Variations in the distribution and radiocarbon age of lignin phenols exported by large river systems

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As a major component of vascular plant woody tissues and soil organic matter, lignin is widely distributed in coastal marine sediments through fluvial transport from the terrestrial environment. However, the transformation of lignin within river drainage basins and the timescales over which it is delivered to the oceans is not well understood. Here we describe analytical details and preliminary results on the distribution and isotopic composition of lignin-derived phenols in sedimentary particles from several major river systems that span a range of latitudes, extending from Arctic (Mackenzie and Lena), temperate (Columbia, Fraser, and Yangtze), to tropical regions (Congo and Ganges-Brahmaputra). These drainage basins are each characterized by large fluxes of terrestrial organic carbon and also encompass a variety of climatic and hydrological conditions. Investigating the provenance and transport of lignin in these areas allows for the assessment of environmental, geomorphic and other factors controlling the dispersal and burial of terrestrial organic carbon in the marine environment. Molecular markers of lignin are isolated by copper oxide oxidation, followed by high pressure liquid chromatography (HPLC), and further purified for compound-specific ^{14}C isotopic analysis. The efficiency of the lignin seperation method and the accuracy of radiocarbon measurement was tested on authentic phenol standards as well as on lignin phenol extracts from wood samples of pre-determined radiocarbon age. The radiocarbon contents of lignin phenols extracted from the sediments are compared with those of leaf wax lipids in order to provide insights on the cycling of different components of vascular plant organic matter within fluvial systems. Overall, our approach enables development of a comprehensive perspective on the transformations and fate of terrestrial organic carbon during riverine transport to the marine environment.

A preliminary study on the mechanism of methylmercury accumulation in rice at abandoned mercury mines in Guizhou, China

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The main objective of this study is to investigate the mechanism of methylmercury (MeHg) accumulation in rice by determining the MeHg levels and distributions in rice plants from a mercury mined area (Wanshan) and a control site (Huaxi). The experiment groups were designed as follows 1) Group 1, a rice paddy field in Huaxi, with low Hg in soil and low Hg deposition flux; 2) Group 2, an experiment box in Huaxi with soil from Wanshan, with high Hg in soil and low Hg deposition flux; 3) Group 3, a rice paddy field in Wanshan, with high Hg in soil and high Hg deposition flux; 4) Group 4, an experiment box in Wanshan with soil from Huaxi, with low Hg in soil and high Hg deposition flux. During the rice growing season (from June to September 2007), we collected samples once every two weeks, including precipitation, soil samples from the rice seeding roots, surface water samples from the rice paddy field and experiment box, pore water in soil, rice plant including roots, stalks, leaves, and seeds, and DOC, ORP and pH in soil pore water. THg and MeHg were measured in all samples according to US EPA Method 1631 and Method 1630. The results revealed that the main active transformation of inorganic Hg to MeHg takes place in rice paddy soil, and the newly deposited Hg is much easier to be transformed to MeHg and accumulated in rice than the 'old' Hg in soil. An interesting outcome of this study is the observation that seeds have the highest ability to accumulate MeHg than other tissues of rice plants (roots, stalks, leaves etc.).