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SITUATION OF GLASS CONTAINER MANAGEMENT IN SERBIA

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ABSTRACT: The aim of this paper is to analyze the current situation of glass containers waste management in Serbia. The total annual amount of glass waste in municipal solid waste (MSW) in Serbia is estimated at 129000 t/year, of which approximately 90000 t/year makes glass containers waste. The level of glass containers utilization in Serbia is very low (about 15.8%), which indicates that most of glass waste is disposed on landfills. Considering that the glass does not degrade over time, appropriate treatment and management of glass containers waste is of a great importance regarding environmental protection.

KEYWORDS: waste management/ glass containers/ environmental protection

INTRODUCTION

Glass is made from natural and sustainable raw materials: sand, soda ash and limestone. As such, glass is not made from scarce resources and therefore it contributes to prevention of exploitation of fossil fuels. In fact glass production needs only energy to melt the raw materials and the recycled glass.

A glass is used for many purposes, but in the waste system glass is predominantly found in terms of beverage and food containers (postconsumer glass containers) with a relatively short lifetime before ending up in the waste [1]. Waste glass is not just waste, but a new resource. Generally, beer, wine bottles and other food jars are among a few common household glass items put into landfills every day. Glass has traditionally been disposed of either in domestic refuse, which ends up in landfill, collected in designated collection spots for reuse/ recycling, or collected from kerbside and then transported to collection sites [2].

In order to reduce glass waste quantities in/on landfills, it is necessary to set up/undertake the measures/actions for glass separation and its treatment. Also, proposed measures/actions for glass collection and treatment should be in accordance with national targets sets for glass recycling rates. Energy is the biggest cost in the glass production for every 10% of recycled glass, energy saving is 3% [3].

Glass presents risks to environment, because when is thrown to the environment, it will never decompose. In order to mitigate negative impact of glass containers, it is necessary to develop strategy for containers glass collection in Serbia. Strategy should have positive effect on environment, in terms of recycling, energy savings and positive effect on economy in terms of saving resources for glass production.

CURRENT SITUATION OF THE GLASS CONTAINERS MANAGEMENT IN SERBIA

In Serbia, 5.4% of total municipal waste is glass waste, of which 3.8% is glass containers waste [4]. The annual demand for glass containers in Serbia is between 130 000 - 150 000 tons/year, of which approximately 30% is produced by Serbian Glass Factory, and remaining quantities are imported [3].

Table 1. Quantities of glass waste in Serbia [5]

Municipal waste (t/year)	Glass waste (t/year)	Glass containers waste (t/year)
2 374 374	129 166	90 416
Percentage in total municipal waste (%):	5.4	3.8

Collection system for glass containers is at very low level. Glass is collected by 3 registered operators, which are also collecting plastic and other recyclates (paper, iron etc) [6]. A very small percentage of glass, collected by the registered operators, are subject to further treatment, together with glass containers from primary selection, while rest of the glass container send up in landfills.

Primary selection is not developed, only 14.200 t are collected and recycled with very low quantity.

There are two supply chains of glass recycling in Serbia including only Serbian glass factory for containers glass, in Paracin.

The first supply chain in Serbia deals with unbroken glass bottles and jars and is operated by a network of small collectors, often individuals working informally. The second supply chain is managed by the Serbian Factory for Recycling (Aleksinac) which presently is the only buyer of secondary glass containers in Serbia. All crushed glass from this factory is being exported [3].

Serbian Glass Factory in Paracin is interested in beginning of a glass recycling on a larger scale, and collecting of glass of all colors, but it does not have a developed strategy for glass collection for recycling.

In Serbia, almost 70% of needs for glass containers is imported (USAID), and only 30 % is produced domestically. As we mentioned previously, most of the glass ends up on landfills, which represents economic lost for the country.

Collection system of glass containers in MSW need improvements and strategy, since all of glass containers collected are disposed at landfills.

MATERIAL FLOW ANALYSIS (MFA)

The use of Material flow analysis (MFA) will be two folded. Firstly, to identify the glass containers flows within the system boundaries. Secondly, MFA will be used to assess the amounts of glass containers flows and stocks that are produced, consumed, imported, exported, collected, recycled and disposed in the landfills in Serbia. All the mentioned processes are connected by the corresponding flows (Figure 1).

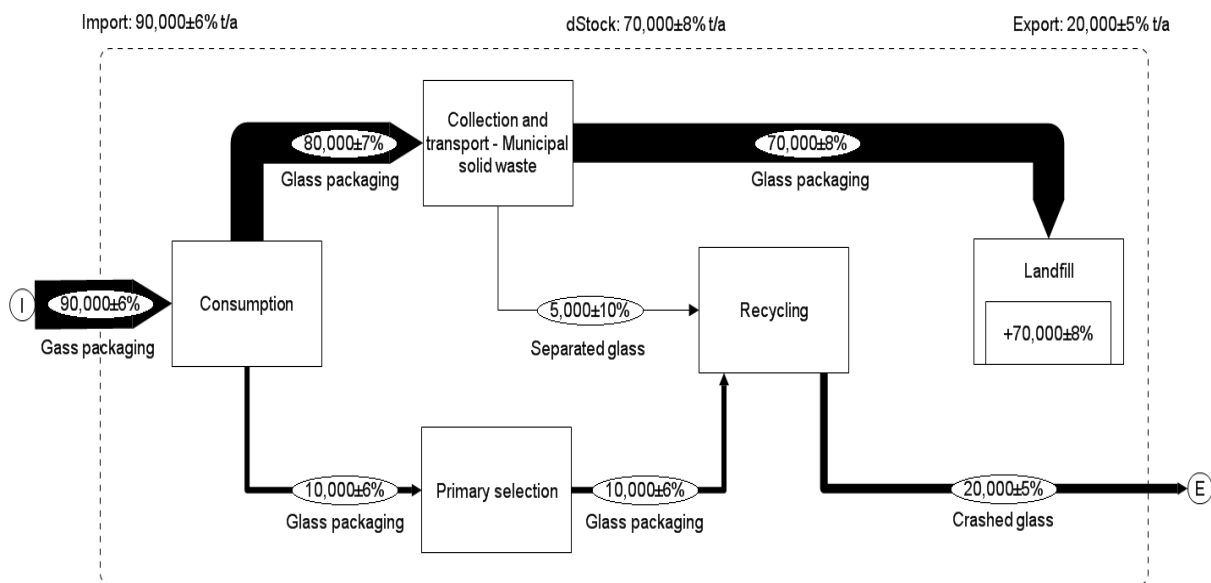


Figure 1. MFA analysis of glass containers flow in Serbia

Software for MFA modelling used in this work is STAN.

STAN is using three types of equations to describe the complete material system in a mathematical way: mass conservation equations, linear relation equations and concentration equations [7].

Here we will use mass conservation equations

$$\sum \text{inputs} = \sum \text{outputs} + \text{changes in stocks} \quad (1)$$

Using the MFA, the main sources and flows of glass materials were identified and quantified in the framework of one year, and for the present study this was the year 2011, for which reliable data were available for the Republic of Serbia.

Goal of this research is to identify the flows and amounts of glass containers within the identified system boundaries in the selected period of time.

RESULTS AND DISCUSSION

Figure 1 shows that the annual amount of glass containers which are placed on the market is approximately 90 000 tons. Most of the glass containers which are placed on the market, 80 000 tons are collected together with MSW, while only 14 200 tons are primary selected.

Glass containers from primary selection are recycled, together with 5 000 tons of glass containers which are separated from MSW. About 20 000 tons of glass cullet from recycling process is being exported.

The rest of glass containers from MSW are going to landfill.

Main obstacle in this research were collection of data, especially those related to the amounts of glass containers produced in Serbia, as well as glass containers exported. Therefore, data used in this paper are with 10% uncertainty.

MFA analysis of glass containers flow in Serbia shows several important issues.

First of all, most of the glass containers are disposed at the uncontrolled landfills (80%). If this trends continuous, in the period of 10 years, 800 000 tons of glass will be stored on landfill. This practice has a negative impact on environment, because glass is not degradable and will remain in environment as a waste.

Primary selection of glass containers is very low. In order to improve primary selection it is necessary to develop appropriate strategy for glass collection. According to the latest released data of glass containers recycling, it is estimated that more than 67% of glass bottles and jars were collected for recycling in EU. This equals to 11 million tonnes or 25 billion bottles and jars collected throughout Europe. Over 80% of these are actually recycled by European glassmakers to make new bottles and jars. Glass is 100% recyclable and infinitely in a closed loop system [8]. Conducted researches demonstrate that by sorting glass container waste from other waste flows, such as single stream separation, a high quantity and quality material for recycling can be provided [8].

Very small percentage 15.8% of glass containers is recycled, actually crushed. Obtained glass cullets are further exported and they are not used as a resource in Serbia. Latest research shows that increase of glass recycling of approximately 10% will lead to reduction of imports and outputs waste of roughly 60% [7].

CONCLUSIONS

MFA model, showed in this paper, presents the current situation in the area of waste management of glass containers in Serbia. It gives current picture of glass containers flow in Serbia, based on available data.

Model points out, that management of glass containers in Serbia, is not developed and it is at a very low level. Most of the glass containers end up in landfills, which are uncontrolled. Since glass is decomposable, glass containers in landfills can pose serious problem in the environment. If glass containers are perceived as resource, this may present great potential in waste management and must be taken into account when designing future waste management systems. Replacing 1.2 kg of raw material by 1 kg of cullet, 0.67 kg of CO₂ are saved [8].

Well planned waste management systems, may reduce imports of glass containers and increase the economy of the country. Based on EUROSTAT's statistical data, the glass container waste generation per inhabitant has steadily increased since 1998 and the price of glass cullet has increased over the years as the amount put on the market has also increased, which can contribute to economic development in Serbia in the field of glass container waste management.

Further investigations in the area of glass containers waste management should be focused on establishing collection system based on EU experiences.

Also, detailed economic analysis of possible collection scheme must be taken, as well as, recycling cost of collected glass containers.

Last but not the least, developing a program for people education and raising their awareness about glass and importance of glass recycling is needed. When introducing, changing or promoting a glass collection service, clear, timely and relevant communications are the key to maximizing performance. A well planned, well delivered communications campaign lets residents know how, where and when to use their service.

Taking into account that gate fee for disposed waste on landfills is between 20 and 30 euro per tons, and that the approximately 70 000 tons of glass containers are deposited, saving of 210 000 euro per tons yearly should not be neglected. MFA model will help to develop and define appropriate strategy for glass containers collection and treatment, which is in accordance with national waste management strategy.

According to identified quantities of glass containers waste, their treatment/recycling will reduce negative impact on environment.

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