

عنوان مقاله:

Harbor water pollution by heavy metal concentrations in sediments

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خلاصه مقاله:

**BACKGROUND AND OBJECTIVES:** The Belawan Harbor is the third largest port, which is located in an estuary, causing the port water area to be vulnerable to pollution, especially heavy metals. Conflicts between the community and the port authorities often occur due to pollution. Heavy metals are dangerous contaminants for waters, and total organic carbon in waters is needed but will cause eutrophication if the concentration is excessive in the environment. The level of heavy metal pollution in the waters of the Belawan Harbor and the factors that cause the pollution should be analyzed, because the level of heavy metal pollution has not been measured in the sediments of harbor waters. This study can be used as a reference for the actions of related agencies in dealing with heavy metal pollution in waters. **METHODS:** Sampling of sediments was performed at ۱۰ locations, starting before the harbor activity began and moving toward the open sea. Sampling was conducted using Van Veen grab. Heavy metal concentrations were analyzed in the laboratory using the atomic absorption spectrometer method to assess the essential heavy metal copper and non-essential heavy metal lead, cadmium, and mercury. Heavy metal pollution in sediments was assessed by analyzing sediment pollution index. The multivariate statistical analysis on the relationship among factors was conducted using Pearson correlation matrix method, principal component analysis, and cluster analysis. **FINDINGS:** The environmental quality standards used indicate average concentration of heavy metals; lead (۲۸,۸۶۹ milligram per kilogram) and copper (۸,۰۰۳ milligram per kilogram) are below the quality standard. The mercury concentrations are undetectable ( $< ۰.۰۰۰۱۱$  milligram per kilogram) at each station. By comparison, the concentration of cadmium (۱,۴۵۵ milligram per kilogram) exceeded the Interim Sediment Quality Guidelines from the Canadian Council of Ministers of the Environment. Results of the index analysis show that the average value of the pollution factor of copper is  $-۰.۱۷۷$  (low contamination), that of lead is  $-۱.۴۳۳$  (moderate contamination), and that of cadmium is  $-۴.۸۵۰$  (high contamination); the geoaccumulation index value of copper is  $-۵.۳۲۸$  (not polluted), that of lead is  $-۰.۱۹۰$  (unpolluted), and that of cadmium  $-۱.۶۵۷$  (moderately polluted). As mercury concentration in sediments is relatively low, it is not considered when calculating pollution levels. Overall, on the basis of a pollution index of  $۱.۰۳۳$  ( $۱ < \text{pollution load index} \leq ۲$ ), this condition indicates that the waters of the ... Belawan Harbor are cate

کلمات کلیدی:

(Belawan Harbor, Heavy metal, Multivariate statistical analysis, Sediment pollution index, Total organic carbon (TOC

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