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AFLATOKSIN DALAM KACANG TANAH MENTAH: PEMBANGUNAN KAEDAH ANALISIS, TAHAP KONTAMINASI DAN KAJIAN DEGRADASI

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ABSTRAK

Kaedah *ISOLUTE™ Multimode Column* (IMC) telah dipilih dan diubahsuai (MIMC) dengan tujuan untuk menggunakan semula satu unit kolum *ISOLUTE™ Multimode* sehingga 10 kali untuk pencucian sampel dalam analisis aflatoksin (AF). Kesemua aras kepekatan (20, 400 dan 2000 ppb) AF-B_1 dan AF-G_1 di dalam sampel kacang tanah tidak menunjukkan perbezaan yang signifikan ($p > 0.05$) di antara 10 kali ulangan penggunaan semula kolum yang sama. Ketepatan kaedah MIMC ini digambarkan oleh nilai perolehan semula keseluruhan yang tinggi iaitu 82.9 % untuk AF-B_1 dan 101.9 % bagi AF-G_1. Nilai pekali variasi (CV) yang rendah iaitu 1.5 % bagi AF-B_1 dan 1.3 % untuk AF-G_1 pula menunjukkan kepersisan kaedah yang dibangunkan ini amat baik. Tambahan pula, kaedah ini bukan sahaja lebih murah berbanding dengan kaedah IMC dan kaedah *National Resource Institute* yang diubahsuai (MNRI) malah lebih cepat berbanding dengan kaedah MNRI. Sebanyak 145 sampel kacang tanah mentah tanpa kulit telah di ambil dari 3 buah daerah di Perak iaitu Kuala Kangsar, Larut Matang dan Kerian untuk dianalisis kandungan AF-B_1 dan AF-G_1 serta kehadiran kumpulan *Aspergillus flavus*. Kaedah pemiringan terus di atas agar *Aspergillus Differential Media* (ADM) digunakan untuk mengesan kehadiran kumpulan *A. flavus* manakala kandungan AF-B_1 dan AF-G_1 dianalisis menggunakan kaedah MIMC. Hasil tinjauan ini menunjukkan bahawa insiden serta julat kehadiran kumpulan *A. flavus* (86%, 1.0×10^2 - 1.1×10^5 cfu/g) dan kontaminasi oleh AF-B_1 (50%, 0.85-547.51 ppb) dan AF-G_1 (37%, 1.37-375.98 ppb) yang tinggi walaupun kesemua sampel yang dianalisis berada pada aras aktiviti air (a_w) 0.72. Insiden kontaminasi aflatoksin keseluruhan ($B_1 + G_1$) juga didapati tinggi (50%) dalam julat 0.85-762.05 ppb dan 45% daripadanya melebihi had maksima yang dibenarkan di Malaysia menurut Peraturan Makanan 1985. Kehadiran AF-B_1 ($r = 0.216$) dan AF-G_1 ($r = 0.272$) didapati berkorelasi secara lemah ($p < 0.05$) dengan jumlah kiraan koloni *A. flavus*. Kehadiran AF-B_1 adalah berkorelasi secara sederhana ($r = 0.698$; $p < 0.05$) dengan kehadiran AF-G_1. Walau bagaimanapun didapati tiada korelasi yang signifikan ($p > 0.05$) di antara nilai aktiviti air (a_w) sampel dengan kehadiran kumpulan *A. flavus*, AF-B_1 dan AF-G_1. Kesan perlakuan pemanggangan kacang tanah menggunakan oven terhadap degradasi AF-B_1 dan AF-G_1 yang sengaja dimasukkan (S) dan yang secara semulajadi mencemari (N) sampel juga telah dikaji. Pasangan perlakuan 150°C-3 jam didapati paling berkesan untuk memusnahkan AF-B_1 (S) dan AF-B_1 (N) di dalam kacang tanah mentah tanpa kulit. Pasangan suhu-masa yang paling berkesan untuk memusnahkan AF-G_1 (S) ialah 120°C-3 jam yang mana menunjukkan degradasi setinggi 84% dan tidak berbeza secara signifikan ($p > 0.05$) dengan keberkesanan pasangan 135°C-3 jam dan 150°C-3 jam. AF-G_1 (N) pula dimusnahkan dengan paling berkesan oleh pasangan 150°C-1 jam yang menunjukkan peratus degradasi tertinggi (67%). Secara keseluruhannya didapati tahap kestabilan AF-B_1 (S) dan AF-B_1 (N) terhadap degradasi oleh perlakuan haba adalah hampir sama. Sebaliknya AF-G_1 (S) didapati kurang stabil terhadap perlakuan haba berbanding dengan AF-G_1 (N).

ABSTRACT

The ISOLUTE™ Multimode Column (IMC) method was selected and modified in this study. The modified IMC (MIMC) method was developed with the aim of using the column up to 10 times for clean-up the samples contaminated by aflatoxins (AF). No significant difference ($p > 0.05$) was found among 10 times repeating usage of a single column in all spiked levels (20, 400 and 2000 ppb) of AF-B_1 and AF-G_1 in the raw shelled peanut samples. The accuracy of this method was relatively good with reference to the high recoveries of AF-B_1 (82.9 %) and AF-G_1 (101.9 %) respectively. The low coefficients of variation (CV) at approximately 1.5 % (AF-B_1) and 1.3 % (AF-G_1) showed that the MIMC method was acceptably in good precision. In addition, the method developed was not only cheaper than IMC and modified National Resource Institute (MNRI) methods, but also more rapid than MNRI method. A total of 145 raw shelled peanut samples taken from three districts in Perak namely Kuala Kangsar, Larut Matang and Kerian were analysed for the occurrence of the AF-B_1 and AF-G_1 as well as *Aspergillus flavus* group. Direct plating method on Aspergillus Differential Media (ADM) agar were used to detect the presence of the *A. flavus* group. The AF-B_1 and AF-G_1 content were analysed by MIMC method. The percentage along with the range of incidence of the *A. flavus* group (86%, 1.0×10^2 - 1.1×10^5 cfu/g), AF-B_1 (50%, 0.85-547.51 ppb) and AF-G_1 (37%, 1.37-375.98 ppb) in raw shelled peanut samples were high even though at water activity (a_w) 0.72. Total aflatoxins ($B_1 + G_1$) contamination were high (50%) in the range of 0.85-762.05 ppb in which 45% of these positive samples exceeded the maximum permitted levels according to the Malaysian Food Regulation 1985. There was also poor correlation ($p < 0.05$) between AF-B_1 ($r = 0.216$) and AF-G_1 ($r = 0.272$) with the counts of the *A. flavus* group. However the occurrence of AF-B_1 was found to be moderately correlated ($r = 0.698$; $p < 0.05$) with AF-G_1. On the other hand, there were no significant correlation ($p > 0.05$) between samples a_w and the *A. flavus* group, AF-B_1 and AF-G_1. The effects of oven roasting at different time-temperature on the AF-B_1 and AF-G_1 degradation were also studied. Treatment at 150°C-3 hours was found to be the most effective in degrading AF-B_1 in spiked (AF-B_1 (S)) and naturally contaminated (AF-B_1 (N)) raw shelled peanut. The treatment at temperature 120°C for 3 hours was found to be the most effective in destroying spiked AF-G_1 (AF-G_1 (S)) with degradation of about 84% and was not significantly different ($p > 0.05$) compared to the treatments at 135°C-3 hours and 150°C-3 hours. For AF-G_1 in naturally contaminated (AF-G_1 (N)) raw shelled peanut samples, treatment at 150°C-1 hour gave the highest percentage (67%) of degradation. In general, the stability of AF-B_1 (S) and AF-B_1 (N) to the thermal degradation were about the same. However, AF-G_1 (S) was found to be less stable than AF-G_1 (N) to the treatment.