

FINAL REPORT

**BIOGENIC VOLATILE ORGANIC COMPOUNDS
EMISSION IN MALAYSIAN LANDSCAPES AND ITS
IMPLICATION TO THE GLOBAL CARBON CYCLE
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SYNOPSIS

Emissions of biogenic volatile organic compounds from vegetation are recognized due to their importance in influencing the chemical and physical properties of the atmosphere. To date, very limited studies in tropical plants have been included in the regional and global inventories of emissions, albeit their role in the global carbon cycle; tropical rainforest is the major sink of carbon dioxide on Earth. This study aims to understand the carbon balance over tropical landscapes by determining how much carbon is being absorbed by vegetation and how much is being emitted back to the atmosphere in the form of biogenic volatile organic compounds in different vegetation landscapes, i.e. primary forest, secondary forest, and oil palm plantations. Results of this study showed that the primary and secondary forests of Danum Valley, Sabah, Malaysia have similar isoprene emission potentials of $2,164 \text{ g km}^{-2} \text{ hr}^{-1}$ and $2,012 \text{ g km}^{-2} \text{ hr}^{-1}$, respectively, while the isoprene emission potential of oil palm plantation is $19,500 \text{ g km}^{-2} \text{ hr}^{-1}$. Isoprene emissions from oil palms are highly dependent to temperature. In terms of species emission potentials, Dipterocarps that dominate the tropical rainforest are non-isoprene emitter but monoterpene emitters, while most of the pioneering plants (Euphorbiaceae, Zingiberaceae) are both isoprene and monoterpene emitters. The sources of isoprene emission from primary forest are from Moraceae, Leguminosae, and Clusiaceae, among others. This study conclude that tropical rainforest of Danum Vally, Sabah, particularly the oil palm plantations are significant sources of biogenic volatile organic compounds and should be considered in regional and global carbon modeling. This study also highlights the need for more studies on the behavior of tropical plants as far as emission of biogenic volatile organic compounds, especially under stressed conditions.

SINOPSIS

*Emisi sebatian-sebatian organik meruap biogeni oleh tumbuh-tumbuhan diakui kepentingannya dalam mempengaruhi ciri-ciri kimia dan fizikal atmosfera. Setakat ini, kajian-kajian yang amat terhad saja terhadap tumbuh-tumbuhan tropika dijalankan untuk inventori emisi serantau dan sedunia di sebalik peranan-peranannya dalam kitaran karbon sedunia; hutan hujan tropika adalah sinki karbon dioksida utama Bumi. Kajian ini bertujuan untuk memahami keseimbangan karbon merentasi landskap tropika dengan menentukan jumlah karbon yang diserap oleh tumbuh-tumbuhan dan jumlah yang dipancarkan balik ke atmosfera dalam bentuk sebatian-sebatian organik meruap biogeni pada landskap tumbuh-tumbuhan yang berbeza, seperti hutan primer, hutan sekunder dan ladang-ladang kelapa sawit. Hasil kajian ini menunjukkan bahawa hutan primer dan sekunder Lembah Danum, Sabah, Malaysia mempunyai potensi emisi isoprena yang hampir serupa, iaitu masing-masing pada nilai $2,164 \text{ g km}^{-2} \text{ hr}^{-1}$ dan $2,012 \text{ g km}^{-2} \text{ hr}^{-1}$, manakala potensi emisi isoprena daripada pohon-pohon kelapa sawit adalah $19,500 \text{ g km}^{-2} \text{ hr}^{-1}$. Emisi isoprena daripada pohon-pohon kelapa sawit adalah amat bergantung kepada suhu. Dari segi potensi emisi oleh spesies-spesies, dipterokarpa yang mendominasi hutan hujan tropika merupakan pemancar bukan isoprena tapi pemancar monoterpena, manakala kebanyakan tumbuh-tumbuhan pelopor (*Euphorbiaceae*, *Zingiberaceae*) merupakan pemancar isoprena dan monoterpena. Sumber-sumber emisi isoprena daripada hutan primer adalah *Moraceae*, *Leguminosae* dan *Clusiaceae*. Kajian ini memutuskan bahawa hutan hujan tropika di Lembah Danum, Sabah, khasnya ladang-ladang kelapa sawit merupakan sumber-sumber signifikan bagi sebatian-sebatian organik meruap biogeni dan seharusnya dipertimbangkan dalam permodalan karbon serantau dan sedunia. Kajian ini turut mengetengahkan keperluan untuk lebih banyak kajian perlakuan tumbuh-tumbuhan tropika serta emisi sebatian-sebatian organik meruap biogeni, khasnya dalam keadaan-keadaan tertekan.*