An Environmental – Friendly Approach to the Remediation of Dredged Polluted Sediments of the Venice Lagoon, Italy

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Abstract:
The contamination of waters and sediments in coastal areas and harbours is due to a wide range of organic (POPs, such as PCBs, PAHs, ecc.) and inorganic pollutants (trace elements, such as mercury (Hg), lead (Pb), chromium (Cr), etc.). In these areas sediments may be a significant sink and/or source of these pollutants. Taking into account the necessity to dredge sediments in order to keep channels of navigation open, remediation and environmental recovery are of great consequence in harbour areas. In fact, the management of dredged sediments is nowadays crucial for the growth of the port of Venice, due to increasing sea traffic and to increasing foreign trades. In view of the dredging of many millions of cubic meters of sediments according to the *Piano di Recupero Morfologico (Regione Veneto, Magistrato alle Acque e ufficio del Commissario Delegato per l'Emergenza Socio Economico Ambientale relativa ai Canali Portuali di Grande Navigazione della Laguna di Venezia)*, the main goal of this project is to assess a novel washing procedure for dredged sediments, which will be environment friendly and suitable for the variety of organic and inorganic pollutants, by exploiting the surface-active and complexing properties of natural organic substances.
In the first phase of the study, dredged sediments from the industrial area of the Venice lagoon were characterised for the concentration of organic pollutants (such as PCBs, PAHs) and for the total concentrations of several trace elements (such as chromium (Cr), nickel (Ni), copper (Cu), zinc (Zn), cadmium (Cd), arsenic (As), mercury (Hg), lead (Pb), etc.). Furthermore, we used a modified sequential extraction procedure (a modified Tessier procedure) in order to evaluate the concentration of the trace elements in the chemical fractions: the exchangeable, the carbonate bound, the Fe and Mn oxides bound, the sulphur and organic matter bound, the residual bound. All the samples analysed were representative of the bulk. The first two fractions are considered the most mobile and thus the most bioavailable and those, which may exert toxic effects on biota.
In the next phase of this study, the sediment washing procedure was assessed, taking into account different parameters and using commercially available natural organic substances. All the batch experiments were run in duplicate, to test the homogeneity and the repeatability of the procedure After being washed, sediments showed an average decrease in the concentrations of organic and inorganic pollutants (40% and 30% respectively, or greater). These results are very promising, due to the holistic approach used for different classes of pollutants. Moreover, this study underlines the importance of speciation, since, according to the most recent frameworks on risk assessment, it is essential to know the bioavailability and bioaccessibility of pollutants in order to plan the most suitable remediation project.