Granular and chemical characterization of harbor sediments: Impact of particle separation and organic pollution assessment

Nathalie AZEMA[1], Fanny COULON[1], Yao LIU[2], Catherine GONZALES[2]

[1]Centre des Matériaux d'Alès, Ecole des Mines d'Alès, 6 avenue de Clavières F-30319 Alès Cedex, France

[2] Laboratoire du Génie de l'Environnement Industriel, Ecole des Mines d'Alès, 6 avenue de Clavières F-30319 Alès Cedex, France

Phone: +00-(0)-0000-0000000

E-mail: Nathalie.azema@mines-ales.fr

Introduction: Sediments in harbor areas constitute an important sink of contaminants and represent a potential source of inorganic and organic pollution to the marine environment (Baumard et al., 1998; De Luca et al., 2004; Huntingford and Turner, 2011; Mamindy-Pajany et al., 2013). Remobilization of sediment-associated contaminants can occur during natural events or anthropogenic activities and increase the bioavailability of pollutants in water column (Eggleton and Thomas, 2004). That may also be a pollution mobilization in solid fraction via the dispersion and the agglomeration of the sediment particles (**Fig. 1**).

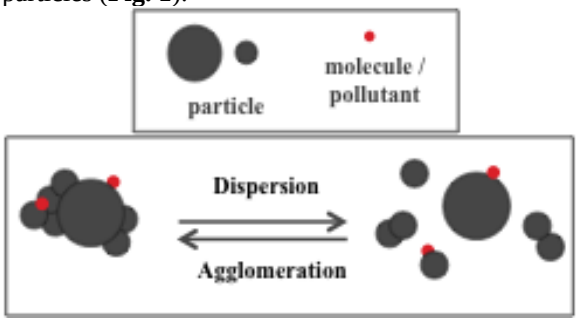

Fig. 1: Dispersion and agglomeration of the sediment particles.

An exhaustive characterization of sediments collected in the Mediterranean Port-Camargue Harbor was carried out to address the pollution mobilization and resedimentation issues during the dredging project. In this work we studied the size fractioned sediments in order to localize the PAH and to try to understand organic pollution transfers during dredging processes.

Methods: Three sediments were chosen in function of different textural properties (sandy, muddy and sandy-muddy sediments) and different sampling sites. The PAH were extracted, purified and the concentrations were determined by GC-MS. The organic matter content in each granular fraction was also defined. The granular aspects (distribution of particle size, specific area, morphology) were jointly studied with laser granulometry and SEM. Several physical parameters were also determined.

Results: The morpho-granular and physicochemical analyses showed that all sediment samples presented many granular populations with grain size, nature and form aspects very different. Because of cohesive sediment properties, sieving process are not effective and can influence the quality of experimental analysis. A particle size fraction separation method was also developed (**Fig. 2**). BET specific area is correlated with the presence of fine particles in each size grain fraction. This discriminate parameter can contribute to pollution sorption phenomena.

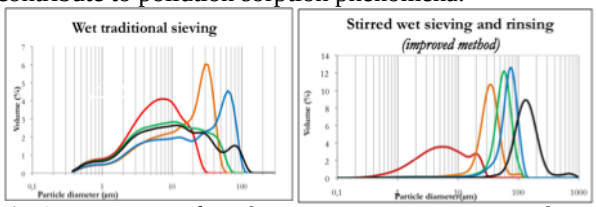

Fig. 2: Impact of cohesive property on granular separation.

The Port-Camargue sediments present generally PAH concentrations below the level N1, so the ecological impact is view as negligible. The PAH concentrations was correlated to several parameters (organic matter content, presence of fine particles, BET specific area).

Sediment type	Mass percent fraction (%)	Pyrène concentration (µg/kg)
Sandy S_{BET} : 2,0 m^2/g	> 80 µm - 85% < 80 µm - 15%	62,6 *(CV 1,1%)* 109,2 *(CV 6,9%)*
Sandy-muddy S_{BET} : 3,5 m^2/g	> 80 µm - 55% < 80 µm - 45%	79,5 *(CV 2,5%)* 146,3 *(CV 0,1%)*

Tab. 1: Influence of size grain on pyrene concentration.

Discussion: The sorption phenomena can be linked to mineral or organic fractions of sediments. Moreover the PAH concentration depend on fine particles presence (indicated by BET specific area), so the particle separation quality should be controlled for analyses and also during dredging process.

References: Baumard et al. (1998) *Estuarine, Coastal and Shelf Science* **47**:77-90; De Luca et al. (2004) *Marine Chemistry* **86**:15-32; Eggleton and Thomas (2004) *Environment International* **30**:973-980; Huntingford and Turner (2011) *Marine Pollution Bulletin* **62**:1557-1561; Mamindy-Pajany and al. (2013) *Chemosphere* **90**:2730-2736