

Characterisation of heavy metal pollution by spent abrasivematerial in nearby marine sediment by using sediment quality indices and single extractions in Van Phong bay – Vietnam.

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In recent years, shipping industrial activities developed in Van Phong bay (South-Central Vietnam), have raised an urgent environmental concern related to the use of copper slag as abrasive material for removing rust and marine deposits from ships. This study was conducted to investigate the characteristics of the spent copper slag used as abrasive material and sediment samples collected nearby the area of the shipping company in Van Phong bay. Moreover, some single extractions were performed to examine under which conditions heavy metals may leach out from the spent copper slag and sediment. The obtained results indicated that sediments at Van Phong bay were characterized by a low clay mineral and organic matter content and a low cation exchange capacity. The carbonate component (inferred from Ca content) was dominant in all sediments (25%). A strong positive correlation was found between Al, Fe, K and organic matter content and some heavy metals (As, Pb and Zn). A combined approach using sediment quality guidelines (SQGs) and different quantitative indices (Geo-accumulation Index- I_{geo} , Enrichment Factor- EF, Pollution Load Index – PLI and Risk assessment Code – RAC) was used to investigate the pollution status for each heavy metal in the area. Arsenic shows the greatest concern because

of its high EF and I_{geo} . Zinc, Cu, Pb and As possess a "high risk" in the sediment and spent copper slag to environment due to the high RAC. Some marine sediment samples adjacent to the abrasive blasting working area can be considered as hot spots of pollution because of the high value of all quantitative indices, classified in SQGs in the highest class: "adverse biological effects". Results from the single extractions suggest that heavy metals in both sediments and spent copper slag show a low actual mobility (according to $CaCl_2$ extraction) and were not easily mobilized by sea water (extractability < 1% of total concentration by NaCl extraction) and organic complexation (extractability < 10% of total concentration by EDTA extraction). Extraction with CH_3COOH was used to assess the acidification on heavy metal release. The ratios of extractabilities using EDTA (to assess the effect of complexation on heavy metal release) and CH_3COOH (to assess the effect of acidification on heavy metal release) were calculated to find out whether heavy metal release was most affected by acidification or complexation reactions. These ratios suggest that acidification has a more pronounced effect on heavy metal release both in sediments and spent copper slag (except for Cd and Pb having a ratio higher than one in sediments).

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