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METHODS OF THE END-USE OF END-OF-LIFE TIRES

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Abstract
The main objective of the study, presented in the article, is to review the possible methods of final recovery of End-of-Life Tires (EOLT). Applied methods of the end-use of EOLT used in Republic of Bulgaria and in some other countries in the European Union are presented and commented in the paper. Also the end-use of EOLT waste criteria is discussed. The possibilities for post-recovery including recycling of the waste generated by the tire recovery process have been explored. The application of the identified methods in Republic of Bulgaria and other European Union Member States have been analyzed and assessed.

Keywords*: end of waste, recovery process, recycling, tyre*

Introduction

End-of-life tires are a source of serious environmental pollution. In recent years they have become a major problem for many developed countries. EOLT are not subject to natural decomposition, are flammable and pose a serious environmental risk. Therefore, landfills for the storage of such tires are considered as posing a danger to public health.

To date, over 10 billion spent tires have accumulated around the world. Add to them annually 13 to 14 million tons of new tires.

Tires can be recycled at 100%. Crushing of the tires is one of the most attractive methods of their processing, as it allows the maximum physical preservation of the physical properties of the rubber in the resulting final product from the processing. They consist predominantly of rubber, soot, metal and textile.

In accordance with the (UN Basel Convention 1998) used tires are not dangerous and harmful when processed, transported and stored properly.

There is no special EOLT Directive at this stage.

Materials and Methods

The necessary information for the analysis is providing through:

- using available public information from the official website of the European Environment Agency (EEA);
- using publicly available information from the official website of the Bulgarian Environmental Executive Agency;
- using publicly available information from the official website of the Bulgarian Ministry of Environment and Waters;
- Statistics information for the methods for the sound treatment of waste generated as a result of the recovery processing of EOLT;

- Examination of the end-of-waste standards in Bulgaria concerning rubber piecies obtained from old tires in shredder plants and a study on the availability of accredited laboratories within the European Union under this standard;
- A study on applied end-of-waste standards in other European countries, including guides with "end of waste" criteria.

Results and Discussion

Methods for EOLT recovering

The methods for the EOLT treatment are described and summarized in the Revised technical guidelines for the environmental sound management of used and waste pneumatic tires (UNEP / CHW.10 / 6 / Add.1 / Rev.1). The data are summarized in Figure 1.

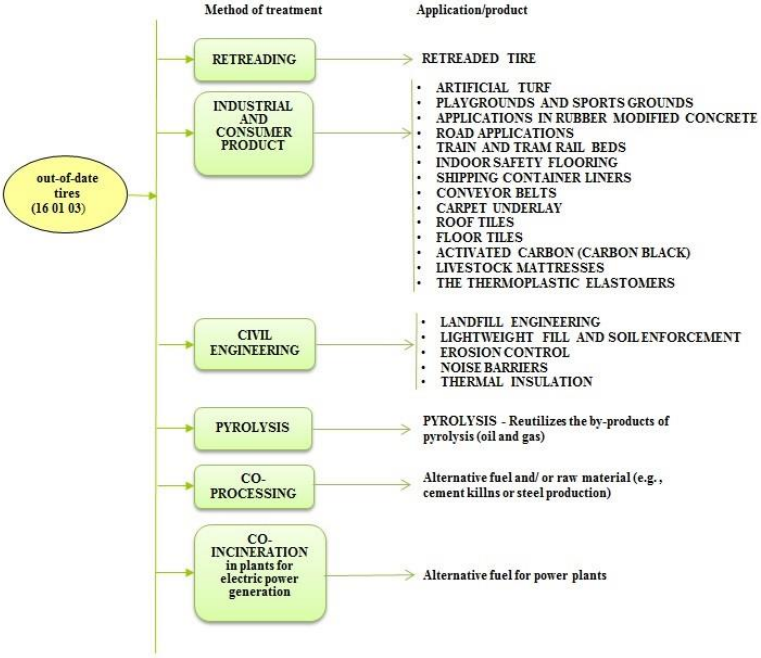
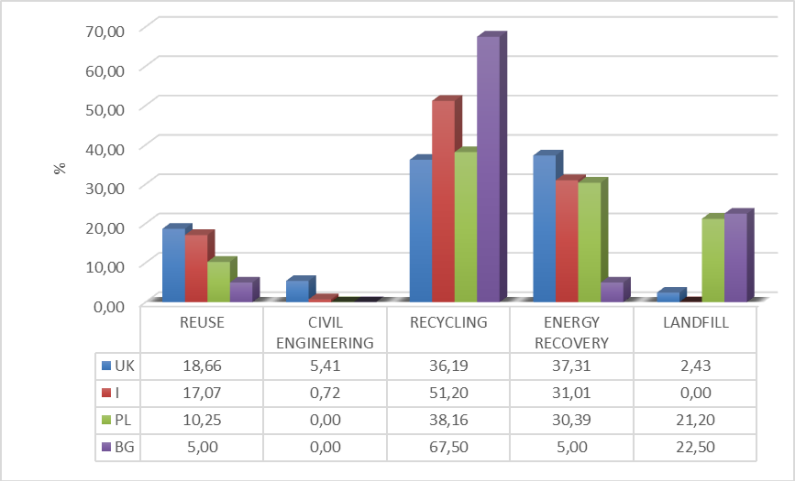


Figure 1. Methods for EOLT recovery

Application of EOLT waste treatment methods across the EU

According to the data from the ETRMA - European Tire & Rubber Manufacturers Association 2016, 40 000 tones old tires are being generated and collected in Bulgaria in 2016. Of this, only 2000 tones are reclaimed, 2000 tones used as fuel to produce heat, and 27 000 tones are recycled. 9000 tones are directed to the landfill for disposal, which is a significant amount.

Unlike in Bulgaria, in England for example, the amount of generated and collected EOLT is 536 000 tones in 2016, with a significant amount of them being regenerated. There, 29 000 tones were used in civil-engineering and only 2.43% of the total amount of tires is targeted at landfills.



	REUSE	CIVIL ENGINEERING	RECYCLING	ENERGY RECOVERY	LANDFILL
UK	18,66	5,41	36,19	37,31	2,43
I	17,07	0,72	51,20	31,01	0,00
PL	10,25	0,00	38,16	30,39	21,20
BG	5,00	0,00	67,50	5,00	22,50

Figure 2. Methods for EOLT treatment used in England (UK), Italy (I), Poland (PL) and Bulgaria (BG) in 2016 (Used Tyres/ELT Management in Europe 2016)

From the survey we can conclude that in Bulgaria, the recycling methods are 67.50% and the reuse and energy recovery represents each only 5% for the year under review.

Methods for EOLT treatment in Bulgaria

To identify the methods used for EOLT treatment in Bulgaria, an extensive study was carried out in the (National Information System for Waste NISW), maintained by the Executive Environment Agency (EEA) at the Ministry of Environment and Waters (MEW). According to the Public Register of persons holding documents for waste activities at NISW there are a significant number of legal entities holding permit documents for waste treatment under the code 16 01 03 (EOLT) (Regulation №2 on the classification of waste 2014). The permitted activities for EOLT waste are presented in Figure 3.

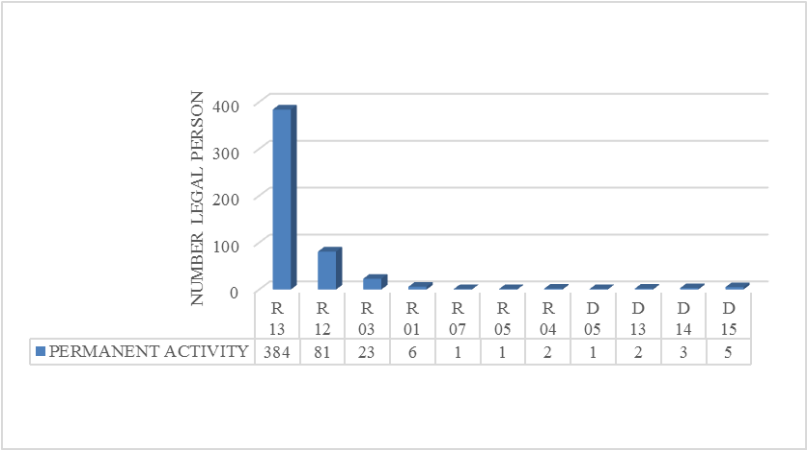


Figure 3. Number of authorized persons for EOLT treatment in Bulgaria

We study recycling activities, which are 67.50% of all activities carried out on EOLT treatment in 2016.

These activities include activity R05 representing the recycling / recovery of other inorganic materials and activity R04 - Recycling / recovery of metals and metal compounds (Waste Management Law). In Bulgaria there are only 3 legal entities that carry out these activities.

However, in the used statistics of the ETRMA – (European Tire & Rubber Manufacturers Association 2016), tire recycling activities include R12 (pretreatment, including shredded tires) and tire pyrolysis is included in activity R1 (Waste Management Law). Taking into account the specific definitions of the statistical data used, we should include in the investigated recycling activities another 87 legal entities, which are authorized on the territory of Bulgaria for these activities.

In conclusion, we can summarize that, in the context of the observed statistics for Bulgaria, a significant percentage of recycling of tires is achieved.

Waste arising from recycling operations with shredder plants. Problems.

In this part of the study we will look at the waste generated from the added recycling activities in the context of ETRMA data exported in 2016 (Used Tyres/ELT Management in Europe 2016), namely R12 / R05 (Waste Management Law), representing the tire shim to rubber granulate (rubber chips).

A flowchart of the process (An application for a waste permit for a company „Pyrolysis" OOD) in a shredder installation is presented in Figure 4.

From the block diagram presented below (see Figure 4), it could be seen that as a result of the operation of the shredder, two primary wastes are formed - waste of mechanical treatment with code 19 12 04 and metal waste with code 19 12 02 (Regulation №2 on the classification of waste 2014). The metal recycling sector is well developed in Bulgaria. This means that for the metal waste from the plant the possibility of end of the waste is ensured, mainly through metal recovery processes (activity R4 Waste Management Law) in existing foundries.

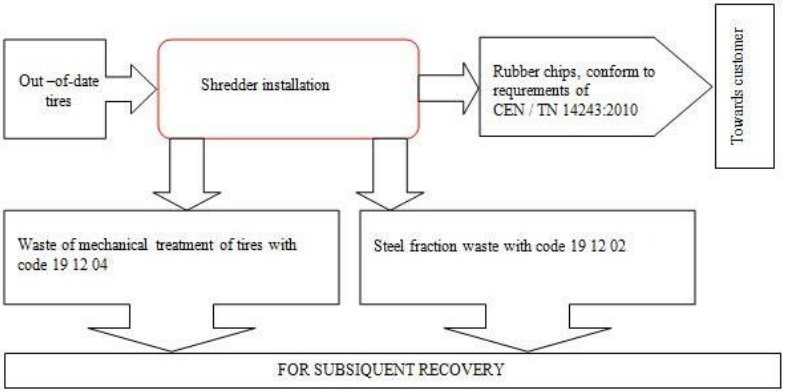


Figure 4. Block scheme diagram of the process (An application for a waste permit for a company „Pyrolysis" OOD) in a shredder installation

Certification of the produced rubber chips from the shredder under the conditions of a waste permit issued by the competent environmental authority requires that the material obtained from the installation to be tested according to the standard *CEN/TS14243:2010 Materials from end of life tyre. Specification of the categories on the basis of their size(s) and impurities and methods for determining the size(s) and impurities.* This standard is in force in the European Union.

For product certification purposes, letters have been sent to certification bodies in the member states of the European Union on the availability of accredited laboratories for the purpose of assigning the test and certifying the compliance of the product. The responses received so far are from the Bulgarian Accreditation Agency; Ente Italiano di Accreditamento; Swedish is the national accreditation body for Sweden; Deutsche Akkreditierungsstelle GmbH; Czech Accreditation Institute; Instituto Português de Acreditação, I.P.; Swiss Accreditation Service; The Latvian National Accreditation Bureau and the United Kingdom Accreditation Service.

All accredited certification bodies inform us that there is no accredited laboratory on the standard CEN / TS 14243: 2010 in their countries.

Under these conditions, the block diagram of the shredding process, represented in Figure 4, changes significantly, as the "rubber chips compliant with CEN / TS 14243: 2010" has to be removed. Thus the produced product - a rubber chips - according to the legislation in force in Bulgaria is obligatorily classified as waste. The activity carried out by the shredder without the CEN/TS14243:2010 certificate is no longer R05- final recycling, but is the interim R12 (Waste Management Law) preparation operation. As a result, only waste is generated as a result of this activity, which, under national law, should be passed on to persons holding permits for waste operations.

In order to study the presence of persons to whom the waste was legally delivered with code 19 12 04 (Regulation №2 on the classification of waste 2014) - primary grinders and chips from the plant, the Public Register of the persons holding documents for carrying out waste activities to NISW was again used (National Information System for Waste). The results of the study are presented in Figure 5. A

considerable number of registered companies carry out storage and pre-treatment activities of non-interest, as they do not include final recycling.
The surveyed waste for which the study was conducted includes plastic waste and rubber waste generated as a result of waste treatment activities.

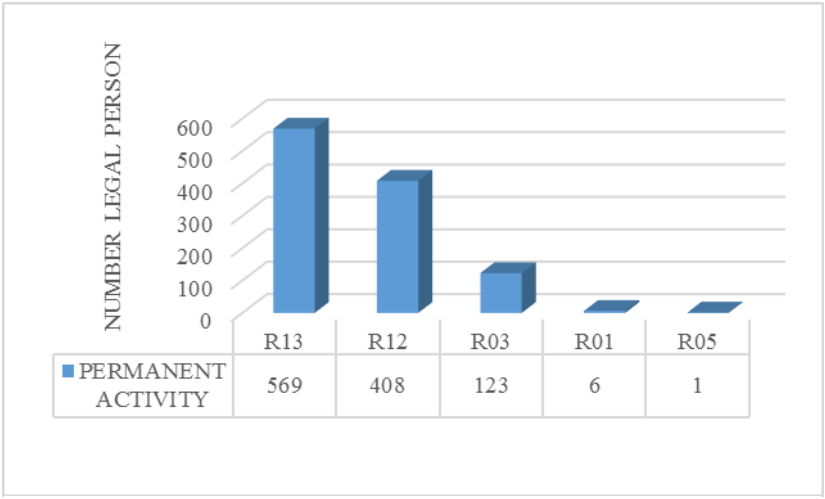


Figure 5. Number of persons authorized to handle waste with code 19 12 04 (Regulation №2 on the classification of waste 2014) on the territory of Bulgaria

In Figure 5 activity R1 (Waste Management Law) is present, as it is allowed for plastic waste generated by waste treatment activities. This activity according to the MEW guidelines is not applicable to the rubber chips from shredder installations and is therefore excluded from the study.
There are 123 legal entities in Bulgaria operating R03 (Waste Management Law) activity with the waste. Surveys on the subject matter of these companies show that they do not work with rubber pulp / chips, but with plastic granulates. We have already commented activity R05 (Waste Management Law) above.
As a result of the present study, a significant problem was found to complete the waste recycling process generated by the recycling of EOLT. The problem stems from the strict legal provisions on the territory of Bulgaria and the lack of developed criteria for the end of waste from shredder installations.

End-of-waste criteria applied in United Kingdom
The leading country in the statistics concerned is England. For this reason, the study is aimed at end-of-waste criteria in the territory of that country. End-of-waste criteria for EOLT have been developed and published at England national level (Tyre-derived rubber materials).
This Guide details the applicable standards for the use of tire waste streams in the civil engineering sector - Appendix C: Engineering standards to which this Quality Protocol applies. Guidelines to which guidance is directed are applicable across the

EU, and our study shows many laboratories that are accredited to conduct tests on them.

Conclusions

The lack of developed end-of-waste criteria in the various recovery processes of EOLT in Bulgaria creates problems with the subsequent recycling of the waste streams generated by these processes.

No accredited laboratories for rubber chips testing are available in the EU as applicable in Bulgaria standard CEN/TS14243:2010.

The material obtained from the shredder installations due to strict regulation is classified as waste, which makes it difficult to use it for the production of industrial and consumer products.

The lack of end-of-waste criteria for the use of tires in civil engineering on the territory of Bulgaria leads to zero results in the field.

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An application for a waste permit for a company „Pyrolysis" OOD

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