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BIODEGRADABLE WASTE IN THE CURRENT ECONOMIC CONTEXT OF ROMANIA - CHALLENGES AND SOLUTIONS

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Abstract

Considering that, in the municipal waste composition, about 50% of the total is biodegradable waste and because there are also important quantities of other categories of organic waste such as: green waste, sludge from waste water treatment plants, animal waste, agricultural waste, etc., the problem of biodegradable waste in the current economic context of Romania is complex and vast. Agricultural land is continuously degrading, 95% of municipal waste goes directly to the landfill, a large number of existing composting facilities are not in use, lack of legislation (Romania is one of the only three countries in Europe that do not have composting legislation), and these are just a few examples of the challenges our country is facing today. To meet these challenges, our country needs to take urgent measures to address the issue of biodegradable waste. This article aims to highlight both the problems and the solutions that can solve these problems in correlation with the best available techniques as well as with the tendencies and the legislation at European level All these, adapted to the Romanian specifics.

Key words*: biodegradable waste, end of waste, circular economy.*

ACTUAL CONTEXT

Earth's population is growing exponentially. Primary resources are limited and become more and more difficult to obtain. Degraded land areas are growing at European and world level.
To address the growing demand for food, new approaches are needed to take into account the re-use of residual bio resources (co-products, by-products, organic waste, sewage sludge, etc.). Romania, unfortunately, not only makes no exception, it is even a negative example in terms of waste management in general and waste bio resources in particular.
Considering that, in the municipal waste composition, about 50% of the total is biodegradable waste and because there are also important quantities of other categories of organic waste such as: green waste, sludge from waste water treatment plants, animal waste, agricultural waste etc., the problem of biodegradable waste in the current economic context of Romania is complex and vast. Agricultural land is continuously degrading, 95% of municipal waste goes directly to the landfill, a large number of existing composting facilities are not in use, lack of legislation (Romania is one of the only three countries in Europe that do not have composting legislation), and these are just a few examples of the challenges our country is facing today.

	Compost = PRODUCT or WASTE	Legal basis or standard	Main criteria for 1) compost ceasing to be waste and/or 2) placing on the market and use of compost even under the WASTE regime
			Test on Pathogens
PT	PRODUCT	NP 1048 – Standard for fertilisers Portaria 672002 pg. 436	Compost is interpreted as organic soil amendment *"Corrective organico"* There are no specific regulations available.
RO	---	---	NO provisions for compost
SE	WASTE	Private QAS and SPRC 152 (compost standard)	Waste Criteria: definition according to European court of justice. The compost standard is managed by the Swedish Standardisation Institute SP)

Figure 1. Waste and product approaches table extract

Addressing the issue of organic waste will help solving a lot of problems starting with decreasing of landfilling, a better organic waste management, closing the chain (circular economy), creating new markets for local products, creating jobs.
In this context, the paper aims to highlight both the problems and the solutions that can solve these problems in correlation with the best available techniques as well as with the tendencies and the legislation at European level.

CHALLENGES

In order to have a 360-degree image of the actual situation in Romania, we have to refer at each main organic waste category separately.

1. Municipal waste and similar waste

In the National Plan for Waste Management, issued on January 2018, data used refers to the 2010 – 2014 period.
Main data and information sources are: National Institutions having roles in waste area, National Institute of Statistics, EUROSTAT, JASPERS – waste related projects (Jaspers, 2012; Jaspers, 2013; Jaspers, 2016), information from County Councils, other actors in the waste area, terrain visits. According to this data, the annual generated quantities of waste are according to the table 1.
In the same time, domestic and similar waste collected by sanitation operator's waste composition is characterized by a high percentage of bio-waste, according to Figure 2. Regarding the composition of parks and garden waste, main fraction is represented by bio waste (in the analysed period, the percentage varies between 83.4% and 99.8% with an average of 93%.

Table 1. Generated municipal waste, 2010-2014

Types of municipal waste	Municipal waste quantities (ton/year)				
	2010	2011	2012	2013	2014
Municipal waste (mixed and separately collected)	3,367,325	2,955,517	2,654,525	2,817,947	2,900,695
Similar waste (mixed and separately collected)	1,176,870	917,794	852,591	874,591	902,144
Waste from parks and gardens	123,514	100,700	95,223	97,204	70,134
Markets waste	81,773	90,024	71,270	61,330	54,170
Street waste	343,550	294,478	313,823	391,168	340,948
Municipal waste (generated and uncollected)	1,250,112	857,650	1,056,687	828,564	687,985
Total municipal waste generated	6,343,144	5,216,162	5,044,121	*5,070,805*	*4,956,075*

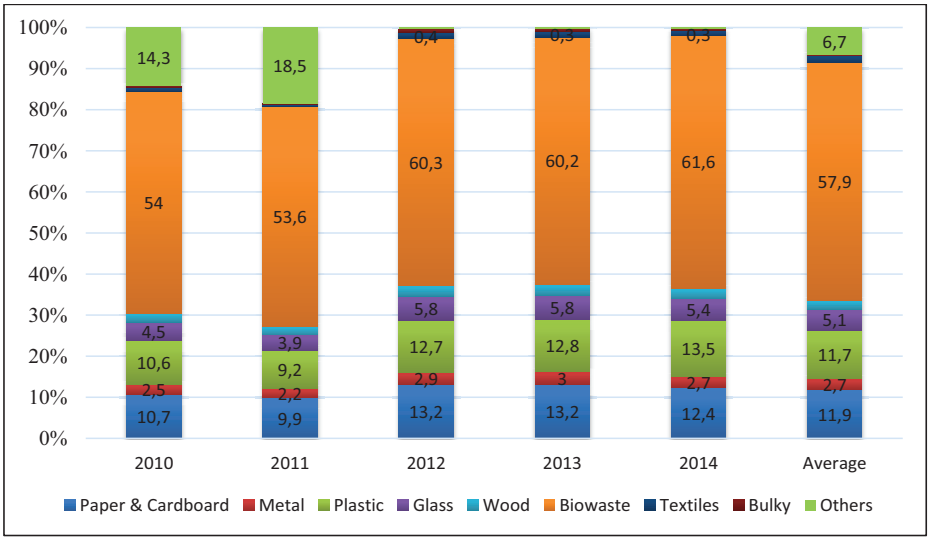

Figure 2. Composition of domestic and similar waste collected by sanitation operators, 2010-2014

Market waste composition is characterized by bio waste as main fraction too with 70%, the rest being recyclables.
Street waste contains less bio waste (in average 60%) and the rest being recyclables.

Regarding waste generation index, it shows lower values in the case of Romania compared with EU-28 according to EUROSTAT as shows Table 2 presented below.

Table 2. Waste generation index in Romania and EU-28

Waste generation index	2010	2011	2012	2013	2014
Romania (kg/year/capita)	313	259	251	254	249
EU-28 (kg/year/capita)	503	496	485	477	474

In accordance with the provisions of HG 349/2005 on the waste landfilling, biodegradable waste is defined as waste that undergoes anaerobic or aerobic decomposition, such as food or garden waste, paper and cardboard.
Thus, biodegradable municipal waste is found in all municipal waste categories, namely:

- Domestic waste and household waste - bio waste, paper and cardboard waste, wood waste and the biodegradable fraction of textile and bulk waste;
- Waste from gardens and parks - bio waste;
- Market waste - bio waste, paper and cardboard waste and wood waste.

Table 3. Biodegradable waste generation index in Romania

	Quantity (Million tonnes/year)				
	2010	2011	2012	2013	2014
Generated municipal waste	6.34	5.21	5.04	5.07	4.95
Generated municipal biodegradable waste	4.30	3.45	3.92	3.93	3.84

Taking into account the data presented above, we can see that over 60% of domestic and similar waste consists of biodegradable waste and, even if the total amount of municipal waste is decreasing, the percentage of biodegradable waste is increasing (from 68% in 2010 to 78% in 2012 and stays at quit the same value in 2013 and 2014).
In the same time, according to data form National Agency for Environment Protection, material recycling rate of the was about 5% from the total treated waste.

Because Romania has assumed that the recycling target by 2020 will be ten times higher (50%) relative to the total quantity (expressed in tonnes) generated in 1995 which was 4.8 million tonnes, we can conclude that, at this moment, Romania is in a difficult situation regarding municipal waste and the main problem for reaching the target is generated by the main fraction of municipal waste – biodegradable waste.
To deviate as much biodegradable waste as possible from landfilling, Romania is currently using three ways to treat it:

- Composting;
- Recovery by co-incineration;
- Mechanical-biological treatment.

As we can see, at present, no anaerobic digestion plant for municipal waste is in operation in Romania.
According to National Plan for Waste Management, composting is, currently, the most widely used method.

2. Sludge from Waste Water Treatment Plants

Due to the updating of the sewage treatment technology and the increase in the degree of connection of the population to the urban sewerage systems, there is a significant increase in the amount of sludge generated between 2010 and 2014, from 82,000 t dry matter in 2010 to 192,000 t dry matter.
According to data published by the National Institute of Statistics, about 6% of the total treated sludge in 2014 was used in agriculture, but the most important part (around 75%) was landfilled or stored on its own platforms.
So, these days, sludge is representing a big problem for our country. The lack of legislation on sludge (Ordinance 344/2004 on the use of sludge in agriculture is outdated) as well as for compost, low tariffs for wastewater treatment, the lack of reaction of operators of waste water treatment plants, the difficult implementation of financing programs in European or governmental funds have led to the accumulation of impressive amounts of sludge in recent years.
Certainly, sludge from waste water treatment plants has some agronomic value due to its loading with nutrients and microelements.

However, it should also be borne in mind that it also contains many other elements harmful to the environment (metals, pathogens, volatile organic compounds, weed seeds etc.) which make it unusable on land of any kind without being previously treated using the best available technologies.

3. Agricultural waste

Another important category of biodegradable waste is represented by agricultural waste. Every year, large amounts of waste are generated due to agricultural activity.
Whether it's vegetal waste, whether we're talking about manure, this waste is a real challenge for farmers.
Agriculture is a growing branch of the Romanian economy and, therefore, the amount of specific waste is increasing. Farmers around Romania are still using old methods for disposal of agriculture waste.
For Manure, legislation in force is transpose European Union legislation.
Regarding the environmental impact of manure landfills there are two European directives to be taken into account: the Council Directive 91/766 / EEC of 12 December 1991 on the protection of waters against pollution by nitrates from agricultural sources and the Council Directive 96/61 / EEC of 24 September 1996 on Integrated Pollution Prevention and Control.
Nowadays, manure is still applied directly to the land, situation that comes together with all the associated problems: VOC emissions, bad smell, pathogen contamination risk, weed seeds spreading etc.

OTHER CHALLENGES

Together with the technical, operational and financial challenges, Romania is facing some logistic problems such as: no data regarding financing sources of some projects mentioned in the National Waste Management Plan in force since January 2018 (we are talking about plans to build several AD plants), many facilities for waste management have no operators or have been poorly dimensioned etc.

A good example in this respect is the composting facilities designed to treat all kind of organic waste.
The Romanian Compost Association has conducted at the end of 2017 a study on composting capacities. The results are presented, in the figures 3 and 4.
Figure 3 shows in yellow existing facilities in operation, in red existing but not operational facilities (mainly due to lack of operators) and in blue the under-construction facilities.
As we can see in Figure 4, the situation of composting capacities in Romania is pretty bad. From a total capacity of about 1.4 Mt/y, only 8.7% (0.12 Mt/y) are in operation and a huge per cent are ready but currently are not in operation.

Figure 3. Composting facilities in Romania

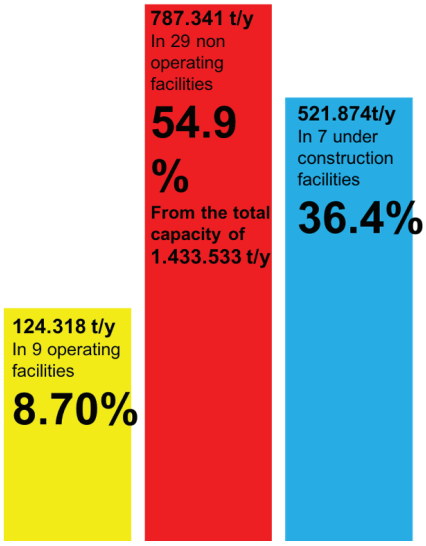

Figure 4. Composting capacities in Romania

SOLUTIONS

Taking into consideration all the aspects presented below, we can say that there is no solution that fits all the types of biodegradable waste and all the associated problems.
Every type of organic waste has its own problems and a mix of solutions must be taken into consideration in order to solve these problems.
For example, for sludge, a good solution is to use two different treatment solutions in order to transform this matter in something useful: first of all, an AD process to convert biosolids in biogas and digestate. Biogas will be used as fuel for CHP's. Digestate will be processed by composting for further reduction of pathogens, and to transform it in compost, a more stable form, with a lot of potential benefits for soils at minimum risks.
In a similar way the green waste can be easily composted and used as organic fertiliser on various soil types. When we are talking about biodegradable fraction of municipal solid waste, the situation is more complex.
The treatment of such kind of material involves some more operations and is more expensive compared with green waste for example: the waste must undergo a mechanical treatment to separate as much as possible biodegradable matter from the other contaminants followed by a biological treatment to stabilize, to sanitize and to dry the material for mass reduction.
In this case, the final product can be used as daily coverage material for landfills.
Sometime, with a good separation and an appropriate control of biological process, the resulting material can be classified as compost like output (CLO).
Another option is incineration or other thermal treatments such as pyrolysis and gasification. In any case, for every kind of option we chose, we have to think about environmental impact and the costs of treatment. The same situation is for biosolids.
A dedicated study conducted by an German Institute – BIFA Environmental in 2015, shows, in an interesting chart (Figure 5), the relation between environmental and financial impact of different treatment technologies for biodegradable waste treatment, currently available on the market (ecology-index<0 means environmental benefit; ecology-index > 0 means environmental burden; costs index: Scaling of the process-specific costs at the maximum value).

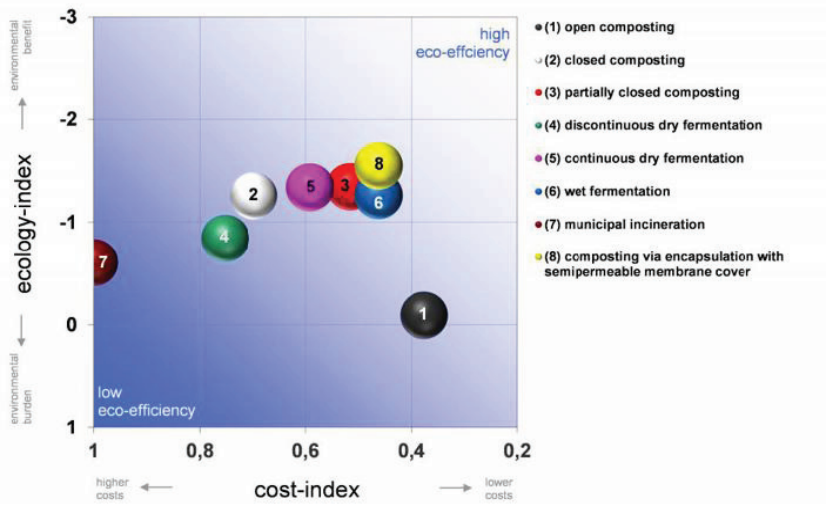

Figure 5. Eco-efficiency portfolio of different biomaterial treatment processes

According to this study, from far, the most expensive and with the highest environmental impact treatment solution are incineration and the most effective; with the lowest environmental impact are modern enclosed composting technologies with semipermeable

membranes. Beyond all this, we have to mention here the human factor. Even with the best technologies for waste collection and processing available on the market we cannot reach the targets without everybody's involvement.

For a successful biodegradable waste management, we have to run many programs to disseminate information for all the citizens. We have to constantly increase the landfilling tax, we have to implement solutions for separate collection and we have to implement adequate programs like "pay as you throw".

CONCLUSIONS

As long as biodegradable waste represents the main component of municipal waste, as long as biosolids and agricultural waste are increasing constantly, we can say a correct approach of related challenges will conduct to a successful story for Romania in terms of waste.

With a deep knowledge of the best available technologies and practices currently used by other countries and following the End of Waste criteria for biodegradable waste as they are stated by the European Commission, we can divert a big amount of biodegradable waste from landfilling to recycling in the spirit of circular economy, we can generate new business lines, new jobs, a better environment and a better life for everybody is living in Romania.

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