Study of phenomena responsible for organic contaminants mobilization within the framework of harbor sediment dredging

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Introduction: This work is performed in framework of Mediterranean harbor dredging and is intended to be use for the improvement of dredging operations management as well as potential beneficial use of dredged sediments. Sediments constitute an important source of inorganic and organic contaminants of marine environment [1]. In order to avoid site pollution increase or taking pollution away from harbor during sediment dredging, factors which could drive organic contamination mobilization are studied.

Indeed, organic pollution mobilization can result from various and complex phenomena: sediment's granular behavior (agglomeration/dispersion) physico-chemical (adsorption/desorption) and/or chemical (dissolution/precipitation) [2]. Thus the main goal is to study and identify those phenomena in other to understand, and predict them. A better understanding of contaminants mobilization factors, will be use useful for dredged sediment quality assessment and for dredging operation consequences.

Pollutants transfer or dispersion depends on several phenomena like partition between interstitial water and solid phase and/or particle dispersion. Morpho-granular, physicochemical, crystallographic and chemical characterizations of sediments collected were realized to study possible transfers of organic pollutant like Polycyclic Aromatic Hydrocarbons (PAHs).

Methods: The samples named M (sea), C (channel) and B (fishing basin) were collected in the Mediterranean harbor of Grau du Roi located in the south of France, from different sites based on sediments' texture proprieties and their organic pollution concentration. Each sample has been sieved in 4 fractions; F0 (<1000µm), F1 (80-1000µm), F2 (40-80µm) and F3 (<40µm). Then granular aspect of different sediment solid fraction has been investigated by Scanning Electron Microscopy with Energy Dispersive X-ray spectroscopy (SEM-EDX), laser granulometry and correlated to PAHs concentration. Liquid fraction of sediment (pore water) was extracted by centrifugation and analyzed by GC-MS to determine the concentration of PAHs. Characterization of the 16 PAHs in sediment's solid and liquid fraction was performed by GC-MS.

Results: Various textures of the studied sediments were revealed by granular characterization (Tab.1). PAH analysis demonstrates that there wasn't PAHs in pore water, they were only found in solid fractions.

Sample	Sand	Silt	Clay	Texture	S_{BET} (m^2/g)	TOC (%)
B_F0	15%	75%	10%	Silty	3,8	3,08
C_F0	52%	41%	7%	Silty Sand	4	3,06
M_F0	62%	34%	3%	Sandy	2,2	1,3

Tab. 1: Morpho-granular characterization and total organic carbon (TOC) of studied samples. Sand (60-2000µm), Silt (2-60µm), Clay (<2µm).

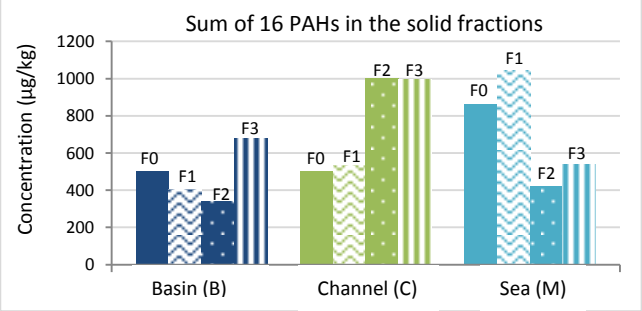

Fig. 1: Total concentration of the 16 PAHs in each solid fraction based on sediment dry weight.

Discussion: Distribution patterns of PAHs are similar for sample B and C, PAHs concentrations are high in fines fractions while it's the opposite for sample M where concentration is high for large fraction (Fig.1). There is a strong correlation between the sum of 16 PAHs with TOC contents. Indeed the more TOC content the more PAHs concentration.

In conclusion, during dredging finest particles in the basin and channel could lead to disperse pollution in the water column and/or to be swept away.

References: [1] Huntingford and Turner (2011) *Marine Pollution Bulletin* **62**:1557-1561; [2] Coulon and Azéma (2015) *Powder Technology* **275**:139–15; [3] Villa-Navia et al. (2016) I2SM Montreal.