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# COMPARISON STUDY OF LINEAR ALKYL BENZENES IN SURFACE SEDIMENTS FROM BRUNEI BAY AND MUAR RIVER

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## INTRODUCTION

Linear alkyl benzenes (LABs) are a suite of the organic marker compounds which are the raw materials of LAS (Linear alkyl sulfonates) type detergents. LABs are ubiquitous compounds due to their intensive usage and their relation to sewage contamination around the world. Surficial sediments were collected from selected locations from developed areas around Peninsular Malaysia including Muar River and Brunei Bay as well, in order to investigate the distribution of LABs, their characteristics and possible sources in these areas. The samples were analyzed, extracted, fractionated and quantified using gas chromatography-mass spectrometry (GC-MS). The Internal/External (I/E) ratio were used as indicators of LABs biodegradation in the aquatic environment. The results showed that the total concentration of LABs ranged from 67.38 to 255.81 (ng/g dw) in Muar River with a mean value of 128.03 and from 7.10 to 41.27 (ng/g dw) with a mean value of 19.76 in Brunei Bay. I/E ratios showed high primary range indicating secondary effluent exists in the study area of Muar River and Brunei Bay. Sewage may have been discharged from wastewater treatment plants and from urban runoff and consequently transported via lateral movements through canals, rivers, and drainage channels and finally settled in these estuaries and bays. The overall view of LABs concentration showed that Muar River stations demonstrate higher LABs concentration than Brunei Bay stations. Anthropogenic activities, rapid population growth and industrialization in the sampling locations on the Muar River and Brunei Bay may contribute significant amounts of LAB discharges to the aquatic systems.

Brunei is a Southeast Asian country located on the island of Borneo consisting of two unconnected parts with a total area of 5,765 square kilometres and a population of 415,717 of which 76% live in urban areas. The rate of urbanization is estimated at 2.13% per year from 2010 to 2015. Brunei has a Bay that is the ocean gateway to the isolated Temburong District of Brunei, separated from the rest of Brunei by

the Malaysian state of Sarawak surrounding it on the bay. The present study was conducted to assess the anthropogenic impacts of LABs on the aquatic environment of the Brunei Bay and Muar River. This study could also provide valuable insights into the degradation of LABs in the marine environment as well as to act as a gauge for the efficiency of sewage treatment plants in this area.

## MATERIALS AND METHODS

### *Study Area*

The study was conducted in the estuary and lower reaches of Muar River (Figure 1) and the inshore areas of Brunei Bay (Figure 2). The Muar River passes the Muar town in Johor and runs into the Muar estuary which includes the Taman Tanjung Emas recreational park. Three surface sediment samples were taken for this study at the sites with the coordinates shown in Table 1. The first surface sediment sample (SMu1) was taken from the upstream of the river. The second and third surface sediment samples (SMu2 and SMu3, respectively) were collected from the middle and downstream of the river. While this river carries a huge amount of organic pollutants, including LABs generated from industries and municipal waste, the Muar estuary is likely to be the final depositional sink for the LABs. Brunei Darussalam is situated on the northern part of Borneo Island. 14 surface sediment samples were collected from Brunei Bay along the main coast.

### *Sample Collection*

Sediment samples for this research were collected in May and December 2013. Surface sediment samples (top 4 cm representing recent input) from selected location along Muar River and Brunei were taken using Ekman Dredge Sediment Samples. Each sediment sample then was placed into a pre-cleaned stainless steel container. The samples were stored in zip-lock bag, labelled and stored in a cooler box with ice or dried ice at about 4 °C. Then the samples were carried to the laboratory and stored at -18 °C before further analysis.