

# Ecological Risk Assessment of Elemental Pollution in Sediment from Tunku Abdul Rahman National Park, Sabah

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**Abstract.** Eleven (11) surface sediment samples were collected from Tunku Abdul Rahman National Park, Sabah. The neutron activation analysis (NAA) and inductively coupled plasma-mass spectrometry (ICP-MS) techniques were applied for the determinations metal contents and their distributions in sediment samples. The results shown that Arsenic (As) concentrations are enriched at all sampling stations except for station TAR 09, with enrichment factor (EF) values ranged from 1.1 to 7.2. The elements such as Cd, Cr, Sb and U showed enrichment at a few stations and other elements (Cr, Cu, Pb, Th, Zn) shown as background levels in all stations. Degrees of contamination in this study were calculated base on concentrations of six elements (As, Cd, Cr, Cu, Pb, and Zn). TAR 11 station can be categorized as very high degree of contamination with degree of contamination value of 43.2. TAR 07 station can be categorized as a considerable degree of contamination (contamination value of 16.9). Six stations (TAR 01, 03, 04, 05, 06, 08, 10) showed moderate degree of contamination, with contamination values ranging from 8.0 to 16.0. TAR 02 and TAR 09 stations showed low degree of contaminations ( $< 8.0$ ). TAR 11 showed very high ecological risk index ( $R_i$ ) with  $R_i$  value is 916. TAR 07 and TAR 10 showed moderate ecological risk index with  $R_i$  value 263 and 213, respectively. Other stations showed low ecological risk with  $R_i$  values ranging from 42.3 to 117 ( $< 150$ ). Very high ecological risk index could give an adverse effect to the benthic organism. The data obtained from the enrichment factor, degree of contamination and ecological risk index provided vital information, which can be used for future comparison. Information from the present study will be useful to the relevant government agencies and authorities in preparing preventive action to control direct discharge of heavy metals from industries, agro-base activities and domestic waste to the rivers and the sea.

**Keywords:** Enrichment factor, degree of contamination, ecological risk index

**PACS:** 80

## INTRODUCTION

Uncontrolled development and rapid industrialization around cities and coastal area have brought alarming level of pollutions to the aquatic environment because of their anthropogenic inputs [1]. Water, sediment and biota can use as an indicator to determine the level of heavy metals pollution. Sediments are important sinks for various pollutions like organic and inorganic (heavy metals) and also play a significant role in the assessment of ecological risk [2,3]. Heavy metals are considered as a serious inorganic pollution because of their toxic effects to the aquatic life [4–6]. Heavy metal sources in marine environment include natural sources from atmospheric deposition, land runoff, rock weathering, river bank/coastal erosion [7,8] and anthropogenic sources from agriculture activities, disposal of liquid effluents, urban and industrial emission, [9-12].

Methods used to evaluate the ecological risk posed by heavy metals in sediments include calculation of the enrichment factor [12-14], the degree of contamination and potential ecological risk

index [15]. A complementary approach that integrated sediment standard criteria, enrichment factor, geoaccumulation index and degree of contamination is necessary in order to provide accurate assessment of heavy metal accumulation from anthropogenic sources [16, 8] and finally to evaluate the potential ecological risk assessment.

Study on heavy metal contents, degree of contamination and ecological risk assessment around Tunku Abdul Rahman National Park is still limited [6]. In this present study, heavy metals in sediment were selected because they are important due to public health concern and impact to the benthic organism at the national park and also vital information for baseline data. The purposes of this study are, to identify the degree of sediment contamination and to assess the potential ecological risk of contamination in Tunku Abdul Rahman National Park.