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Optimizing the Methodology of Characterization of Municipal Solid Waste in EU Under a Circular Economy Perspective

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Abstract

The methodology for the characterization of residual municipal solid waste (RMSW) is available since decades. Some modifications have been introduced in order to modernize it. Now, in order to take into account the targets of the circular economy, an additional effort must be made to be sure of generating the right information suitable for the optimization of municipal solid waste in that frame. In that perspective, the Authors present a few proposals in order to avoid mistakes and to deepen the reliability of the data generated during the analysis performed to classify the residual municipal solid waste in fractions. A new model of characterization is thus proposed, suitable for planning waste management in the frame of the circular economy principles.

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1. Introduction

In the last decades, the characterization of Municipal Solid Waste (MSW) in the European Union has shown a remarkable evolution in terms of efforts made from the local management Authorities in zooming on its composition. In the same time, the increase of the rate between collected MSW and generated MSW, today very

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close to 100% in the best managed regions, simplified the efforts in assessing the quantities produced: indeed, the collected streams can be easily weighted. The growing reliability of information has positive implications on the design of the MSW treatment plants [1-3]. For that reason, the present paper focuses mainly on the methodology of MSW characterization, specifically on the characterization of the residual MSW (RMSW) that is the waste remaining after source separation. It must be pointed out that source separation (also named selective collection, SC) is compulsory in the European Union (EU) thus the methodology must see beyond the present needs of information in a region, looking at the need of a good planning for the expected scenarios of MSW management, necessarily based on high efficiency of SC. Only through a deep knowledge of the waste streams a sustainable management of waste can be performed. Before analyzing the methodology of RMSW characterization it is important to clarify what is MSW in the EU [4-8]. In practice, we must consider four main subcategories to understand what MSW is:

- Household generated waste (the household waste)
- Waste generated out of domestic building but similar to it (the assimilable waste)
- Bulky waste generated at urban level
- Waste from street sweeping

This paper will consider the methodology related to the characterization of the first two sub-categories, because they are the most important for a correct planning of the management of MSW. These two categories are collected according to the principles of SC; thus, they can be easily characterized when we deal with source separated streams (paper, glass, etc.) but they include also the fraction of RMSW whose characterization is crucial for a correct management of MSW [5,9-11]. Just to understand, an overestimation of few percentage points of the energy content of RMSW in a small region where a waste to energy plant must be constructed (e.g. an incinerator with energy recovery) can give an extra cost in its implementation that can account million Euros. It is clear that a reliable methodology for RMSW characterization is compulsory in the sector of engineering and management. In spite of that, the history of the sector showed an underestimation of the problem, with limited efforts (also from the economic point of view) when a RMSW characterization had to be performed. As an example, the literature has shown a trend in the number of fractions taken into account decade after decade but even recently the number of fractions taken into account is often around ten, with limited information for a good MSW management planning in the key of a circular economy perspective [9].

If we consider the target of the circular economy [12] we shall see that we must accept as adequate a characterization based even over 20 fractions and sub-fractions (a fraction is a class of material like paper, glass, etc.).

2. Critical analysis of the basic characterization

We can consider *basic characterization* the one referring to the following steps that can be reconstructed from the studies reviewed by Goetze [9]:

- Selecting a pathway representative of an area of RMSW generation
- Selecting a day representative of RMSW generation
- Selecting the fractions to be characterized in percentage
- Selecting additional parameters of the fractions to be characterized
- Preparing a site for the fractions characterization
- Preparing the tools for the fractions characterization
- Preparing the team for the fractions characterization
- Collecting an amount of RMSW representative of that area
- Analyzing the results in terms of fraction percentages
- Managing the additional laboratory analyses

The present paper analyzed critically the conventional approach in order to put forward some considerations to enhance it.

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