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RESIDUAL ALUMINIUM IN DRINKING WATER SUPPLIES IN RELATION TO PEATLAND CATCHMENT AREAS IN MUKAH, SARAWAK

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Abstract: This study focused on the relationship between peatland catchment areas and aluminium (Al). For some major development areas in Sarawak, the only available water sources are peat waters. Thus, the objectives of this study were to quantify the levels of Al and other trace metals in raw and treated water from peat and non-peat sources and also to quantify the levels of organic matter and nutrients in raw water from peat and non-peat sources. The study was conducted at four selected catchment areas in Mukah, Sarawak. In particular, this study shows that the treated and raw water sources from both peat and non-peat sources have high levels of Al, ranging from 0.089 – 3.458 mg/L for raw water and 0.235 – 4.574 mg/L for treated water. In addition, results show that treated water from two of the peat water sources were significantly higher in mean levels of Al as compared to before treatment in both sampling trips. Treated water from non-peat source also was significantly lower in mean levels of Al than the treated water from peat sources. Low pH, a typical peat swamp water characteristic was shown to have a big impact on the levels of Al in treated water, mainly due to the higher solubility of Al in acidic condition, with the use of Al-based coagulants in its water treatment processes. Thus, considerations have to be made on the use of Al-based coagulants.

Keywords: Raw water, trace metals, treated water, water quality

Introduction

Challenges in health and aesthetic parameters in public water supply are major concerns in drinking water treatment. What have always been feared since the practice of using chemical treatment in water are the residues and by-products it produces. For example, trihalomethane (THM) is a widely known carcinogenic by-product produced by the application of chlorine in water disinfection process (Richardson & Postigo, 2012). In order to provide potable water supply, surface water has always been treated with aluminium (Al)-based chemicals like Al sulphate $(Al_2SO_4)_3$, polyaluminium chloride (PAC) or Al chlorohydrate (ACH). Addition of these chemicals are favorable due to their effectiveness in the removal of particulates and colloidal and dissolved substances by the formation of visible flocs through coagulation and flocculation that can then be eliminated through other series of physical treatment processes such as sedimentation and filtration before water can be disinfected using chlorine (Srinivasan *et al.,* 1999; Binnie & Kimber, 2009). Often, this treatment will produce a certain level of residues; thus, all water purveyors in Malaysia are to comply with the National Drinking Water Quality Standards (NDWQS) set by the Ministry of Health (MOH). For residual Al, the maximum permissible limit is set at 0.2 mg/L (NDWQS, 2004) for treated water. Although acute exposures to high doses of Al are well tolerated, some studies had shown possible relationship with neurodegenerative diseases such as Alzheimer's (AD) and Parkinson's Dementia (PD) (Gidding, 1998; Flaten, 2001; Virginie *et al.,* 2009) regardless that the risk factor for these diseases has not been resolved conclusively. Dosing of Al-based chemicals in water treatment is suggested to be the major source of residual Al in drinking water; however, it is not the only cause, as Al also occur naturally in soil and water bodies (ATSDR, 2008).

There are two naturally abundant types of soil available in Sarawak, namely Histosols and Ulvisols, and these largely contribute to the