ABSTRACT

Although formaldehyde has been declared as a 'human carcinogen', world demand for this organic compound is remained strong as there is no suitable substitute for its multi applications. A study was carried out to determine the effects of wood species and its moisture content on the formaldehyde emission. In the quantitative analysis, solid phase micro-extraction sampling from the absorbing solution (SPME-A) and air sampling directly from the wood specimen (SPME-W) were used for comparison with the existing methods: desiccator-acetyl acetone (DC-AA), small chamber-chromotropic acid (SC-CA) and liquid-liquid extraction with different detectors (LLE-FID and LLE-ECD). Meanwhile, the plywood was treated to upgrade its formaldehyde classes physically by increasing the surface veneer thickness and through chemical scavenging.

Both moisture content and wood species significantly affected the formaldehyde emission. Validation of the SPME method was evidenced. It showed better repeatability (RSD 1.8 %) and proven to be highly precise (at the 95% confidence level) with better efficacy by exhibiting a good level of recovery (102%). In addition, the SPME method exhibited better linearity with regression value of 0.9982. Furthermore, the limit of detection (0.01 mg/L) and limit of quantification (0.02 mg/L) obtained enlarged the coverage of the SPME for trace levels of formaldehyde determination. The SPME-W method best correlated with DC-AA (R^2 = 0.9834) for original samples and with the LLE-ECD (R^2 = 0.9486) for treated samples. The headspace SPME proved to be a reliable alternative in the volatile formaldehyde determination similar to the other official methods used. Both the physical and chemical treatments were found to be effective in formaldehyde minimisation and to reach the permitted safe level of emission.

ABSTRAK

Walaupun formaldehid diisytiharkan ‘karsinogen kepada manusia', permintaan dunia terhadap sebatian organik ini kekal tinggi sebab tiada pengganti sesuai dengan aplikasinya yang menyeluruh. Kajian pengaruh spesies dan kelembapan kayu terhadap pembebasan formaldehid dijalankan. Bagi analisis kuantitatif, kaedah lebih cekap diperlukan demi meningkatkan tahap kepekaan dan kejituan. Oleh itu, pengekstrakan mikro fasa pepejal yang menyampel larutan penyerap (SPME-A) dan secara langsung dari spesimen kayu (SPME-W) dibandingkang dengan kaedah sedia ada: desikator-asetil aseton (DC-AA), kebuk kecil-asid chromotropik (SC-CA) dan ekstrakan air dengan pengesan yang berbeza (LLE-FID dan LLE-ECD). Papan lapis dirawat demi menaikkan taraf pembebasan formaldehid secara fizikal dengan menambah ketebalan lapis dan melalui perangkap kimia.

Faktor kelembapan dan spesies kayu didapati mempengaruhi pembebasan formaldehid dengan ketara. Pengesahan kaedah SPME terbukti. Kaedah SPME menunjuk kebolehulangan yang lebih baik (RSD 1.8%). Ia terbukti jitu (pada tahap keyakinan 95%) dengan keberkesanan yang lebih baik serta menunjukkan tahap pemulihan yang cermerlang (102%). Disamping itu, kaedah SPME dengan nilai regresi 0.9982 telah menunjukkan kelinearan yang lebih baik. Selain itu, had pengesanan (0.01 mg/L) dan had kuantifikasi (0.02 mg/L) meluaskan lingkungan SPME dalam penentuan tahap surih formaldehid. SPME-W berkorelasi paling baik dengan DC-AA (R^2 = 0.9834) bagi sampel asal dan dengan LLE-ECD (R^2 = 0.9486) bagi sampel terawat. SPME headspace terbukti menjadi alternatif dalam penentuan pembebasan formaldehid seperti kaedah piawai yang lain. Kedua-dua jenis rawatan secara fizikal dan kimia terbukti berkesan dalam mengurangkan formaldehid dan mencapai tahap pembebsan yang selamat seperti yang dibenarkan.

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