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Methanotrophy Potential in Tropical Peatland under Different Land Use in Sarawak, Malaysia

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Tropical peatlands hold immense global significance, serving as critical ecosystems that provide a wide range of services including carbon storage. The conversion of a large fraction of tropical peatlands into primarily agricultural lands in Malaysia has raised concern over the dynamics of carbon cycle including methane (CH_4) in tropical peat soil. As CH_4 is a potent greenhouse gas mainly produced under anoxic conditions, it is widely assumed that the waterlogged nature of peatlands emit a significant amount of CH_4, though CH_4 emission in tropical peatlands are comparatively lower than boreal peatlands. Methane oxidation (methanotrophy) by methanotrophic bacteria is the only known biological oxidation of CH_4. However, there is a limited understanding of the methanotrophy in tropical peat soil of different land use. This study aims to study the methanotrophy potential in both tropical peat swamp forest and oil palm plantations. Soil sampling was carried out in July 2023 (dry season) from peat swamp forest of Maludam National Park and an oil palm plantation (OPP), encompassing both matured and young OPP. All sites are historically from Mixed Peat Swamp (MPS) forest type. Peat sample was collected from the topsoil (0-10 cm depth). Methanotrophy potential was assessed by incubation in 100 mL vial bottle supplemented with 2-3% $_{v/v}$ CH_4. Soil pH, moisture content, total C and N, and electrical conductivity were determined. The total N differs significantly ($p<0.05$) with 1.93%, 1.72%, and 1.53% in the peat swamp forest, matured OPP, and young OPP, respectively. Total N has been associated with methanotroph community composition and its oxidation activity. Soil methanotrophy ranged from 0.35 to 0.60 µmol g dw soil^{-1} day^{-1} during the microcosm study. Results from this incubation demonstrated methanotrophy potential rate across three sites showed no significant difference, suggesting methanotrophy of topsoil may not be affected by different land use. In addition, the methanotrophy rate showed no correlation with the total N in this study. Nevertheless, validation of *pmo*A gene abundance across different land uses using quantitative polymerase chain reaction analysis will be conducted to further confirm if methanotrophy is affected by different land use on tropical peat soil.