



Lignin derivatives as tool of organic matter studies in the marine coastal sediments

J. Pempkowiak, A. Staniszewski

Institute of Oceanology, ul. Powstancow Warszawy 55, PL 81-712 Sopot, Poland

Lignin compounds are phenolic polymers that occur as major constituents of the vascular plants cell walls. As a result of their natural abundance, wide distribution, and resistance to degradation, lignin is also commonly found in soil and sedimentary organic matter. Aldehydic phenols and phenolic acids are the predominant products of lignin chemical oxidation and are often used for characterizing lignin in marine sediments (Hedges & Ertel 1982).

Lignin polymers in plant tissues, soils, and sediments are not available to direct chemical analysis without prior isolation. Lignin in such samples can be characterized by chemical degradation. Oxidation with cupric oxide is one of the most commonly used methods of degradative chemical analysis.

The polar functional groups of the oxidation products are derivatized to make products more volatile, and analysed by capillary gas chromatography on fused silica columns with flame ionisation detection (Hautala *et al.* 1998; Miltner & Emeis 1999).

The total concentration of the phenols is then used to calculate percentage of lendar-derived organic matter in the sediments. The ratio of syringic to vanillic phenols (S/V) is indicative of the angiosperm plants tissue contribution, the cinnamyl to vanillyl units (C/V) is used to assess the importance of nonwoody tissue. The ratio of vanillic acid/vanillin (Ad/Al) as indicator of lignin digenetic changes extend is used.

Identification and quantification of lignin transported from the Vistula River (accumulation area in the Gdansk Basin) and Odra River (accumulation area in the Pomeranian Bay) to the sediment depositional areas in the southern Baltic was used to assess provenience of sedimentary organic matter, an important factor of carbon budget in the Baltic sea sediments.

The S/V ratios were found to range from $0,11 \pm 0,003$ to $2,23 \pm 0,08$. The vanillic acid-to-aldehyde ratios range from $0,18 \pm 0,001$ to $3,21 \pm 0,01$. The S/V ratios values are in the range from $0,13 \pm 0,005$ to $2,23 \pm 0,08$.

The measured differences in quality and quantity of the identified oxidation products, provide insight into transport processes of land derived organic matter from river mouth to the depositional area. Analyses of lignin degradation products in sediment cores is used to assess historical variations in quality and quantity of land derived organic matter discharged to the southern Baltic with river run off. The contents are discussed in terms of the organic matter origin and fate in the southern Baltic (Gdańsk Basin and Pomeranian Bay) in the course of transportation and diagenesis.

The overall conclusion is that some 40% of organic matter in sediments originates on land. Large scale engineering activities influence the land derived organic matter distribution.

References

Hedges J., Ertel R. (1982): Charakterization of Lignin by Gas capillary chromatography of Cupric Oxide Oxidation Products., Anal. Chem, 174-178.

Hautala K., Peuravuori J., Pihlaja K. (1998): Organic Compounds formed by chemical degradation of lake aquatic humic matter., Env. Int., Vol. 24, 527-536.

Miltner A., Emeis K., (1999): Origin and transport of terrestrial organic matter from the Oder Lagoon to the Arkona Basin, southern Baltic Sea., Organic Geochemistry, 57-66.