Humic like substances (HULIS) are major constituents of PM10 (Havers et al., 1998). Those organic compounds are characterized by molecular weights up to several hundred Dalton. Their brownish colour reveals light absorbing properties, which may affect Earth’s albedo. The ultimate sources of HULIS in atmospheric aerosols are still under debate. Several reports pointed to biomass combustion (Feczko et al., 2007), while others showed no obvious similarity between HULIS isolated from biomass burning emissions and those found in winter ambient aerosols (Klatzer, 2013).

This study depicts the concentrations of total (water and alkaline soluble) HULIS, measured at the urban site affected by coal combustion emissions (Krakow, Poland). Additionally the concentrations of organic (OC) and elemental carbon (EC), levoglucosan and inorganic ions are discussed. The results are compared with values obtained for biomass burning influenced aerosols in Austria. Samples of particulate matter (PM10) were collected using two parallel low volume samplers (2.3 m³/h). Sampling was conducted from 27.01. to 17.02.2014 at the roof of University of Science of Technology in Krakow, Poland. Quartz fibre filters were changed every 24h from Monday till Thursday and left for 72 hours over Friday and weekend.

PM10 mass was determined gravimetrically. Quantification of HULIS was done separately for water extracts and alkaline extracts. The method includes a two-step HULIS isolation procedure (C18, SAX) and the subsequent thermal dissolved organic carbon analysis with NDIR detection (Limbeck et al., 2005). Carbon parameters were analysed with thermo-optical method (Sunset Laboratory Inc.) using EUSAAR2 protocol. Inorganic ions were determined by suppressed isocratic ion chromatography with conductometric detection (Thermo Scientific) and for the analysis of levoglucosan the high performance anion exchange chromatographic method with pulsed amperometric detection (Dionex) was applied.

The sampling period was characterized by high PM10 concentrations, lying between 30 and 237 µg/m³ with an average concentration of 76 µg/m³. The short time limit value of 50 µg/m³ was exceeded for 8 samples. Average OC contribution was 37%, revealing higher values during the days with higher PM10 concentrations. In contrast, the average EC share was around 13% and was constant during the whole period. According to preliminary results, the total (water and alkali soluble) HULIS-OC concentrations determined for pooled samples were between 1 and 24 µg/m³, resulting in average contributions of 17% to OC, and 6.5% to PM10. HULIS-OC correlates with EC values, while the correlation with levoglucosan, which could indicate the relation between HULIS emissions and wood combustion, is not visible (Figure 1).

Ambient winter HULIS concentrations in coal combustion influenced area - case study for Krakow, Poland

M. Kistler¹, A. Kadnar¹, K. Szramowiat², G. Woznica², K. Styszko², J. Golas² and A. Kasper-Giebl¹

¹Institute of Chemical Technologies and Analytics, Vienna University of Technology, Vienna, 1060, Austria
²Department of Coal Chemistry and Environmental Sciences, AGH University of Science and Technology, Krakow, 30-059, Poland

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Presenting author email: magdalena.kistler@tuwien.ac.at

HULIS-OC concentrations determined for pooled samples were between 1 and 24 µg/m³, resulting in average contributions of 17% to OC, and 6.5% to PM10. HULIS-OC correlates with EC values, while the correlation with levoglucosan, which could indicate the relation between HULIS emissions and wood combustion, is not visible (Figure 1).

The missing correlation with levoglucosan is not the only indication that biomass combustion is not the most prominent HULIS source. The comparison of total HULIS concentrations observed in Krakow with those found for the residential sites in Austria (Ebenthal-Zell, Leibnitz) reveals significant differences, pointing much lower relative contributions at places influenced mainly by wood combustion.

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