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Review

Methods Used in Urban Waste Treatment

BURDUHOŞ P., I. OROIAN,* M. PROOROCU, Antonia ODAGIU, I. BRAŞOVEAN

University of Agricultural Sciences and Veterinary Medicine Cluj - Napoca, Mănăştur St., No. 3 - 5, 400372 Cluj-Napoca, Romania

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Abstract

The paper presents the main options aiming the treatment of urban waste consisting mainly of the household and those resulting from industrial activities, acordin to the present EU legislation. The aspects of the two major types of waste treatment, mechanical biological treatment and incineration respectively are described. Distinction is made between mechanical and biological treatment of aerobic and anaerobic issues being addressed and biological drying process. The result of these processes is reflected in obtaining products that can be used as soil improvers. With regard to incineration, the basic components of industrial installations for the purpose, and usability of products resulting from their processing, most often, various types of solid fuel are presented. The paper also highlights the importance of these treatments in efficient waste management planning.

Keywords: mechanical-biological treatments, incineration, soil improvers, combustibles

1. Introduction

The present study aims to emphasize the treatment methods used in urban waste treatment in UE, acoording to the prevention, recycling, treatment and elimination principle. The present EU legislation [4, 5, 6, 7] represents the basis of implementing this methodology (EU Directives, and Directive 2008/98 that rationalize and fulfill the present legislation). According to above mentioned, the specific operations for processes of prevention of waste production, to which are added those of waste reusing, recycling, recovering and eliminating in safe environmental conditions, involves the mentioning of the following details:

- definition of material types that can be recovered
- nomination of stuff quantities that can be recovered
- definition of energy type that can be produced
- nomination of quantities and nature of the residual that fits to soil deposition.

2. Techical and economical issues

The urban waste management, reprezented by household waste and those resulted from economic activities developed in towns represent the responsibility of municipality who generated them. The authorities have as duty thewaste collection and aimed at finding solutions to their storage and disposal. The problem is even more acute as the amount collected can reach very high values. For example in England in 2008 were 34.8 million tons of waste generated [10] U.S. urban centers in 2009, were collected over 190 million tons of municipal waste [9], and for the year 2010 in China expected collection of over 180 million tonnes [1]. At the international level are charged various waste

* Corresponding author.
Tel.: 0040 264 596384; Fax: 0040 264 593792
e-mail: neluoroian@gmail.com

treatment methods that include both mechanical and biological treatments (fig. 1 and 2) and incineration (fig. 3 and 4).

I.The mechanical-biological treatment

The industrial waste processing by mechanical-biological treatment can be achieved by anareobic, aerobic, by combining the two, as well as through biological drying process [2, 3]. Aerobic treatment is suitable for: recyclable materials, residual fuel, organic biostabilized materials used in compost production. The material result of applying the treatment can be used successfully for soil remediation, through its storage in the soil [2].

The anaerobic treatment of recyclable materials processes and/or waste fuel, biogas and organic matter, which are biostabilized through this way and, as well as products from anaerobic treatment can be used by storage with aim of soil remediation [2].

The mixed treatments consist in applying an anaerobic process followed by aerobic process to recyclable materials and/or waste fuel, biogas and organic materials that are thus stabilized and can also be used for soil remediation.

The biological drying pretreatment is a process which converts municipal solid waste into solid fuel used in thermal treatment processes [3].

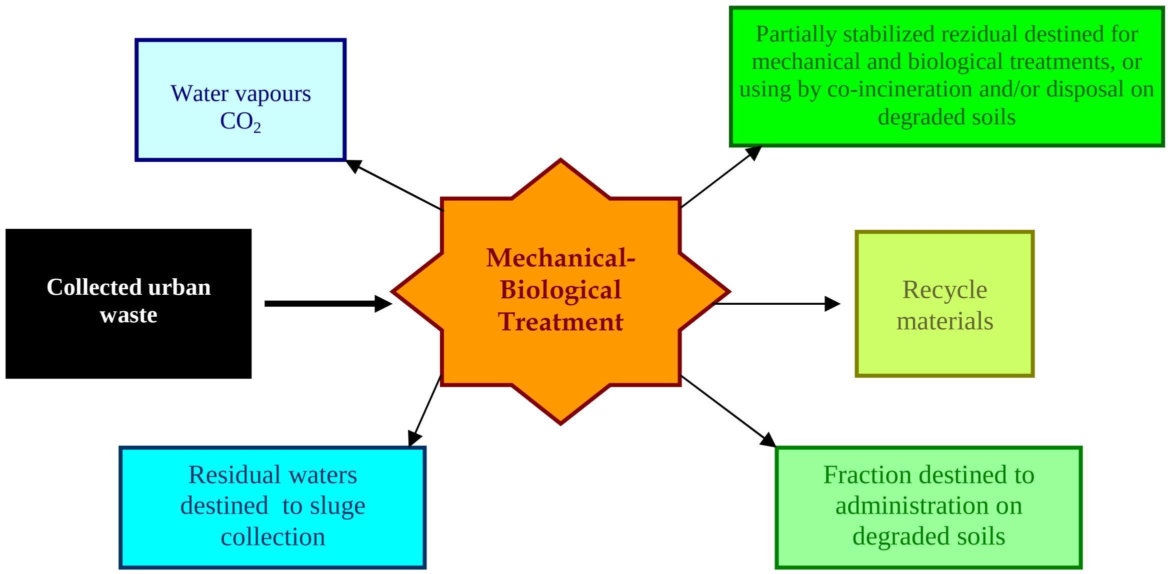

Figure 1. The principle pattern of the mechanical - biological treatment

I.1.The aerobic mechanical-biological treatment, involves the followings stages:

- material separation
- aerobic biostabilization of the biodegradable organic fraction
- refining of biostabilized organic compounds and the existence of a separation unit where recyclable materials mey be recovered (paper, plastic, glass, metal etc.) and/or secondary fuels, eg. paper and plastic. Biodegradable materials are separated from the rest of the waste, mixed in proper proportions with green waste (wood and/or yard waste)
- mixing with sludge from the wastewater treatment unit and introduction in aerobic biostabiliztion unit. Resulting organic compounds are subject to a period of 4-7 weeks decomposition under controlled conditions including monitoring of moisture content and temperature.

The product may be directly used as degraded soil improver [2].

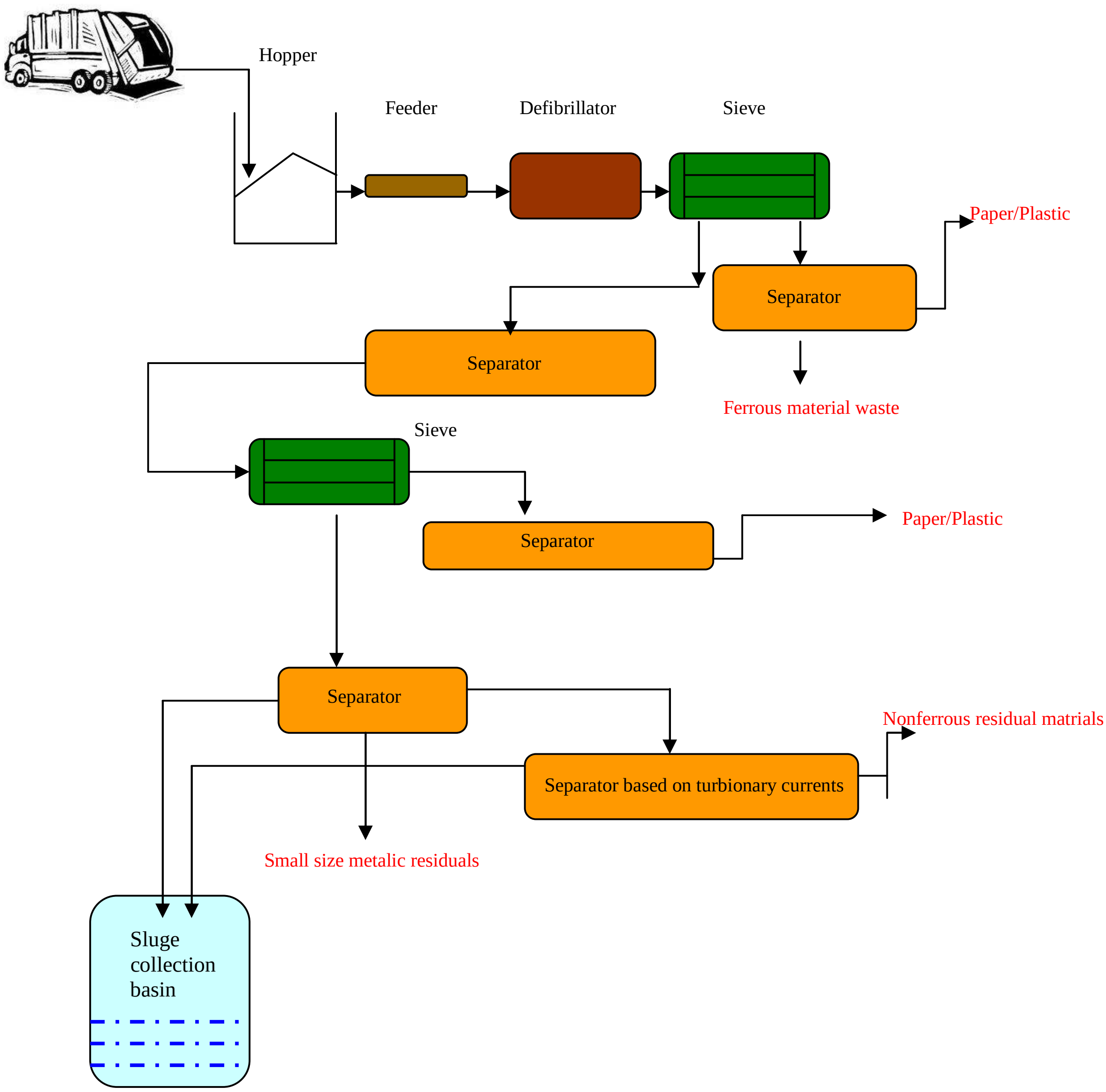

Figure 2. The general pattern of a mechanical - biological treatment

I.2. The anaerobic mechanical-biological treatment,

It is similar to the process described above, but decomposition takes place under anaerobic conditions. The anaerobic systems are:

- solid (containing low, medium and high solids), depending on the degree of dilution and synthetic intermediates
- mesophilic (30 - 40^{0}C) or thermophilic (50 - 65^{0}C), depending on the operating temperature
- with one or more stages, depending on the number of reactors used.

Most of the anaerobic systems in use today are those with a high-solids content followed by thermophilic ones with a single step, with retention times ranging from 14 to 20 days [2].

I.3. The biological drying

It is a pretreatment process of municipal waste to solid fuel making them recoverable. The waste is crushed, and their moisture content is reduced by drying aerobic less than 15%. Ferrous and nonferrous metals are recovered (e.g. aluminum), and the fuel is obtained sis eparated by recoverable residues. The energy required for drying is generated by aerobic exothermic decomposition of biodegradable organic compounds. In Europe does not exist yet indiustrial installations that use this raw material [3].

II. Incineration

In accordance with the Framework Directive 2008/98, the incineration of waste should be done in terms of quantity limits for energy efficiency. In this context, it should be noted that only facilities intended exclusively for electricity production can not meet these limits [8].

For industrial waste incineration facilitieshave as basic units:

- the incinerator
- boiler
- flue gas treatment system

Exhaust of combustion is achieved through a heat exchanger, and heat transfer is used to produce steam. The steam is then used to generate electricity. Proper combustion practices (higher combustion temperatures of 850 ^{0}C, held for at least 2 and the presence of more than 6% oxygen), combined with the use of appropriate treatment systems, such as activated carbon filters (injection activated carbon, followed by fabric filtration) have the ability to reduce emissions of dioxins and furans at low levels. BAT are applicable under revision.

The basic criteria of the assessment of municipal waste treatment technology are the possibility of using their products.

Those possibilities of using products resulting from their processing, include field administration to improve degraded soils, combustion in furnaces which are within the structure of cement production facilities, and co-incineration with fossil fuels.

All these uses have advantages and disadvantages.Administration directly on degraded soils to improve their quality:

- costs are not justified
- to production cost is added the cost of placement on the floor
- progressive reduction of the quantities of biodegradable material for placing on degraded soils should be less than 30%
- the sole benefit is the metal recovery

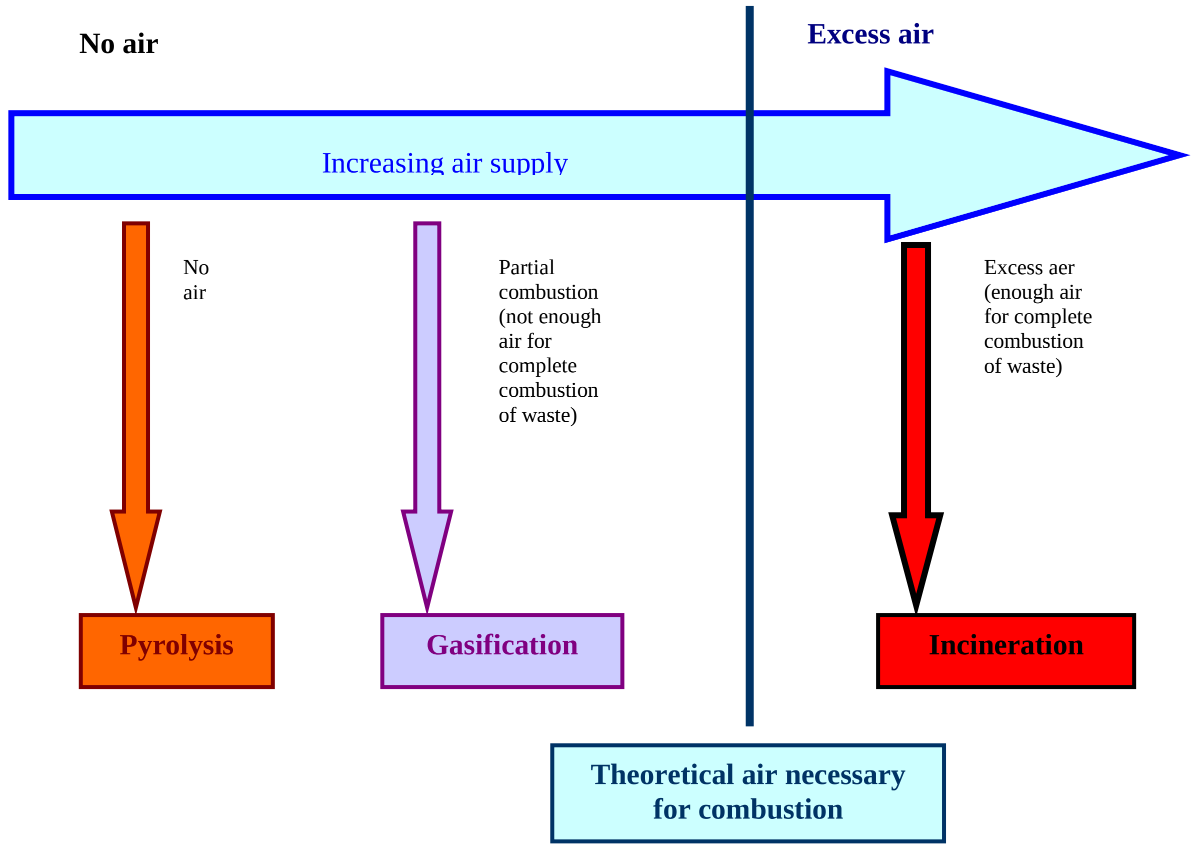

Figure 3. The principle pattern of an incineration process

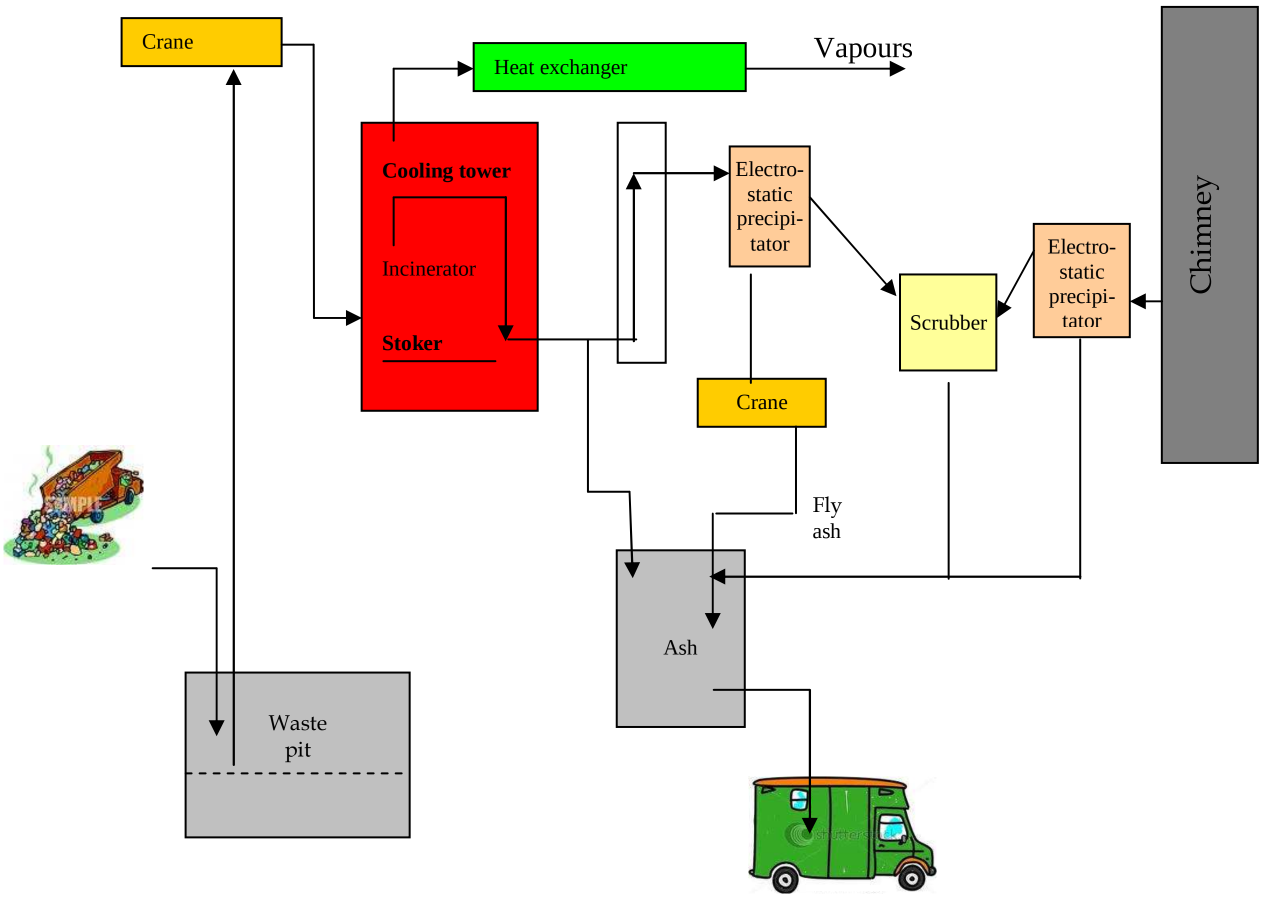

Figure 4. The general pattern of an incineration instalation

Use in cement kilns burning:

- cement industry can absorb limited amounts of secondary fuels, furnace operating problems
- replacing fuels included in the conventional category

Co-incineration with fossil fuels:

- emission control system of the entire plant must be upgraded to current standards
- the process is expensive and increases the energy consumption, which could be expected from its use
- the incineration of toxic dust mixture with large amounts of coal ash or coal combustion creates a costly system management the problem of air pollution control resources.

3. Conclusions

Processing of municipal waste can be accomplished in several ways, with more or fewer benefits. The mechanical - biological aerobic is the least expensive and its use is compatible with all waste management directives, including Directive 2008/98 [7], while mechanical treatment - anaerobic biological is more expensive, compared to the aerobic treatment.

The incineration is more expensive than aerobic mechanical - biological treatment but the technology used worldwide.

The burning fuels, obtained by drying the biological drying is not a practical option, because it is considerably more expensive compared to incineration and less direct energy efficient.

For solutions regarding the use of urban waste treatment products, we emphasize that in cases of solid fuels resulting from their processing used to restore soil, they do not met the requirements of Directive 1999/3 [4]. In addition, this operation is considered by Directive 2008/98 [7] as having a lower priority.

The possibilities of urban waste treatment and especially the possibility of using these treatment products in various aims (e.g. degraded land improver, fuel) represent important contribution to efficient planning of waste management in any EU country.

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