

Ecological characterization of sediments in Flanders

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Abstract:

Sediment is an essential, integral and dynamic part of our river basins. Sediment is derived from the weathering and erosion of minerals, organic material and soils in upstream areas and from the erosion of river banks and other in-stream sources. As surface-water flow rates decline in lowland areas in Flanders, transported sediment settles along the river bed and banks by sedimentation. Sediments are the centre of intense biological activity which co-determine the good ecological functioning of all aquatic ecosystems, and which are affected by pollutants that accumulate in the sediments. They form a variety of habitats. Many aquatic species live in the sediment. Sediment dynamics and gradients form favourable conditions for a large biodiversity, from the origin of the river to the coastal zone. A healthy river needs sediment as a source of life.

Sediment acts as a potential sink for many hazardous chemicals. Since the industrial revolution, human-made chemicals have been emitted to surface waters. Due to their properties, many of these chemicals adsorb to sediment. Hence in areas with a long record of sedimentation, sediment cores reflect the history of the pollution in a given river basin. Where water quality is improving, the legacy of the past may still be present in sediments hidden at the bottom of rivers. These sediments may become a secondary source of pollution when they are eroded and transported further downstream.

In Flanders chemical analysis for the assessment of contaminated sediment is used to determine concentrations of selected hazardous chemicals and checked if the concentrations exceed quality standards. The toxic effects of sediment on organisms is tested by using bioassays. Through a field inventory the long-term impact on sediment biota is investigated. These three assessment methods (chemical, bioassay, biological field monitoring) are complementary by giving an answer that cannot be given by any of the individual methods. This Triad approach is used over the last decennium (2000-2010) in a large scale routine monitoring network by the Flemish Environment Agency (VMM). More than 600 locations are monitored in a cycle of 4 years. So a sediment quality assessment of more than

1500 sampling locations is done and results are gathered in a database.

Sediment was collected with a Van Veen grab sampler, mixed and stored at 4°C. Physical parameters such as the organic content, clay content and granulometry were analysed. The chemical compounds measured were arsenic, cadmium, chromium, copper, mercury, lead, nickel, zinc, mineral oils, extractable organohalogens, organic chlorine pesticides, PCB's, PAH's etc. Both acute and chronic tests were applied on the solid phase, the porewater and on extracts. The biological in-situ quality was characterised based on the present macrobenthic community.

With this database and experience the VMM get a lot of knowledge of the sediment quality of the Flemish watercourses. Moreover the monitoring network on sediments is recently enlarged by measurements on quantity. Quantity and quality would enable us to quantify the pollutant load.

In Flanders the sediment of 65% of the sampling sites has a relative high contamination of oil, 50% of the samples are contaminated with mercury, whereas 40% has a high concentration of PAH's. According to the triad assessment the sediment of almost 40% of the sampling sites can cause a severe threat to the ecosystem. In order to reach the goals of the WFD on both water- and sediment quality, a cost and ecologically efficient and effective sanitation program will be developed for the coming decade.