



Ecological risk assessment of heavy metal pollution in surface sediment of Mahakam Delta, East Kalimantan

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Abstract

Spreading heavy metals in the water column may be accumulated in sediment because of low solubility then become sensitivity indicator for aquatic organism existence. Ecological risk is assessed through the heavy metals concentration in the surface sediment. Sediment samples were grabbed from 20 stations in Mahakam Delta divided into four zones. Hakanson method was used to identify potential risk ecology then multivariate analysis was used to determine heavy metals pollution source. The results showed that Zn (0.12 mg/kg), Cr (4.77 mg/kg), Cd (76.17 mg/kg) and Ni (33.48 mg/kg) concentration exceeded Threshold Effect Level furthermore Ni also exceeded Probable Effect Level. Base on the type, potential risk heavy metals sequence were Pb>As>Cd>Ni>Zn>Cr>Cu. The criteria of ecological risk on Pb and As were considerable risk (E_r^i Pb: 52.18 and E_r^i As: 50.00) and the others were low risk. Moreover, the potential ecological risk sequence base on the location of study were ST18>ST3>ST8>ST1>ST7>ST6>ST11>ST20>ST19>ST4>ST16>ST5>ST9>ST15>ST2>ST13>ST14>ST17>ST10>ST12. The criteria of ST 18, ST 3, ST 8, ST 1 and ST 7 belong to considerable risk, ST 12 was low risk and others location were medium risk.

Keywords: Ecological risk assessment, heavy metal, surface sediment, Mahakam Delta

Method

Potential ecological risk index (Hakanson 1980):

$$C_f^i = \frac{C_s^i}{C_r^i}; E_r^i = T_r^i \times C_f^i; ERI = \sum_{i=1}^n E_r^i$$

- C_s^i : contamination factor of heavy metal;
- C_o^i : concentration of heavy metal on sediment;
- C_r^i : reference value of heavy metal;
- E_r^i : ecological risk potential of heavy metal;
- T_r^i : toxicity response factor of heavy metal;
- ERI: potential ecological risk index

E_r^i	Ecological Risk Criteria of Heavy Metal (Gan <i>et al.</i> , 2000)	ERI	Potential Ecological Risk Index Criteria (Gan <i>et al.</i> , 2000)
$E_r^i < 30$	Low Risk	ERI < 100	Low Risk
$30 < E_r^i < 50$	Moderate Risk	100 < ERI < 150	Moderate Risk
$50 < E_r^i < 100$	Considerable Risk	150 < ERI < 200	Considerable Risk
$100 < E_r^i < 150$	Very High Risk	200 < ERI < 300	Very High Risk
$E_r^i > 150$	Disastrous Risk	ERI > 300	Disastrous Risk

Result

