*], Vasile MATCAŞU[2]

Abstract: The surrounding protection, in the present day conception, entails the development of new technologies for the revaluation of waste resulted from different industrial activities.

The paper presents the tests achieved in view of burning the sludge resulted from the paper producing industry and also the accomplishing conception of a steam-generating boiler, in order to highly energetic revaluate this sludge.

Keywords: Sludge, residue, low heat value, combustible substitute.

1. Introduction

To know the sources and the types of solid waste together with their composition and generating rate represents the research work base, with the view of an efficient design work and operating elements for a high revaluation of solid waste.

The waste could constitute combustible substitute, taking into account the necessity of the preservation of the natural resources of coal, oil and gas, if the energetic utilization doesn't create life and surroundings problems [1].

It has to take into account also:

- to keep clear of overcrowding the controlled depositing places (dump heaps).
- to dimension the surroundings risks (like uncontrolled dump heaps, the soil and water pollution), resulting both from the dump heaps and the combustion produce.
- to obtain thermal energy at lower prices.

The amount of the industrial waste fluctuates every year, taking a downward curve; this decrease is due to the drastically reduction of the coal mines activities, but also the metallurgic activities and electric power production.

[1] Conf.dr.ing., Mechanical Engineering Department, University "Politehnica" of Bucharest, Romania (*e-mail<manuelag@caz.mecen.pub.ro)
[2] Engineer, "Vrancart" Adjud, Romania

In Romania the industrial activities mainly generating waste are: the coal extractive industry, metallurgy, power production, oil refining, chemical industry, engineering, food industry.

The plurality of waste resulted from industrial and technological processes and the fact that those waste could be a danger of pollution of environment constituted the base of the research works made for the revaluation of the waste and their use in clean power production by cremation.

Some of those primary waste could be reinsert in connected technological processes, such as power production and thermal energy production, the new residues (secondary waste) being smaller quantitative than the initials.

The solid waste could represent a combustible substitute for power production and thermal energy used in the small communities and district area plant. This is a better revaluation than the simply cremation of that waste in the district incinerators.

2. The properties of solid waste

For a better evaluation of the necessary equipment for the burning or some other use of solid waste, it is necessary to know their physical and chemical composition [2].

The physical composition of waste includes:

- individual components
- density of waste
- humidity content.

The waste density depends of geographic place, season and stoking lasting. The humidity content of solid waste expresses usually like humidity mass per mass unit of dry or wet material. The method of measuring the wet mass expresses the humidity of sample like percentage of the wet material mass, but the dry mass method expresses the wet of sample like percentage of the dry material mass.

The humidity content is expressed in the equation below:

$$W[\%] = \frac{a-b}{a} \cdot 100$$

Where :
W- humidity content
a- initial sample mass
b- sample mass after drying process.

The knowledge about chemical composition of solid waste are important for the evaluation of alternative processes or recuperation options. If the solid wastes are used as combustible the most important properties are:

- the elemental initial state analysis,
- humidity (105^0C/h loss),
- the volatile matters (supplementary loss when heating at 950^0C),
- mineral incombustible mass or ash (after combustion residue),
- fix coal (the coke combustible substance),
- the temperature of ash fusion,
- the anhydrous state composition: C(carbon), H(hydrogen), O(oxygen), N(nitrogen), S(sulphur), A(ash),
- low heat value,
- organic chlorine.

The typical inactive residue and energetic values of solid waste maybe converted as follows:

$$\frac{kJ}{kg(dry\ basis\ ash)} = \frac{kJ}{kg(thrown\ out\ residue)} \cdot \left(\frac{100}{100 - \%ash - \%humidity} \right) \quad (1)$$

3. The power characteristics of waste

The combustible sludge resulted from the industrial pasteboard processing was analyzed and they were set out the following power characteristics strictly necessary for the combustion process:

- the elemental analysis of combustible waste
- the ignition temperature of waste
- the low heat value
- the residue after combustion analysis.

The characteristics of the sludge are shown in the table bellow (table 1):

Table 1

The characteristics of the sludge

Label	MU	Waste-sludge
Hygroscopic humidity	%	38,8
Ash	%	26,48
Combustible sulphur	%	0,1
Nitrogen	%	0,25
Organic carbon	%	14
Low heat value	Kcal/kg	1365
Ignition temperature	^{o}C	650
Ash-residue	%	97,5
Fix coal-residue	%	1,7
Moisture-residue	%	0,8

For the sludge resulted from the paper industry the first problem to solve is its drying process. In the dump heap (deposit) the sludge has an initial humidity of 90%. By draining and pressing process, the humidity lowers at 38-40%. This activity of preparing the waste, in order to incinerate it, is very important, but expensive, in the same time.

The experimental installation for the sludge draining and pressing is presented in the figure 1.

This final 30-40% humidity permits the sludge to be energetic revaluated by burning and the resulted residue is a non-biodegradable sterile which does not contain active elements for the ground-water layer (soil).

The elemental analysis of the sludge studied in this case is:

C^i =12.8%; H^i =1%; N^i =1%; O^i =18%; A^i =25.6%; W^i =41.6%

The low heat value is:

H^i_i =2402.2, kJ/kg

The considered steam-generator produces 18t/h steam, with an efficiency of 80%.

The fuel/combustible consumption is B=0.82 kg/s

The available heat (thermal power) is P=15MW

The furnace volume is $V=45m^3$

The heat loading of the furnace volume is $q_v=300kW/m^3$

The sludge burning installation is presented in figure 2.

After calculus[3] resulted, for a quantity of 0.82kg/s sludge, an addition of natural gas of $0.311m^3N/s$. The sludge needs for burning to be mixed with natural gas [3].

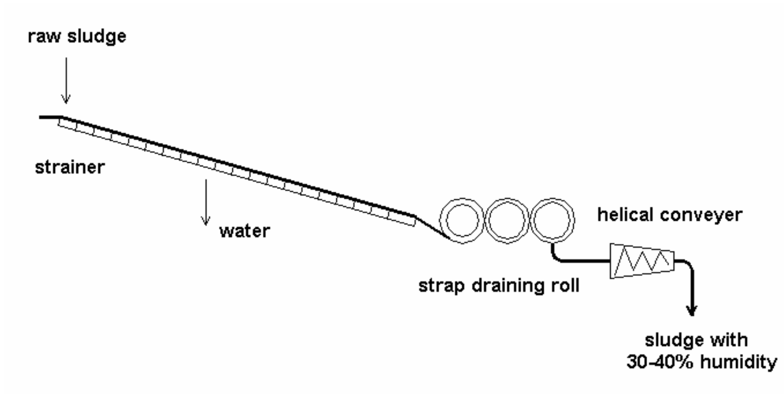

Fig. 1 Sludge drainage and pressing equipment

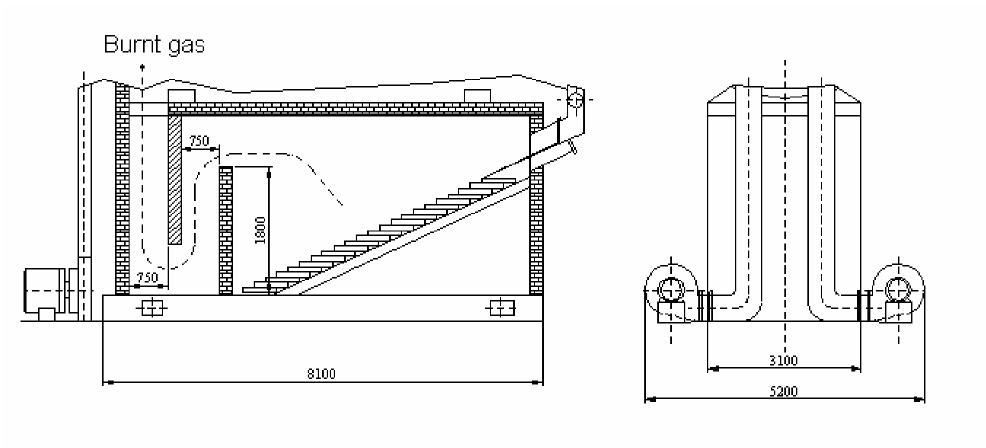

Fig. 2 The sludge burning installation

REFERENCES

[1]. *Manuela Elena Georgescu, and other*, The sources and characteristics of solid waste generated in Romania, with the view of high revaluation of their energy potential, 2and INTERNATIONAL CONFERENCE *METIME 2007*, Galati, Romania

[2]. *Manuela Elena Georgescu, and other*, The power characteristics of combustible waste and means of their dump heaping with the view of incinerate, 2and INTERNATIONAL CONFERENCE *METIME 2007*, Galati, Romania

[3]. *Lucian Mihăescu, Tudor Prisecaru, Manuela Elena Georgescu, and other*, Limitele poluării la arderea nămolurilor din industria hîrtiei, Conferința ETCNUR 2007, București, Romania.