ANALYSIS AND CHARACTERIZATION OF POLYAROMATIC HYDROCARBONS (PAHs) IN SELECTED INDUSTRIAL AREAS

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FAKULTI SAINS DAN TEKNOLOGI

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ANALYSIS AND CHARACTERIZATION OF POLY AROMATIC HYDROCARBONS (PAHs) IN SELECTED INDUSTRIAL AREAS

By

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JABATAN SAINS KEJURUTERAAN
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LIST OF ABBREVIATION AND SYMBOLS

Symbol / Abbreviation	Description
ACL	Acenaphthylene
ANT	Anthracene
BAA	Benzo[a]anthracene
BAP	Benzo[a]pyrene
BBF	Benzo[b]fluoranthene
BKF	Benzo[k]fluoranthene
BPR	Benzo[ghi]perylene
CAN	Acenaphthene
CHR	Chrysene
DBA	Dibenzo[ah]anthracene
DCM	Dichloromethane
FLR	Fluoranthene
FLU	Fluorine
GC-FID	Gas Chromatogr aphy-Flame Ionization Detector
HVAS	High-Volume Air Sampler
INP	Indeno[1,2,3-cd]pyrene
K_{ow}	Hydrophobicity Index
NAP	Naphthalene

OSHA	Occupational Safety Health Act
PHE	Phenanthrene
PYR	Pyrene
PAHs	Polycyclic Aromatic Hydrocarbons
v/v	Volume per volume

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ABSTRACT

For the past three decades, polycyclic aromatic hydrocarbons (PAHs) have been one of environmental concern due to their toxicity and their ubiquitous presence in the environment. In view of globally, PAHs are the largest emission into the air or atmosphere; and the effect to the exposure of PAHs is cancer. The emissions of PAHs are mainly dependent on fuel types, combustion conditions, chemical composition of that fuel and the type of appliance. Therefore, the characterization and concentration of PAHs compounds emitted from different biomass burning and dust emission in particulate phases are studied as well. The concentrations of PAHs in aerosol, soil, dust and ash particles were measured at two selected industrial areas such as oil palm and paddy industry in Kuala Terengganu, Malaysia. Aerosol particles were collected using High-Volume Air Sampler (HVAS) on glass fiber filters for 24 hours. The samples were extracted with dichloromethane by ultrasonic agitation. The extracts are then fractionated on a silica gel and alumina using column chromatography. Quantification and identification of individual PAHs components were performed on Gas Chromatography-Flame Ionization Detector (GC-FID) by comparing their retention times with those known standards. Total concentration of aromatic hydrocarbons in air particle samples in oil palm industry was 26 times higher than the samples in paddy industry which no combustion process. The PAHs concentration in air particle is greatly high compared to soil and dust samples (below 10 μg/g.D.W). Naphthalene (NAP) is generally present in all the samples (0.105 μg/g.D.W- 45.158 μg/g.D.W) where else, a few of compounds had detected. Among of the samples, ash samples found at high level where 11 types of compounds had detected. The result indicates high amount of the aromatic hydrocarbons condensed onto air particulates or dust rather than soil or ash samples. It also observed that samples from oil palm industry exhibit higher concentration of PAHs than samples from paddy industry.

ABSTRAK

Pada tiga dekad yang lalu, polisiklik aromatik hidrokarbon (PAHs) telah diberi perhatian kerana ketoksikannya dan ia mudah hadir di mana-mana di dalam persekitaran. Pada pandangan secara global, PAHs merupakan unsur pelepasan terbanyak ke dalam udara atau atmosfera; dan kesan pendedahan PAHs boleh membawa kanser. Pelepasan utama PAHs adalah bergantung kepada jenis-jenis bahan api, keadaan pembakaran, kandungan kimia dalam bahan api tersebut serta jenis peralatan yang digunakan. Maka, gambaran sifat-sifat dan kepekatan PAHs akan dikaji berdasarkan asap pembakaran biojisim dan pelepasan habuk dalam fasa partikel. Kepekatan PAHs dalam partikel-pertikel atmosferik, tanah, habuk dan abu akan diukur di dua kawasan perindustrian yang terpilih seperti kilang kelapa sawit dan padi dalam Kuala Terengganu, Malaysia. Partikel-partikel atmosferik akan dikutip dengan menggunakan Pensampel Udara Berisipadu Tinggi (HVAS) di atas kertas penapis fiber kaca dengan persampelan sepanjang 24 jam. Sample-sampel yang dikutip akan diekstrakkan dengan dichloromethane oleh pengadukan ultrasonik. Kemudian, ekstrak-ekstrak tersebut akan dipecahkan atau diasingkan di atas gel silica dan alumina dengan menggunakn Turus Kromatografi. Pecahan aromatik yang diperolehi akan disuntik ke dalam G*as Chromatography-Flame Ionization Detector* (GC-FID) untuk dianalisis. Jumlah kepekatan PAHs dalam sampel partikel udara di kilang kelapa sawit adalah 26 kali lebih tinggi daripada sampel dari kilang padi yang tidak melibatkan proses pembakaran. Kepekatan PAHs dalam partikel udara adalah jauh lebih tinggi daripada sampel-sampel tanah dan habuk (kurang daripada 10 μg/g.D.W). Naphthalene (NAP) adalah komponen yang biasa wujud dalam semua sampel (0.105 μg/g.D.W- 45.158 μg/g.D.W). Bagi sampel yang lain hanya dapat mengesan beberapa PAHs komponen sahaja. Di kalangan semua sampel, sampel abu mendapati 11 jenis PAHs komponen. Daripada keputusan yang ada, didapati bahawa kebanyakan kandungan PAHs adalah dikondensasikan ke dalam partikel atmosferik berbanding ke dalam tanah atau abu. Selain itu, didapati juga kepekatan PAHs yang diperolehi dari kilang kelapa sawit adalah lebih tinggi dari kilang padi.