

Morphological analysis of municipal solid waste: Review

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ABSTRACT

This article represents an overview of existing methods for determining the amount of formation and morphological composition of municipal solid waste. It also represents their history and evolution. The method for determining the amount of formation and morphological composition of municipal solid waste is an important task for efficient management of solid waste (MSW). This problem is existing for decades. But today it is absolutely relevant for the countries of Eastern Europe, that includes Ukraine. There were listed and given a brief description of each method. In the article, the tendency towards taking into account social and economic characteristics of households in the production of MSW were detected. Also, it is given the list of main problems that cause the low accuracy of the data obtained, while applying the methods of research the formation number and morphological composition of MSW.

Key words : Management of solid waste, Morphological composition, Methods

Introduction

Actuality of Research

A case study and a literature review have been carried out to address the main problem of Waste Management System of Ukraine: How waste flow data from systems be matched. Analysis of this data one of the important question on the way of development of the New National Waste Management Strategy of Ukraine till 2030. Therefore, it is advisable to analyze all existent methods in order to apply them to Waste Management System of Ukraine.

According to the European Commission, effective management of the MSW system is one of 12 Sustainable Development Strategies (European Commission, 2015). Therefore overcoming the problem issues in the management of the MSW system is an important task on the way to European integration. Today, this is the main task of our country's

political life. According to the legislate of the European Union (EU) (Directive, 2008), one of the tools for developing the MSW system is the characterization of the morphological composition of MSW. The absence of statistical volume and composition data of MSW is one of the main problems that were faced by the government when it was developing a new regulatory legislation in the field of MSW. According to the opinion of Slovak expert, Yuraya Farkasha (representative of the EU project APENA), who is the main consultant for the drafting of the Legislation Bill and the National Waste Management Plan, the primary objective of the solution of the efficient management MSW problem is to monitor the quantity and morphology of MSW. The trend of the last decade shows that while there were developing of the sanitary cleaning scheme in Ukrainian cities, the amount and composition of MSW were determined either by normative, either were not in accordance with the instructions. In the

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In our review, we came up with the main issues that arise while using the methods of studying the morphological MSW composition, namely when we are sampling. Among the main ones are: spontaneous selection, a low culture of MSW treatment, as well as the absence of a single national method and others. The number of identified uncertainties underlines the importance of improving and standardizing methods for measuring the morphological MSW composition. Reliable waste statistics are the key to assessing the performance of the MSW.

The obtained analysis of the methods allowed to obtain the basis for the development of clear and realistic forecasts in modern systems of Waste Management System, which are based on the morphological composition of solid waste.

References

- Act 10.01.2006 N 7. On Approval of Norms for the Formation of Solid Wastes for Locations of Ukraine
- ASTM D5231-92(2016), Standard Test Method for Determination of the Composition of Unprocessed Municipal Solid Waste, ASTM International, West Conshohocken, PA, 2016, www.astm.org
- Beigl, P., Sandra, L. and Stefan, S. 2008. Modelling municipal solid waste generation: A review. *Waste Management*. 28, pp:200–214.
- Burnley, S. J., Ellis, J. C., Flowerdew, R., Poll, A.J. and Prosser, H. 2007. Assessing the composition of municipal solid waste in Wales. *Resources, Conservation and Recycling*. 49(3) : 264-283.
- Cornelissen, A.A.J. and Otte, P.F. 1995. Physical investigation of the composition of household waste in the Netherlands – results 1993. National Institute for Public health and the Environment (RIVM) Filenr 776201011, The Netherlands.
- Dahlén, L. and Lagerkvist, A. 2008. Review. Methods for household waste composition studies. *Journal of Waste Management*. 28(7) : 1100-1112.
- Dahlén, L., Vukicevic, S., Meijer, J.E. and Lagerkvist, A. 2007. Comparison of Different Waste Sorting Systems in six Swedish Municipalities. *Journal of Waste Management*. 27(10) : 1298-1305.
- Denafas, G., Ruzgas, T., Martuzevicius, D., Shmarinc, S., Hoffmann, M., Mykhaylenko, V., Ogorodnik, S., Romanov, M., Neguliaev, E., Chusov, A., Turkadze, T., Bochoidze, I. and Ludwig C. 2014. Seasonal variation of municipal solid waste generation and composition in four East European cities. *Resources, Conservation and Recycling*. 89 : 22–30.
- Dennisona, G.J., Dodd, V.A. and Whelan, B. 1996. Resources. A socio-economic based survey of household waste characteristics in the city of Dublin, Ireland. *Conservation and Recycling*. 17(3) : 227-244.
- Directive 2008/98/EC of the European Parliament and of the Council, of 18 november 2008. Available online at: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32008L0098> (Accessed march 15th, 2016).
- Dyson, B. and Chang, N.B. 2005. Forecasting municipal solid waste generation in a fastgrowing urban region with system dynamics modeling. *Waste Management*. 25 : 669–679.
- Edjabou, E., Jensen, B., Götze, R., Pivnenko, K., Petersen, C., Scheutz, C. and Astrup, F. 2015. Municipal solid waste composition: Sampling methodology, statistical analyses, and case study evaluation. *Waste Management*. 36 : 12–23.
- European Commission (2004) Development of a Methodological Tool to Enhance the Precision and Comparability of Solid Waste Analysis Data – Final Report Waste Analysis in Cracow
- European Commission, European Green capital, 2015. Available online at: http://ec.europa.eu/environment/europeangreencapital/wpcontent/uploads/2016/01/egca_2018_application.pdf (Accessed march 15th, 2016).
- Franklin and Associates, 1999. Characterization of municipal solid waste in the United States: 1998 Update..Report No. EPA530. Municipal and Industrial Solid Waste Division, Office of Solid Waste, Environmental Protection Agency, US.
- Gidakaros, E., Havas, G. and Ntzamilis, P. 2006. *Waste Management*. 26 (6) : 668-679.
- Good Practices of Waste Quantity and Morphology Determination in the Region of South East Europe. Network of Associations of Local Authorities of South-East Europe, 84 p.
- Korhonen, P. and Kaila, J. 2015. Waste container weighing data processing to create reliable information of household waste generation. *Waste Management*. 39: 15-25.
- Lisa, D. and Anders, L. 2008. Methods for household waste composition studies. *Waste Management*. 28: 1100–1112.
- Maria, F. and Micale, C. 2014. A holistic life cycle analysis of waste management scenarios at increasing source segregation intensity: The case of an Italian urban a *Waste Management*. 34 : 2382–2392.
- Ogwueleka, T. 2016. Survey of household waste composition and quantities in Abuja, Nigeria. *Resources, Conservation and Recycling*. 77 : 52-60.
- Ozcan, H.K., Guvenc, S.Y., Guvenc, L. and Demir, G. 2016. Municipal solid waste characterization according to different income levels: A case study. *Sustainability*. 8 : 1044-1048.
- Proceedings of the International Conference on Industrial Engineering and Operations Management, Rabat, Morocco, April 11-13, 2017 Assessing the Morpho-

- logical Composition and Energy Potential of MSW, the Case of the City of Johannesburg S. O. Masebinu*, E. T. Akinlabi, E. Muzenda, A. O. Aboyade and C. Mbohwa Faculty of Engineering and the Built Environment, University of Johannesburg, South Africa
- Purcell, M. and Magette, W. 2009. Waste. Prediction of household and commercial BMW generation according to socio-economic and other factors for the Dublin region. *Management*. 29(4) : 1237-1250.
- Qu, X., Lia, Z., Xie Yu-mei, Lei Yang S. and Chen, Y. 2009. Survey of composition and generation rate of household wastes in Beijing, China. *Waste Management*. 29(10) : 2618-2624.
- Sahimaa, O., Hupponen, M., Horttanainen, M. and Sorvari, J. 2015. Method for residual household waste composition studies. *Waste Management*. 46 : 3–14.
- Savage, G.M. The history and utility of waste characterization studies. In: Air and Waste Management 86th Annual Meeting and Exhibition, vol. 93-WA-90.02, Denver, Colorado, US.
- Scott, P.E. 1995. The International Energy Agency's (IEA) work in harmonising sampling and analytical protocols related to municipal solid waste (MSW) conversion to energy. *Biomass and Bioenergy*. 9(1-5).
- Suthar, S. and Singh, P. 2014. Household solid waste generation and composition in different family size and socio-economic groups: A case study. *Sustainable Cities and Society*. 14 : 56–63.
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