Organic matter in bed-sediments of the River Danube and a small unpolluted stream, the Oberer Seebach

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With 7 figures and 1 table in the text

Abstract

Organic matter, the energy base of aquatic ecosystems, was studied in bed-sediments of the 9th order River Danube, near Loiben at river-km 2007. These sediments are well colonized by benthic consumers, and biofilm is a very important compartment of the organic matter. Total organic carbon and total organic nitrogen were measured as the main organic matter parameters. Horizontal and vertical distributions of organic matter as well as grain size distributions were measured. Results from the regulated, polluted and much-used large River Danube are compared with measurements in the unpolluted quasi-natural 2nd order stream Oberer Seebach, where the amount of organic matter is ten times higher. Possible explanations for these large differences are examined. Another comparison is made between an exceptionally silty study area and the sediments of impoundment Altenwörth at river-km 1992.

Introduction

Organic matter is the basic source of energy for consumers in ecosystems (e.g. CUMMINS 1974, HYNES 1963). In lotic ecosystems, most of the organic matter is allochthonous, imported as bank runoff (already processed soil material) or as aerial drift (unprocessed leaves, twigs etc.); in most streams only a small part of the organic input is autochthonous in origin. The energy content of unprocessed organic matter is not readily available to consumers; it has to be processed by the microbial community. Microbes are most active in biofilms, comprised of fungi and bacteria, and their organic excretions (exocellular polymers) attached to surfaces (MARSHALL 1984). The colonizable surface area in sediments is negatively correlated with grain size (HARGAVE 1972, LEICHTFRIED 1985, 1986). Therefore, the largest amounts of organic matter are likely to occur in small grain size classes, if biofilms are actually important components of the organic matter pool in river bed-sediments. Closely connected with these biofilms are protozoans and most of the meiofaunal species (SCHMID-ARAYA 1994, 1995). Biofilms and their associated communities are doubtless important food sources for benthic consumers (e.g. IVERSEN 1973).

The main energy pathway passes from organic matter to the microbial community, mainly in biofilms, and the biofilm community transforms the organic matter and makes it available to benthic consumers. In many streams the zoobenthic community is distributed vertically in the sediments, in the Danube to a depth of ca. 0.5 m...