How we could beneficially use and remedy contaminated marine sediments in KOREA?

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Introduction: More than 250 remediation methods have been being used separately or combined with one or more method(s) in well developed nations such as USA, European Countries during few decades. In KOREA, the remediation of contaminated marine sediments was originated from 1988. However sustainable remediation methods were very limited, the feasibility of beneficial use and on-site treatment of contaminated marine sediments was focused on in this research in order to solve the scarcity of various treatment and disposal methods in KOREA. Although the remediation mechanism of contaminated marine sediments is similar to that of soil, particle size distribution, high contents of organic matters and the presence of chlorine ions might be also limit factors comparing to the remediation of contaminated soil. If remediation process could be conducted on-site (or immediate area) of target area and if treated sediments might be used benificially followed by environmental dredging, Korea's dilemma such as the mass transportation hardship of dredged materials, the lack of treatment area (upland/near shore) and et cetra will not take place.

Methods: Marine sediments were collected at a coastal area (N) which were candidate sites for the remediation of contaminated marine sediments and then used as samples. In this research, the percentage of water content (WC), chemical oxygen demand (COD), acid volatile sulfide (AVS), ignition loss (IL), heavy metals (Nickel (Ni), Copper (Cu), Zink (Zn), Arsenic (As), Cadmium (Cd), Lead (Pb), Mercury (Hg)) and persistence organic pollutants (PCBs, PAHs) were analyzed based on internationally approved methods. Besides, dilute HCl extractions method [1] were used for the evaluation of the state change of heavy metals. In batch experiments, 30 g (dry weight) of sediment sample were put in 500 ml poly propylene (PP) wide neck bottle and then mixed with oxidants and/or surfactants. H_2O_2 and Tween 80 were used as non ionic surfactants. Total volume of sediment and additive(s) were 100 ml. Treatability of sediment samples were tested in 1 h. Hence, laboratory scale experiments using pilot, sample (lower than 125 μm(particle size)) were tested in continuous flow reactor which was composed of 2 reactors (effective volume: 18ℓ) with H_2O_2 (oxidant) and/or Tween 80 (non-ionic surfactant) as additives under various conditions (reaction time and concentration of additives). Micro-bubble (size: 1 mm) were also tested in order to increase the removal efficiency of pollutants in fine particles of marine sediments. And each treatment process of washing technologies combined with particle separation was also tested under various conditions.

Results: Based on experimental results, the use of H_2O_2 as oxidants and Tween 80 as non-ionic surfactant was very effecitive and adequate on the viewpoint of environmental safety, cost and second pollution. Lots of treated sediments under various conditons were to meet domestic environmental standards for disposal such as near shore confined disposal facility (NS-CDF) as well as beneficial use at up-land landfill. Thus washing technology by using H_2O_2 and Tween 80 combined with particle separation (higher than 125 μm, 125~ 63 μm, 63~ 32 μm, lower than 32 μm) might be successfully applied in the remediation of contaminated marine sediments. Besides washing and particle separation technologies which were selectively used on the basis of their contamination degree, were applied repeatedly and then treated sediments of all particle size distribution including lower than 32 μm could be used as various purposes.

Discussion: Fine particles of contaminated marine sediments could be treated by particle separation of specific range with washing technologies under suitable conditions. And fine particles of contaminated marine sediments could be treated by particle separation of specific range with washing technologies under suitable conditions (sample (30 g, dry weight) with H_2O_2 (5M, 100 ml) and surfactant (Tween 80, 100 ml) for 1 h).

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References: [1] Scouller, RC et al. (2006) *Chemosphere*, **65**: 294-309.