



11–12 October 2012, Riga

**Riga Technical University
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Dedicated to the 150th Anniversary and
The 1st Congress of World Engineers and
Riga Polytechnical Institute / RTU Alumni

DIGEST

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Slow Pyrolysis Waste-to-Energy Technology for Latvian Market

Vjaceslavs Lapkovskis (*Riga Technical University*), Viktors Mironovs (*Riga Technical University*), Karlis Zarins (*Orions Siltums SIA, Latvia*), Giovanni Codenotti (*Officina Meccanica di G.Codenotti, Italy*).

Keywords – slow pyrolysis, wastes, pyrogas, district heating.

I. INTRODUCTION

Normally any organic substance (oil, plastic, wood, paper, rubber, cloth, animal waste biomass, sludge etc.) heated above a certain temperature, about 200-300 °C, spontaneously ignites and burns, which always occurs in presence of the air (or in oxidizing atmosphere). If the heating is carried out in a special container in the absence of oxygen the substance does not burn but partially gasifies and partially transforms in char [1,2].

At higher temperatures (around 700-800°C), a total gasification of organic substances occur. The gas (pyrolysis gas or pyrogas) produced by the conversion of certain organic substances possess excellent characteristics that allow its further usage as a fuel to support the process and to recover the excess energy as a part of waste-to-energy approach.

II. THE SLOW-PYROLYSIS PROCESS

The following figure illustrates a principle of slow pyrolysis process for municipal and industrial waste treatment.

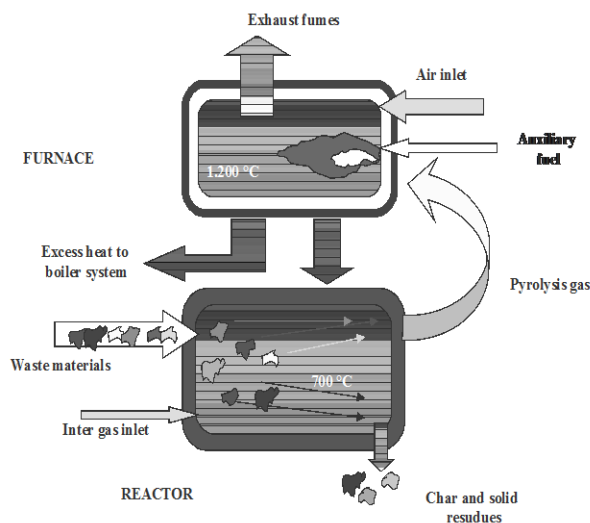


Figure 1. Schematic of slow-pyrolysis process developed by Latvian-Italian joint group.

III. INDUSTRIAL REALIZATION

Several customized pyrolysis plants have been constructed in Italy and in Europe. An average capacity of municipal solid waste processing plant is 1-2 t/h, however it can be scaled-up to 12-16 t/h of processed waste materials. In most cases, a pretreatment of raw wastes is necessary for higher efficiency of pyrolysis process and in order to ensure better characteristics of pyrolysis gas. The produced pyrolysis gas can be used either for heat production in

district heating systems or for industrial application (further gasification). In the following figure (Fig. 2.), an overview of pyrolysis reactor is shown (length 16 m, diameter 0.8 m, production capacity 0.5-1.5 t/h).



Figure 2. Slow pyrolysis waste processing plant. Pyrolysis reactor (kiln).

Some characteristic parameters of pyrogas obtained from mixed organic materials (humidity 30%, organic part 40%, pyrolysis temperature ~600°C) are shown in Table 1

Table 1. Parameters and composition of pyrogas obtained by slow pyrolysis process.

Parameter	Values
Flow, Nm ³ /h	2400 – 4200
Temperature, °C	400 – 650
Density, kg/m ³	1.2 (0 °C, 1 atm)
Composition, (% by vol.)	CO ₂ ~ 5% CO ~ 10% H ₂ ~ 2% N ₂ ~ 60% H ₂ O ~ 6% Hydrocarbons (C ₁ -C ₄) ~ 15% Hydrocarbons (C ₅ -C ₁₀) ~ 2% Fly ash: 200 – 350 kg/h (mainly char ~ 20 g/Nm ³)

IV. CONCLUSIONS

A slow pyrolysis process can be considered as an alternative to waste incineration. It can be used for thermal treatment and decontamination of metallic wastes and contaminated soils (oils removal), as well as for processing of organic wastes of different origins.

V. REFERENCES

- [1] N. P. Cheremisinoff, *Gasification Technologies. A Primer for Engineers and Scientists*. Taylor & Francis Group, 2005, p. 336.
- [2] V. Lapkovskis, "Report: Chemistry of Slow Pyrolysis (University of Cagliari)," 1999.