MUNICIPAL WASTES AS A POSSIBLE ENERGY SOURCE FOR A CITY

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The principal ground for the application of the wastes treatment or elimination methodologies is not the reason that the wastes are a raw material source or an energy source, but the presence of theses methods have a high environmental impact. In the European Union the incineration of the municipal wastes, with or without the recovering of the flue gases resulted, represents one of the most important methodologies for the treatment and elimination of the municipal wastes. At the same time, using these proceeds we can realize an energetic revaluation of the wastes.

In this paper we have inventoried the energetic potential of the municipal wastes collected from a municipal community and we have determined the low calorific power of the collected wastes. Using these values, we have calculated the quantities of the fuel (conventional fuel) which would be saved applying the wastes incineration technology for a certain period.

The next conclusions resulted from the analysis that we have realized. It refers at the reason that the municipal wastes incineration has a triple effect on the environment:

- *it conducts to the physical elimination of the wastes;*
- *it reduces the environmental effects of the classic fuels utilization by conserving the existent raw materials, saving the fuel and obtaining the heat from the wastes incineration process;*
- *it assures a possible heat recovering from the flue gases resulted, characterized by a high thermal potential, which would evacuate to the environment an additional heat (simultaneous with the chemical pollution) affecting the ecological equilibrium.*

Keywords: municipal wastes, environment, recovering, fuel saving, incineration.

1. Introduction

The municipal wastes resulted from the municipal community, which include substances with different nature, have become a big problem because of their storage and treatment needs. The quantity and the quality of the municipal wastes depend on next aspects:

- the life and leaving level of the city inhabitants;
- season;

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• local climate;
• technology development (wrapper nature, domestic products).

The composition of the municipal wastes is very different. Their components can be group in tree principal fractions:
• fermentable organic matters;
• chemical inert matters, windows and metals;
• paper, plastic and textile matters.

The municipal wastes have different properties influencing the choosing of the treatment technology for their elimination. The most important are:
• the moisture content – it is an important parameter with a big influence on the calorific power and the decomposition of the fermentable matters; it varies with the nature of the wastes, with the nature of the place and with the season. His average value is between 25% and 60%.
• the calorific power – generally, for the wastes characterization the low calorific power it is used. This parameter has a dynamic character, depending on: life level, tendency of the people alimentation, rural or municipal character of the wastes and type of the wrapper. Based on this property it can be tackled the municipal wastes energy revaluation.
• carbon/nitrogen report – the municipal wastes contains milliards of termophile microorganismo germen/gram, which have the tendency to ferment very quickly. For the fresh municipal wastes this report is between 20 and 35.

2. The municipal wastes environmental impact

The reason of the application of the municipal wastes treatment and elimination technologies is not the fact that these represent a raw material source or an energy source but the fact that their presence has a big environmental impact. By their evacuation in the air, each previously presented fraction produce problems (rodents and insects procreation, fermentation gases discharge, no biodegradable fraction accumulation), many of them producing a negative effect on the people health.

The wastes incineration, with or without flue gases recovering, is one of the most important treatment and elimination technologies applied in the Union Europe. In the same time, this technology gives the possibility to an energy revaluation of the wastes.

2.1. Characteristics of the municipal wastes incineration

The incineration represents a main elimination screw considering the characteristics of the municipal wastes that can be eliminated applying this proceeding and also the normative regulations which enforce it like a treatment method. The incineration can be defined like a process used to reduce volume and

the waste noxious potential, tacking place in an enclosure and which is based on the physic phenomena: vaporization, sublimation and chemical phenomena: pyrolysis, combustion.

This proceeding is recommended to the treatment of the wastes with high hydrocarbons content, more or less rich in halogens, sulphur and cyanides. For a total efficiency, this wastes elimination methodology must not conduct to other noxious elements, which could form a pollutant transfer. For this reason, the wastes treatment must being a total process giving attention to the physical-chemical phenomena, which happen out of the furnace during the evacuation of the gaseous, of the liquid and solid wastes, generated by their combustion.

The global efficiency of the furnace-boiler aggregate has values between 30 and 80%. The slam resulted from the combustion process represents 10% by the wastes volume and its grading varies between 0 and 30 mm. It is rich in metallic elements and windows fragments. The slam is used to the new technologies for the construction materials manufacturing, to the hydro technical arrangements.

The temperature of the flue gases resulted from the burning point of the furnace has values between 900°C and 1000°C, but when the gases arrive in atmosphere their temperature must be in range of 150°C - 300°C. To rich these temperature values, the gases must be cooled, operation made with the recuperation of the sensitive heat contained by the gases.

The complex composition of the wastes is also reflected in the composition of the flue gases resulted by the toxic produces and by the no fuel metals. The cooling and the treatment of the gases must be realized according to international laws and prescriptions. These flue gases resulted from the wastes incineration are more dangerous than the flue gases resulted from the conventional fuels combustion because they are chemical combinations of the chlorine and flour with the oxygen. From these the dioxins are the most dangerous.

The dust can contain mineral substances (mercury, cadmium), but also organic substances (dioxins) with a very high noxiousness. The Table 2 presents a type analysis of a free ash sample contained by the flue gases. Generally the percent of the ash is about 10 – 20%. The flue gases treatment requires investigations that can conduct to a rising of the installations initial cost with 30-40%, by example:

- grids used for the cleaning of the flue gases to retain the chlorine and sulphur compounds;
- grids used for the chemical treatment (active carbon with catalysts) to eliminate the dioxins;
- magnetic grids used for the metallic elements separation from the ash.

3. Energy revaluation of the municipal wastes – case analysis

In this paper it is realized an inventory of the municipal wastes evacuated by the analyzed city and we will analyze two possibilities for the energy revaluation of the municipal wastes.

3.1. Direct combustion in presence of a base fuel

Because we didn't measure the calorific powers of the wastes compounds, wastes that were collected in the analyzed city, we have estimated these values from the technical literature. Based on these values and for the analyzed period we have determined the calorific power of one waste tone and the fuel quantities (conventional fuel) that could be economized by the wastes incineration.

The corresponding dates for the municipal wastes, collected from the analyzed city in the analyzed period 2004-2005, and the structure of these wastes are presented in table 1.

Table 1

Wastes quantities for the Zalău

Wastes composition	Quantity (tone)		
	2004	2005	2006
thin particles	0	0	43700
organic wastes	40261	46585	18246
non-classified non-fuel materials	0	0	
plastics	512	592	108
windows	384	444	300
paper	981	1135	0
textiles	0	0	0
sanitary textiles	0	0	0
cardboard	0	0	400
metalls	427	493	100
non-classified fuel materials	0	0	9353
composites	85	97	20047
Total	42650	49346	92254

Based on the wastes composition and on the calorific powers, specific to each wastes component, we have determined the low calorific powers of the municipal wastes collected in the analyzed period. These values are presented in table 2.

Table 2

Wastes structure and the calorific power

Wastes composition	Composition (%)			Calorific power (kWh/t)		
	2004	2005	2006	2004	2005	2006
thin particles	0.00	0.00	47.37	64	64	64
organic wastes	94.40	94.40	19.78	195	195	195
non-classified non-fuel materials	0.00	0.00	0.00	0	0	0
plastics	1.20	1.20	0.12	671	671	671
windows	0.90	0.90	0.33	0	0	0
paper	2.30	2.30	0.00	725	725	725
textiles	0.00	0.00	0.00	59	59	59
sanitary textiles	0.00	0.00	0.00	59	59	59
cardboard	0.00	0.00	0.43	725	725	725
metalls	1.00	1.00	0.11	0	0	0
non-classified fuel materials	0.00	0.00	10.14	68	68	68
composites	0.20	0.20	21.73	0	0	0
Total	100.00	100.00	100.00	208.80	208.81	72.81

Table 3 presents the annual wastes quantities (for 2004 and 2005) and the energy contained by these wastes.

Table 3

Energy revaluation

Year	Wastes mass (t)	Energy produced by combustion (MWh/year)	Annual fuel economy tcc/year
2004	42650	5343,403	729,474
2005	49346	6182,509	844,028
2006	92254	4030,342	550,217

Note: We have considered an average efficiency of the incinerator equal with 60%, 90% - the efficiency for the installation using conventional fuel and the value for the calorific power of the economized conventional fuel equal with 29300 kJ/kgcc.

3.2. The resulted flue gases recovering

Taking into account the high thermal level, the flue gases resulted from the municipal wastes incineration can be considered secondary energy sources with high temperature, existing many possibilities for the recovering of their sensitive heat, but which can be realized only after a preceding treatment, due to the reasons up mentioned.

The internal recovering of the flue gases can be realized direct in the wastes combustion installations, after they pass through the filters and after they are chemical treated, conducting to the rising of the combustion installations productivity. The sensitive heat contained by the flue gases can be recovered for:

- wastes drying for improving the combustion conditions - the flue gases with 800°C temperature can be diluted with the gases more colder from the out zone having 250-300°C temperature. In this way a mixing with temperature by 500-550°C results and the wastes pyrolysis is avoided that could have negative effects by the volatiles eject.
- preheating of the air combustion for the improvement of the installations combustion conditions.

The external recovering can be done in the next way:

- to thermal goal – the flue gases can be used in recovering furnace, heat water producing (domestic water, sanitary water) and/or hot water producing, water that is used for the urban and industrial producers.

4. Conclusions

In case of the analyzed city, for the established period, the collected quantity of the municipal wastes has increased. This aspect will reflect by the energy quantity that is possible to be recovered in the incineration process and in the economized fuel. Those, taking in account that the municipal wastes have always approximately the same composition; we can say that the energy possible to be recovered in 2005 is bigger than the energy obtained in the 2004.

Although the municipal wastes quantity collected in 2006 is bigger than the quantity collected in the previous years, the energy possible to be recovered by the incineration of the wastes is smaller due to the different structure of the wastes (according with the situation presented in table 2 the content of the paper and organic wastes decreases).

In fact, the municipal wastes revaluation is the result of the ecological necessity of their elimination. The existence of the wastes in the atmosphere conducts to the modification of the ecological equilibrium.

The municipal wastes incineration has a triple environmental effect:

- physical elimination of the wastes;

- decreasing of the fuel using effects on the environment by the existent reserves conservation;
- possible recovering of the physical heat of the flue gases with high thermal potential, that could reject in the air a double supplementary heat quantity (in the same time with a chemical pollution), fact that will conduct to a modification of the ecological equilibrium.

The economical quantification of the ecological effect of the municipal wastes elimination and of the energy recovering must taking into account the taxes paid in case of the overfufilments of the admissible pollutants limits, established by the existent regulations, and the collected taxes for the waste-dump.

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