Waste Management in Romania: past and present

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Abstract

In Romania, as well as in other countries, the impact of waste on the environment has increased at an alarming rate during the past 20 years. On the 1st of January 2007 Romania became one of the European Union members and had to apply all the European regulations regarding waste. This paper presents data regarding the waste management in Romania in the past and in the present, taking into account also specific results from two co-supervised international researches. Romania must strongly modify the sector of landfilling because of a significant presence of dump sites (that require site remediation interventions). Selective collection is growing but gives today only a small contribution to the overall waste management. Bio-mechanical plants could be constructed also to exploit the availability of industrial plants suitable for co-combustion.

Keywords

management, landfilling, municipal solid waste, regulation, site remediation, Romania

1 Introduction

In Romania, as well as in other countries around the world, the impact of waste on the environment has increased at an alarming rate during the past 20 years. The inappropriate management of this problem has caused soil, subsoil and groundwater contamination, fugitive emissions of methane and toxic gases, with direct impact on the public health.

One of the biggest problems that Romania encountered before and after the entrance in the European Union (EU) is the waste management policy. On the 1st of January 2007 Romania became one of the European Union members. The European Association Agreement stipulates that Romanian development policies must be guided by the principle of sustainable development and take full account of environmental considerations. For this reason Romania began to implement the EU principles on waste management trying to put, in the first place, waste prevention, in the second one recycling and energy generation, and in the last one disposal of waste with no recovery of either materials and/or energy.

Since 2007 Romania has to apply all the European regulations regarding waste and for this reason a National Waste Management Plan was developed taking into account the

European and the National legal previsions (Framework Council Directive 75/442/EEC on waste, amended by Council Directive 91/156/EEC, Council Directive 91/689/EEC on hazardous waste). It must be pointed out that a significant part of the European Directives were adopted even before 2007, but their implementation encountered some difficulties. According to the Governmental Emergency ordinance 78/2000 modified and approved through the Law 426/2001, the National Waste Management Plan is valid for municipal solid waste (MSW), for sludge from municipal wastewater treatment plants, for construction and demolishing waste and for other non-hazardous and hazardous special waste.

The present paper deals with the waste management in Romania in the past in the present and in the future taking into account specific results from two co-supervised international PhD researches.

2 Romanian waste management situation before entering in the EU

In 1993, as a result of a contract between the Ministry of Waters, Forests and Environmental Protection and the Institute for Research and Developing for the Environmental Protection, Bucharest, a data base for waste generation and management was created (Romanian inventory made in conformity with the Government Decision 155/1999). Data refers both to industrial wastes and to municipal solid waste (MSW). A new Waste List including also the hazardous wastes was set by the Government Decision no. 856/2002. Moreover, Romania reported data concerning waste since 1995, to EUROSTAT and to the European Agency for Environment (through EIONET).

Since 1998, the percentage of urban population who benefitted of the sanitary services increased arriving in 2006 to 48.84 at national level (about 80% in the urban area and about 12 at rural level); about 95% of waste were landfilled every year in open dumps. Generally, in Romania a person generates daily about 0.9 kg_{MSW} at urban level and about 0.4 kg_{MSW} at rural level. The percentage of biodegradable matter in the MSW decreased slowly during the years and at rural level the quantity of biodegradable material is 10% bigger than the one in the MSW at urban level . This trend can be explained by the increase of packaging in the waste. In Figure 1 the MSW composition during the years is presented (ANPM, 2010).

Since 1991 Romania has demonstrated attention to the international waste shipment, accessing to the Basel Convention. With the Order No.2/2004 for Procedure and regulatory approval controls on waste transport, modified and completed by the Order MAPAM No.986/2006, Romania completed its regulation on shipment.

In 2002, after the implementation at local level of some pilot selective collection experiences (related only to the valuable materials) it was seen that the adopted methods were insufficient to recover a significant part of the recyclable materials. Due to the selective collection in pilot projects, 2% of the total quantities of recyclable materials were recovered. The rest was disposed of, loosing large quantities of secondary raw materials and energy resource.

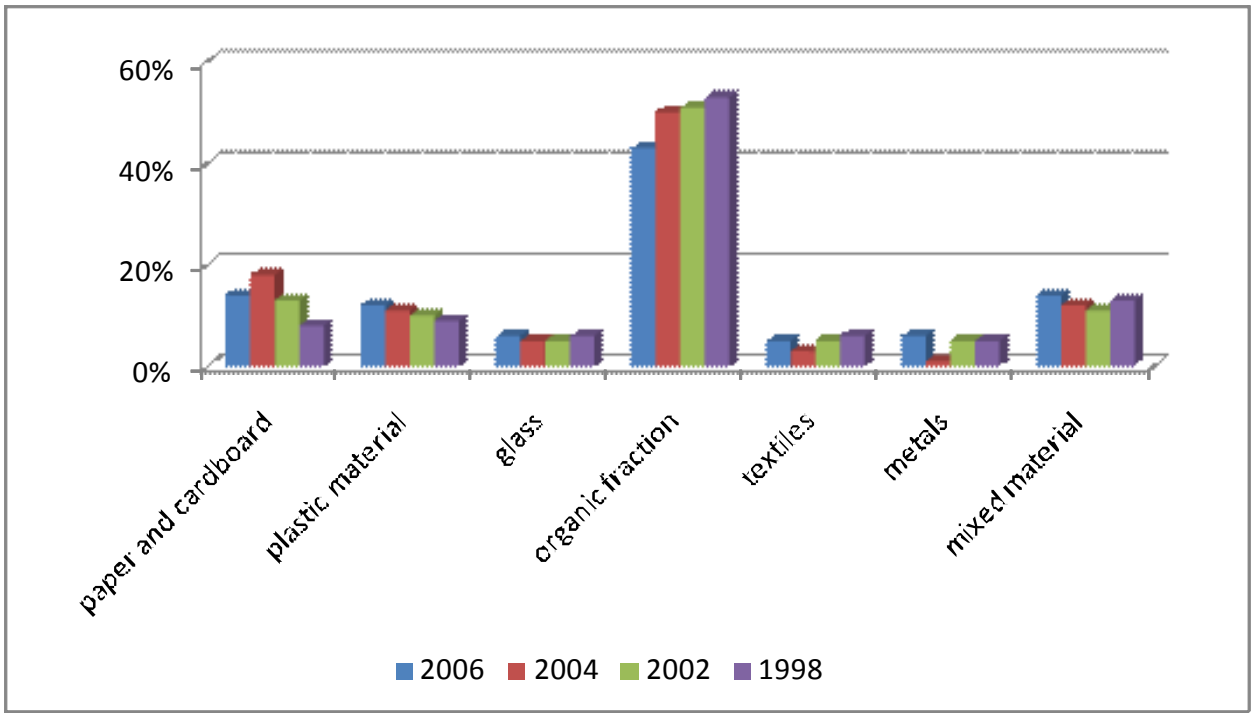

Figure 1 Average percentage of MSW composition for 1998 to 2006

The Governmental Decree No.162/2002 on waste pointed out the necessity of reducing the quantity of biodegradable waste disposed of. The imposed target is 25% less until 2011, taking into account the quantity of biodegradable waste produced in 1995. In 2005 with the governmental decision No. 621/2005 the management of packaging has been introduced.

In some regions, thanks to EU funds like ISPA and PHARE, between 2003 and 2004 some small projects regarding the integrated MSW management were implemented (for instance, composting and selective collection of sellable materials and also construction of transfer stations).

In 2003 in the north-central part of Romania, a composting micro pilot plant placed in a landfill site was implemented. In 2006 it produced about 100 t of compost, demonstrating the micro-scale of the initiative. This compost were used on public lands, in greenhouses and on the existing waste landfill close to the plant.

In 2004 an evaluation of landfills from urban areas was done and resulted in an inventory of 240 landfills that were operating not complying with the European requirements on landfilling (MESD, 2007). Most of those were mixed waste landfills (60%) accepting for disposal both domestic, construction and demolition waste but also non-hazardous industrial waste. Over 40% of those had no environmental protection facilities and more than 45% had only a fence enclosure (in practice they were dump sites). About 80% of waste landfills occupied relatively small areas (between 0.5 and 5 ha), and the rest of 20% were large MSW landfills, occupying areas from 5 ha to over 20 ha. The number of small landfill sites in rural areas is still unknown. In 2004 approximately 2,686 waste deposit spaces in rural areas were identified with an area of less than 1 ha (MESD, 2007; EEA, 2009). In 2002, only 10% of MSW landfills were authorized by the local Environmental Protection Agency.

In 2005 a study regarding the inventory of polluted sites and the history of intervention priorities based on a risk analysis were developed. As a result of irrational interventions (pollution by industrial activities, storage of waste or inappropriate agricultural work performance), a series of negative effects are accentuated as compaction, destruction of soil structure, depletion of nutrients, resulting in diminishing soil fertility used in agriculture.

The Accession Treaty Romania – European Union, signed on the 25th of April 2005 includes concrete commitments of Romania regarding the "*acquis communautaire*" implementation. This treaty underlines also some deadlines for the implementation of environmental obligations (up to 2015 for industrial installations with high pollution degree, 2016 for municipal waste landfill, and 2018 for the expansion of urban collection and wastewater treatment).

3 Romanian waste management situation after entering in the EU

Collection, recycling and waste treatment are a priority and is reflected in the commitments made by Romania to the European Union. The law with the directives on waste sorting is the Law 27/2007.

In 2007, Regional Waste Management Plans were made starting from the National one presented in 2004. In 2008 the plans were developed at Province level. This last plans have present in deeper details the objective and the action that must be implemented in short, medium and long term.

Romania obtained a transition period to comply with EU Directives for MSW landfilling until 2017 (having to close 139 landfills until the 16th of July 2009 and other 101 until the

16th of July 2017). Temporary landfilling rules for hazardous waste were set until 2009 and hazardous industrial waste landfilling until 2013.

Romania has to comply carefully with the planned closure of landfilling sites in order to avoid the starting of infringement procedure by the European Commission. Also, if this problem will not be solved, a hard penalty for each day of delay will be applied to Romania starting with 2010.

Romania has the possibility to postpone of 4 years the achievement of targets to reduce the biodegradable municipal waste by 25% until 2010 and 50% before 2013.

By the year 2013 the annual amount of biodegradable waste that will be landfilled must decrease up to 2.4 million tones, representing 50% of the total amount produced in 1995, and some important measures for reducing landfilled waste packaging must be implemented.

The target for MSW biological treatments (composting and mechanical-biological treatment) must reach a ratio of 70% in the year 2017 (CRAC, 2004). It has been pointed out that an incorrect management of toxic waste (that could be collected together with MSW) could give an unexpected impact from biological treatments (RADA ET AL., 2008).

By the year 2013 it is foreseen a recovery degree of useful materials from waste packaging (for recycling or incineration with energy recovery) as 60% for paper or cardboard, 22.5% for plastics, 60% for glass, 50% for metals and 15% for wood (MESD, 2008). Also special measures are foreseen between 2008 and 2013 for the recovery of waste electrical and electronic equipment (ISTRATE ET AL., 2009) and also for the closure of incineration installations of hospital waste that are not made according to the EU standards.

The proposed targets for 2015 are the creation of 30 integrated systems of waste management at regional / county level, the closure of 1,500 small landfills located in rural areas and of 150 old landfills in urban areas; the achievement of 5 pilot projects for the remediation of historically contaminated sites is an additional target (MESD, 2008).

One of the future aims is also the development of an integrated waste management by improving waste management and reducing the number of historical polluted areas in at least 30 counties by 2015.

For these activities an amount of 1.7 billion € will be necessary, whose 80% can come from European Regional Development Founds.

Currently, in Romania there are no operating incinerators for MSW. The composition and the characteristics of MSW in Romania (moisture about 50% and calorific value

less than 8,000 kJ/kg_{MSW}) and the higher costs of this option do not allow incineration today. The expected trend in the characteristics of waste will change this scenario.

Taking into account the past, present and future scenarios of waste management in Romania, the Politehnica University of Bucharest (Energy Faculty, Department of Energy Production and Use) started a bilateral scientific and technological agreement and (since 2003) a co-supervised PhD program with the University of Trento, Italy. The involved Faculty is the one of Engineering (in particular the Department of Civil and Environmental Engineering). This Faculty was selected thanks to its international and national ranking. The aim was to study and develop together some technologies regarding two important sectors of the waste management in Romania:

- Mechanical-biological treatments of MSW (bio-drying treatment) aimed to energy generation;
- Site remediation techniques (electrochemical treatment) for leachate contaminated soils.

4 Contributions from the research

Today in Romania the Refuse Derived Fuel (RDF) from MSW market is not implemented, but the RDF from MSW and its utilization is viewed in Romania as a strategic component of an integrated waste management policy because in this way the quantity of the biodegradable materials that could arrive in a landfill can be reduced as requested from the Landfill Directive from 1999/31/EC (APOSTOL ET AL., 2008). A RDF based strategy at national level could help to decrease the amount of waste (even biodegradable waste) sent to landfilling decreasing the putrescibility of the landfilled material, exploiting existing combustion plants (thermal power plants fed with coal, cement works, etc.) where a partial substitution of the conventional fuel could be organized.

Presently in Romania bio-drying plants for MSW are under discussion but not yet implemented but recently the first authorisations for co-combustion in cement works have been released but only for special waste. Bio-drying prepares the MSW to a post-treatment that can easily separate recyclable materials as glass, metals and inert leaving a final product (the refined bio-dried material) that can be classified as RDF (RAGAZZI ET AL., 2007). Thus this process can enlarge the sector of co-combustion in Romania. However the effects of bio-drying implementation concern also waste transportation, decreasing the mass to be moved.

In order to generate useful data for bio-drying design and management (when applied to Romanian MSW), an experimental research was developed since 2003 thanks the signing of a co-supervised research between the University of Trento, Italy and the Politehnica University of Bucharest, Romania.

For a better understanding, some results of a bio-drying run applied to the Romanian waste are presented in this paper. For developing bio-drying runs a pilot scale biological reactor was used (RADA 2005A). The runs lasted generally 2 weeks. The lower heating value (LHV) increased at the end of the process of about 30% from the MSW to the bio-dried material and of about 60% from the MSW to the RDF (obtained after the separation of inert, metal and glass from the bio-dried material) (RADA ET AL., 2005B; 2007A). In this way a waste not suitable for a good combustion (because of a low LHV) can be converted into a RDF suitable for a good co-combustion in existing plants.

The Lower Heating Value (LHV) dynamics of the present Romanian MSW, bio-dried material and RDF during the bio-drying treatment are reported in Figure 2, (RADA ET AL; 2007B]). It must be underlined that the biodried material and LHV increase of RDF after two weeks is respectively around 35% and 50%. This is not an energy increase because it must be taken into account that the available mass of fuel is lower after the process. After two weeks the mass loss was about 25% and the volatile solids consumption was about 33 g/kg_{MSW}. The process allows “concentrating” the initial energy with a contemporary consumption of electrical energy. Generally the energy available at the end of the process is about 3% lower than the initial one apart from the electricity needs that changes depending on the adopted technology.

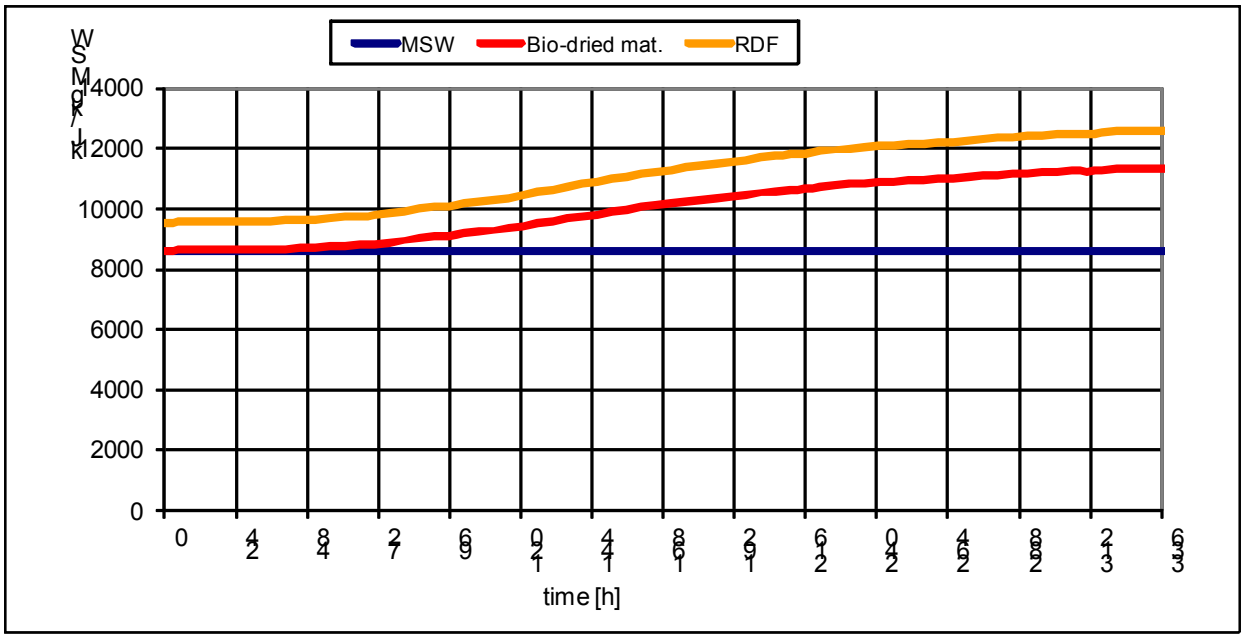

Figure 2 LHV dynamics

Since 2004 the soil pollution has been a prioritary topic in Romania. This is demonstrated by the Order MEWM No.344/2004 concerning the use of sewage sludge in agriculture. Anyway a need of techniques for site remediation (for dumps, refinery areas, alterated agrucultural soil, etc.), was clear and compulsory.

For this reason another co-supervide PhD research regarding the soil remediation research was developed since 2006 between the two cited Universities in order to set design and operation parameters to be applied to Romanian industrial polluted sites and dump sites. In this paper some results regarding Direct Current Technologies (DCTs) are presented.

Some tests were performed with a one-dimensional experimental setup for bench scale testing (ISTRATE 2009). In the Figure 3 the results of the application of this treatment to a the diesel-contaminated soil samples are presented (OPREA ET AL, 2008A,B).The removal efficiency can be interesting for real scale application.

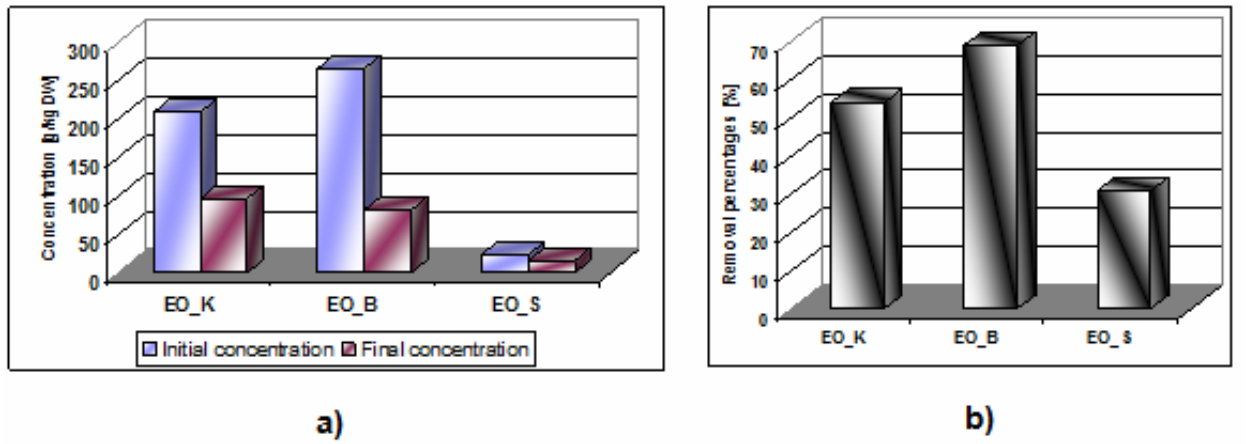

Figure 3 *The final concentrations obtained after a treatment period (a) and the removal percentages achieved (b) for three samples*

Another target was to evaluate the effectiveness of electro-oxidation treatment for the removal of organic substances and ammonia nitrogen from clay that have been contaminated by municipal landfill leachate.

The tests were performed on artificially contaminated clay. The clay was mixed with the landfill leachate to emulate the pollution of the clay at the bottom barrier of a landfill, deriving by a leakage in the geomembrane line. The obtained results after 1 day and after 1 week are presented in Figure 4. Also in this case the research gives important parameters for real scale application.

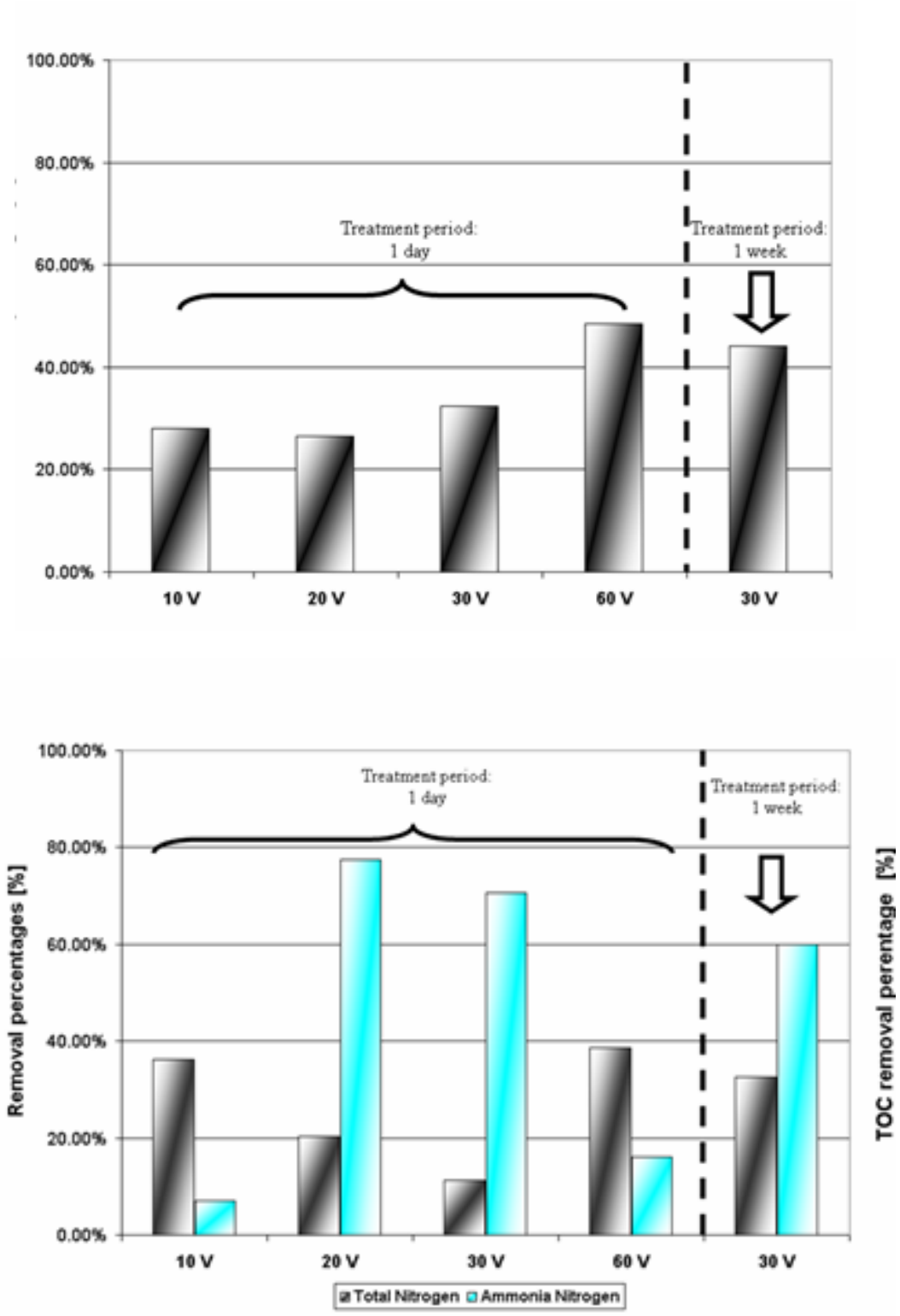

Figure 4 & 5 Removal percentages for Total Nitrogen, Ammonia Nitrogen and TOC for the tests performed for a treatment period of 1 day and 1 week with different voltage

Of course, the present step concerns the implementation of the described approaches at real scale. For this reason at the moment in Romania at regional level some initia-

tives are under evaluation concerning the co-financing of real scale plants for waste treatment and site remediation, by EU structural funds.

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