INFLUENCE OF BLACK CARBON ON SORPTION OF ORGANIC POLLUTANTS

RIVER BASIN MANAGEMENT ISSUE

Water Quality						Water Quantity		Alterations		Others
1	2	3	4	5	6	7	8	9	10	
C		C	C, M							

(1) Diffuse pollution by agriculture
(2) Salinisation
(3) Contaminated sediment and floodplain soils
(4) Large scale pollution due to past mining / industries activities
(5) Pollution by organic matter
(6) Emerging compounds
(7) Water scarcity
(8) Floods and low flow
(9) Hydromorphological alterations
(10) Soil erosion

C = System Characterisation
M = System Monitoring
T = System Trend
R = System Remediation, Mitigation

RIVER BASIN

Danube	Ebro	Meuse	Elbe	Brévilles	Others
✓	✓.	✓	✓	✓	

Spec. : Results specific to selected River Basin

KEY FINDING TYPE

Understanding Processes (lab-scale)	Characterisation (field scale)	Modelling
✓		

BENEFITS TO END-USERS

Technical		Management	Policy	
WFD Implementation	Research	River Basin	Compliance	Policy making
✓	✓	✓		

INTRODUCTION

BGC2 deals with the sorption of organic contaminants. BGC2 aims to understand what part of the organic matter controls the sorption process and especially studied the contribution from black particles on the sorption process. The novelty of BGC2 is to follow a **mechanistic approach for the determination of Kd**. BGC2 also studies the relationship between atmospheric pollution and sediment pollution by quantifying the distribution of organic contaminants in soil samples.

KEY ISSUES

BGC2 studied the influence of black carbon[1] on sorption of organic pollutants such as selected pesticides (atrazine), PAHs and chlorinated organic compounds. At first materials containing elevated organic matter content (e.g. such as coal, peat, lignite) were used as samples reference to undertake the experiment. In a second step, samples from the four AT basin were characterised. As BGC2 research deals with characterisation of organic compounds behaviour, it can potentially address any river basin management issues associated with *organic pollutants* (i.e. *Diffuse pollution by agriculture (due to pesticides) or atmospheric deposition; Contaminated sediment and floodplain soils; Large scale pollution due to past mining / industrial activities).*

[1] Black carbon is defined as follows. Although there is some consent about the general perception and implication of BC, scientists from various disciplines still have largely diverting understandings about what BC in detail is, and how it is measured. For instance, on the one hand, soil geochemists and petrographers envisage BC as macroscopic particles originating from different sources such as natural vegetation fires or kerogens (e.g. coals). On the other hand, atmospheric scientists and environmental chemists see BC mostly as nanoparticles derived from incomplete combustion of liquid fossil fuels (soot; termed “elementary carbon”).

As the knowledge gained in BGC2 is valid for organic contamination in general, BGC2 results will be assessed with respect to the overall issue of *Organic pollution*.

The research on black carbon and its influence on organic compound sorption enables to gain knowledge about the system characterisation with respect to soil and sediment characterisation and isotherm sorption characterisation.

- ***System characterisation***:
    - Black carbon content of reference soil samples and river basin samples was quantified through coal petrography using microscope. These experiments showed that black carbon represents 2 to 100% of organic matter present in the reference soil samples (100% for pure coals), and 1 to 50% of organic matter in the river basin sediment samples. Sorption isotherms were determined for a range of contaminants including pesticides, chlorinated compounds and PAHs for a range of concentration of 5 orders of magnitude. These results were in line with literature value. These two series of analysis enabled to show that there is a correlation between the black carbon content and the Kd for the reference materials: Kd increases as black carbon content increases. BGC2 results demonstrated that for hydrophobic compounds black carbon content is a key parameter of organic compounds sorption. However, the limitations of this finding (e.g. soil characteristics and type of contaminants) in still under research.
    - Research results showed that both organic matter and black carbon content could have an effect on Kd of organics: In BGC2.7BIS, results for OM and BC from samples taken in the different basins are reported. For instance, the sediment sample taken in the Danube basin has a relatively high organic carbon content, but a very low BC content and consequently a lower sorption capacity than the samples taken from the Elbe basin (OM content comparable).

RECOMMENDATIONS

The research carried out by BGC2 related to black carbon enabled to propose the following recommendations:

- ***Mitigations***: Black carbon by its properties of sorption can be used to reduce diffuse organic pollution. Indeed, it can be spread on contaminated soils or sediment and promote the immobilisation of contamination. This mitigation method could be applied in harbour area to immobilise organic contaminants in sediments and minimise the release of organic contaminants in the surface water.

These recommendations can be useful for the following **end-users:**

- **People who managed the River basin dealing with organic diffuse pollution**