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Combined mineralogical and EXAFS characterization of polluted sediments for the definition of technological variables and constraints

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An extremely severe aspect, both from environmental and economic viewpoint, is the management of polluted sediments removed from drainage and irrigation canals. Canals, in order to retain their functionality over the time, need to have their beds, periodically cleaned from sediments there accumulating. The management of removed sediments is extremely demanding, also from an economical perspective, if these latter needs to be treated as dangerous waste materials, as stated in numerous international standards. Furthermore the disposal of such a large amount of material may introduce a significant environmental impact as well. An appealing alternative is the recovery or reuse of these materials, for example in brick and tile industry, after obviously the application of appropriate techniques and protocols that could render these latter no longer a threat for human health. The assessment of the effective potential danger for human health and ecosystem of sediments before and after treatment obviously requires both a careful chemical and mineralogical characterization and, even if not always considered in the international standards, the definition of the coordination shell of heavy metals dangerous for human health, as a function of their oxidation state and coordination (e.g. Cr and Pb), and introducing technological constraints or affecting the features of the end products. Fe is a good representative for this second category, as the features of the end product, such as color, strongly depend not only from Fe concentration but also from its oxidation state, speciation and coordination. This work will first of all provide mineralogical characterization of sediments from various sampling points of irrigation and drainage canals of Po river region in the north-eastern of Italy. Samples were investigated with various approaches including X-ray powder diffraction under non-ambient conditions, thermal analysis and EXAFS spectroscopy. Obtained results, and in particular EXAFS spectra were used to define and optimize the technological variables of the recovery process.