CHARACTERISTICS OF FINE PARTICULATES OF TWO LARGEST CITIES IN INDONESIA USING ION BEAM ANALYSIS

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Urban air pollution is a major problem in Indonesia and has growing recognition of the health effect problems resulting from airborne particles. Even some cities have been identified for their high levels of air pollution. Therefore, characterization of the chemical composition of air particulates is a fundamental step for identification of pollutant sources. These chemical compositions are generally at trace levels thus require an accurate and suitable analytical method such as Ion Beam Analysis (IBA) which is fast, effective and has high sensitivity. In this study, a non-destructive IBA method was applied to characterize $PM_{2.5}$ of ambient air samples in the two largest cities in Indonesia, namely Jakarta and Surabaya which have different characteristic as urban cities. There are two sampling sites in Surabaya; East-South Surabaya is an area where a lot of industries are located, and West Surabaya which is close to port but no metal industries, while Jakarta has been identified as Mega City with the most populous city in Indonesia. The locations of the sampling were present in Fig.1. The $PM_{2.5}$ air particulate samples were collected for 24-hours using GENT sampler from 2019 – 2020. As much as 105 samples; 32 samples from Jakarta, 35 samples from East-South Surabaya and 38 samples form West Surabaya, have been collected and analyzed. Several elemental compositions i.e., F, Na, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, As, Br, Rb, Sr, Y, Zr and Pb, have been well quantified. Figure 2 showed the ratio of elemental concentration between East-South Surabaya and West Surabaya to Jakarta as comparison.
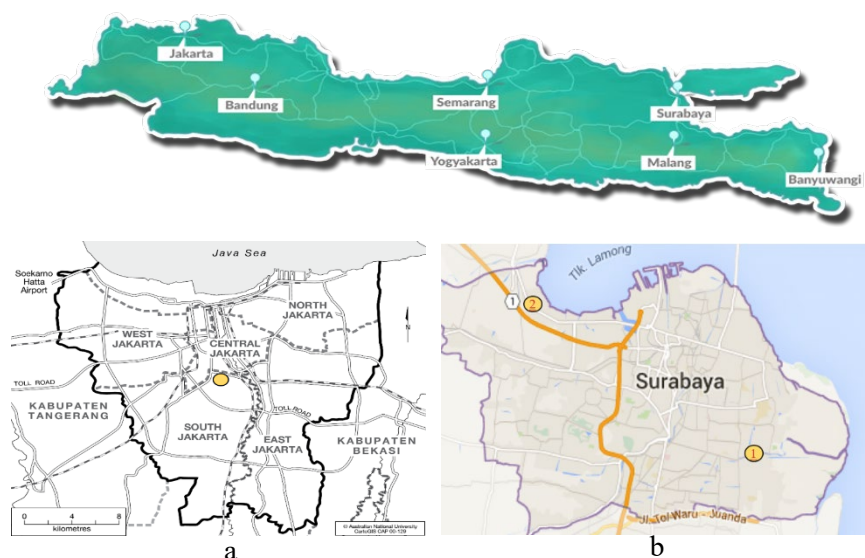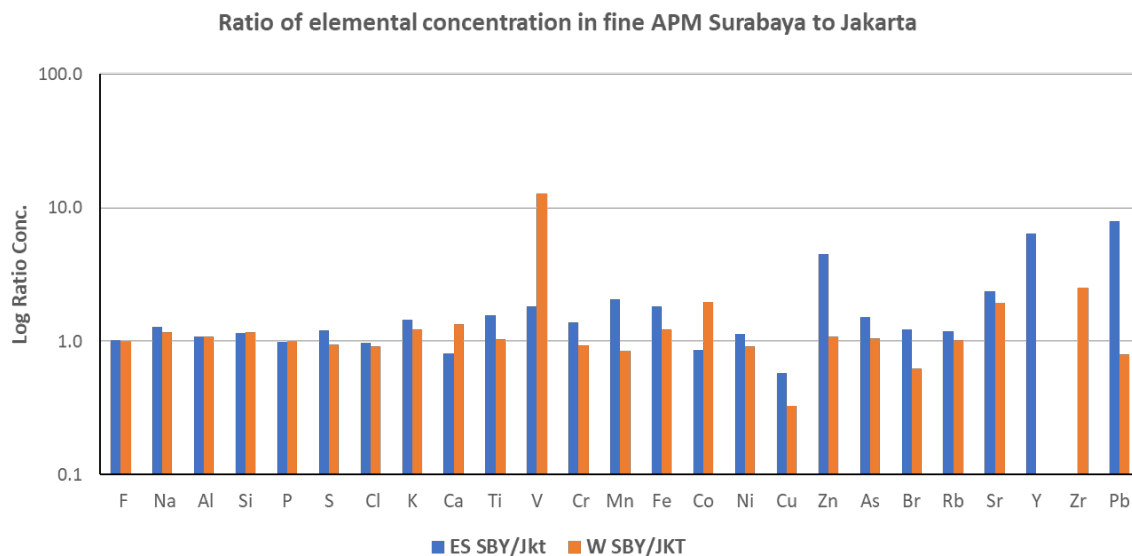

Figure 1. The sampling locations in Jakarta (a) and Surabaya (b)

Ratio of elemental concentration in fine APM Surabaya to Jakarta

Figure 2. The elemental ratio concentration of ambient air PM$_{2.5}$ between East-South Surabaya to Jakarta (ES SBY/Jkt) and West Surabaya to Jakarta (W SBY/Jkt)

From Fig 2, it can be seen that Potassium in Surabaya at 2 sites were higher than in Jakarta that may related to biomass burning. In West Surabaya, Vanadium was found significantly higher than in Jakarta as showed in Fig.2. This may be due to the location that close to the port since Vanadium is one of key elements to the emission of refinery oil. Several metals such as Cr, Mn, and Fe were found higher in East-South Surabaya which may related to the metal and steel smelter industries. Significant high concentration of Zn and Pb were also found in East and South Surabaya, reached 4.5 and 7.8 times respectively, which are due to Lead and Zinc smelter in the area. While in Jakarta, Cu concentration was 2-3 times higher than it's found in East-South Surabaya and West Surabaya as well, describing the possibility of the sources from non-ferrous industries.

The results of elemental composition in ambient air PM$_{2.5}$ using IBA technique analysis is able to provide good and comprehensive results in term of urban air characterization. Three sampling locations from Jakarta and Surabaya gave different results according to the characteristics of the area. The multi-element identification from the IBA analysis is also able to provide an overview of the contribution of emissions from industry to air quality in the surrounding environment.

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