CHEMICAL TRANSFORMATIONS OF PLASTIC WASTE AND BIOMASS – MONITORING AND PRODUCT ASSESSMENT

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The transformation techniques of plastic waste and biomass are essential tools in modern applied research, providing a valuable data for better understanding of circular economy as well as for other environmental topics. Pyrolysis, a thermal decomposition process in the absence of oxygen, is one of the attractive and effective ways of utilizing different type of waste. This transformation technique converts waste, such as plastics and biomass, into various products, which are considered as alternative resources in the petroleum and chemical industry. The conditions of pyrolysis, technology unit set-up, and feedstock pre-treatment influence the distribution of the final products into three main groups, i.e., gas, liquid (oil), and solid (pyrolysis wax and char).

Pyrolysis products are complex mixtures of numerous components and chemical compounds. A combination of different analytical methods with the necessary sample pre-treatment techniques is needed for the characterization and identification of these products. In order to perform detailed and robust non-targeted identification of pyrolysis products, High-resolution qTOF analyzers in combination with 1D or 2D chromatography separation and various ionization techniques are used, predominantly followed by targeted quantification of selected compound classes. In cases of solid products, the obtained results are compared with the total concentration of elements provided by XRF and ICP-MS analyses.

Presented results show a various spectre of organic compounds, especially alkanes, polyaromatic hydrocarbons, organic acids, chlorinated and brominated hydrocarbons, and other specificized organic substances. Detailed insights into pyrolysis products helps to understand the mechanism of the process and optimize the technology. They also support the development of suitable recycling technologies as well as the research of alternative resources and fuels. The better understanding of pyrolysis mechanism improves the control, prevention, and minimizes the negative impact on the environment and human health as toxic and carcinogenic compounds are known to be formed during the process.