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CHEMICAL ANALYSIS OF PLASTIC WASTE IN AND ALONG THE DANUBE RIVER – DONAU-AUEN SAMPLING

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ABSTRACT: XPS and FTIR could provide quick and reliable analysis of plastic waste samples because there are large spectroscopy database of polymer and other materials. Degradation process, soil or metal contamination it is possible to measure or determine by processing of obtained spectra. This are reasons why we choose this to methods for plastic waste analysis.

Keywords: plastic waste, Danube, river banks, XPS, FTIR, optical microscopy, chemical analysis, microplastics

1. INTRODUCTION

Plastic, the lightweight and long-living material, has become a serious environmental hazard and has been recognised as a global problem (UNEP, 2016). Hundreds of marine species are affected by plastic debris and humans can also be indirectly affected through the food chain, however its full environmental impacts are not yet understood. As currently no standardised procedures and methodologies for the analysis and assessment of plastic waste in fluvial systems exist, standardized protocols and procedures for macro plastic sampling, sorting and analysis will serve as tool to assess waste amounts, composition and properties. To have more precise knowledge about the type of plastic waste in Danube river cross-border project PlasticFreeDanube focuses on extending the knowledge about sources and transport behaviour of macro plastic (> 5 mm) in the Danube River and its environmental impacts. Standardised methods to monitor and evaluate pollution by macro plastic are developed which should then lead to pilot measures and finally to an action plan against plastic pollution in and along the Danube. For plastic detection also chemical analysis are employed.

All materials interact with environment through their surfaces. Influence of environment changes physical and chemical properties and composition of the material surface. The composition of material surface depended from many factors as corrosion rates, catalytic activity, adhesive properties, wettability, contact potential, and failure mechanisms. X-ray photoelectron spectroscopy (XPS) and Fourier-transform infrared spectroscopy (FTIR) are methods suitable for determination of materials and surface changes on materials.

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2. RESULTS AND DISCUSSION

XPS and FTIR could provide quick and reliable analysis of plastic waste samples because there are large spectroscopy database of polymer and other materials. Degradation process, soil or metal contamination it is possible to measure or determine by processing of obtained spectra. This are reasons why we choose this to methods for plastic waste analysis.

Together with the chemical analysis, the photodocumentaton from the sampling of waste was of high importance in order to get the detailed output of the plastic waste sampling.

3. CONCLUSIONS

Plastic waste samples contained metal oxides (XPS: Fe2p signal at ca 711 eV) on the surface and higher amount of oxygen compared to original material (e.g. showed on Bounty stick collected as a waste and bought freshly in the market). All of the plastic wastes were successfully identified by the combination FTIR and XPS analysis. Results from optical microscope clearly shows the scratches on the surface, which can lead to the formation of microplastics.

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