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THE ROLE OF PEAT LAYER ON NUTRIENTS AND METAL CONCENTRATION ON PEATLAND WITH A SUBSTRATUM OF SULPHIDIC MATERIALS

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SUMMARY

Peat soil in tropical area is characterized as marginal or infertile soil. In Indoneia, the majority of them have sulphidic materials as substratum. The disappearance or depletion of peat layer may lead to the changes in environmental condition and quality due to increasing of peat material oxidation, moreover sulfidic material as subtratum mineral of peatlands may oxidized when contact with oxygen. This paper aims at reviewing the contribute of peat layer on contentration of phosphate (P), nitrogen (N), iron (Fe) and aluminium (Al) in the peatland with sulphidic material as substratum. Peat layer might act as the main source nutrients and had an important role on the solubility of Fe and Al in peatland with sulphidic material substratum. The Depletion or disappearance of peat layer decreased P concentration and total N but increased Al and Fe^{2+} concentration in soil solution. Disappearance of peat layer mean loss of a natural sources of N and P for peatland with sulphidic material as substratum, therefore peat layer must be kept in order to maintain of peatlands.

***Keywords**: nutrients, metal, peat layer, sulphidic materials*

INTRODUCTION

In the tropical area, peat material are formed on anaerobic condition. Peat layer is organic material that relative resistant on decomposition processes. Duly, peat material may contain nutrient even though in low amount. However, peat soil in tropical area is characterized as marginal or infertile soil. Most of the peatlands in Indonesia have sulphidic material as substratum layer, the soil layer contain metal element in large concentration, especially iron and aluminium. Considering the present of peatland with sulphidic material as substratum layer in tropical area that in the fact has important role on environmental function. This paper aims at reviewing the contribute of peat layer on contentration of phosphate (P), nitrogen (N), iron (Fe) and aluminium (Al) in the peatland with sulphidic material as substratum.

PHOSPHORUS AND NITROGEN CONCENTRATION

Phosphorus and nitrogen in peat layer was higher than sulphidic material layer, the concentration pattern was gradually decrease with increasing soil depth (Figure 1). These fact indicated role of peat layer as the main source of P and N in peatland with sulphidic material substratum. According to Xing *et al.* (2011) peat matter is N reserves in peatland. The presence of P and N in surface layer mainly supplied through mineralization process of peat. Organic matter that highly humified or poorly decomposable provides a small but constant source of nutrients which may favour the formation of organic P (Malik *et al.,* 2012) and Geurts *et al*. (2010) also have reported that peat mineralization process enhance P concentration in the soil surface of peatland. According to Yonebayashi *et al.* (1997) P tend to accumulated in the upper layer due to the relatively rapid decomposition processes in forest soil ecosystems. Stone and Plante (2014) concluded that low P concentration in subsurface of mineral soil corelated with microbial communities and substrate concentrations.

Plant and organism residue indirectly may be a source of renewal of peat material, peat layer and organic material that continues to be added from the plant and organism residue is the main source of P and N in the peatland with sulphidic material substratum. The majority of P residue in plant litter that lies aboveground has the potential to be delivered to soil in a form readily available to plants and soil microorganisms (Noack *et al.,* 2012). Weedon *et al.* (2014) demonstrated the important role of substrate input from organic material on nutrient cycling on the peatland.

Higher N and P concentration in upper layer of the peatland is indication that peat layer act as source of soil nutrients. The depletion or disappearance of peat layer may decreased N and P concentration in soil solution,

this mean loss of a natural sources of P for peatland with sulphidic material as substratum, therefore peat layer must be kept in order to maintain of peatlands.

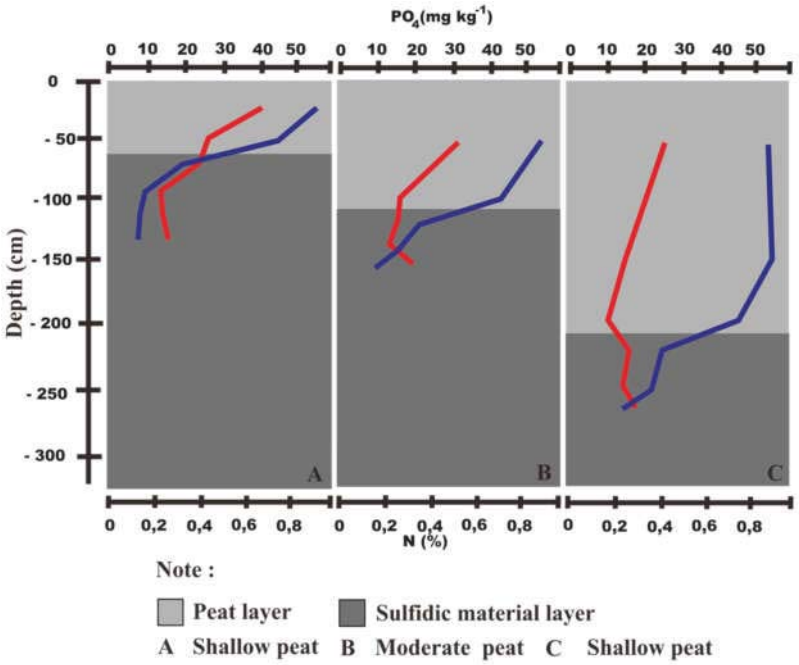

Figure 1: Phosphate concentration (red line) and total nitrogen (blue line) in shallow, moderate and deep peat (Fahmi *et al*., 2013*;* Fahmi *et al* ., 2014).

ALUMINIUM AND IRON CONCENTRATION

The presence of peat layer above on sulfidic material decreased Fe concentration and exchangeable Al concentration (Figure 2). In addition, Fe concentration and exchangeable Al concentration in the shallow peat are higher than moderate peat. This condition shows the influence of the peat thickness on the dynamics and movement of Al and Fe in the peat layers. Aluminium and Fe tend to be more easily dissolved in a peatland with thinner peat layer, although peat has a large fixation ability on metal ion but low affinity of the peat for Al compared to Fe (Saragih, 1996). This condition may cause the high content of exchangeable Al in the shallow peat. This result is similar to an experiment conducted by Kolii *et al.* (2010), they reported that Al concentration in the peaty soil was higher than in peat soil. High content of organic compound in peat leads to higher of Al in the peat layer chelated by these compound. This condition is reflected by low exchangeable Al concentration in peat layer. Depletion in peat layer leads to increased in exchangeable Al concentration. These facts indicated the roles of peat thicknesss and peat material such as humic substances in complexation of Fe and Al, especially by humic matter (Karlsson dan Persson, 2010).

Large of exchangeable Al concentration in shallow peat shows that 50 cm of the peat thickness (shallow peat) was critical for peat to reduce the Al solubility in the peatland. The thinner peat will decrease the retention power for the metal ions. This condition leads to the increasing concentration of dissolved Al and Fe in the peat layer. Aluminium and Fe in peat soil may originated from sulphidic material layers. Concentration is very high in sulphidic material layer but low in peat layer due to chelation by humic substances contained in peat. The depletion in peat layer will potentially release of Al and Fe to surrounding environment. For this reason, the existency of peat layer must be conserved.

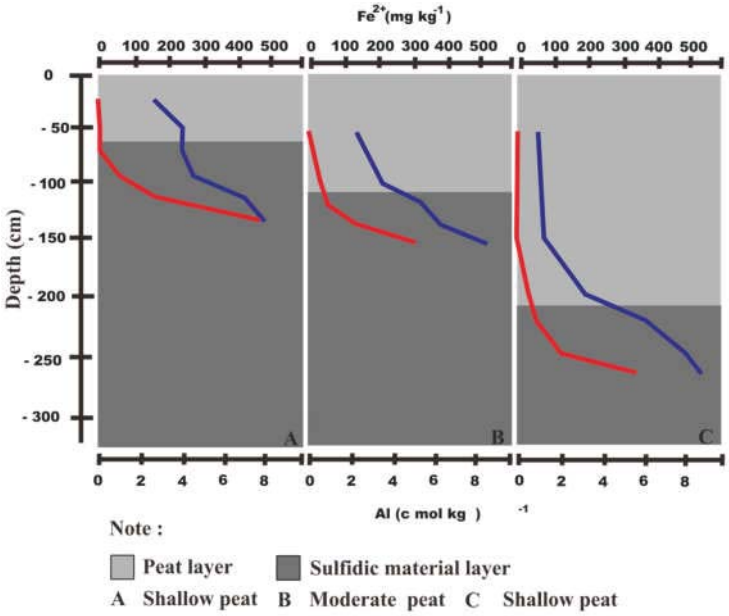

Figure 2: Exchangable aluminium (dot line) and Ferro concentration (red line) in shallow, moderate and deep peat (Fahmi *et al*., 2010*;* Fahmi *et al.,* 2012).

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