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Clinical screening of paraquat in plasma samples using capillary electrophoresis with contactless conductivity detection: towards rapid diagnosis and therapeutic treatment of acute paraquat poisoning in Vietnam

Vu Anh Phuong[1,2], Ha Tran Hung[1,3], Ta Thi Thao[2], Nguyen Thi Anh Huong[2]
[1]Vietnam Poison Control Center, Bach Mai Hospital, Vietnam. [2]Department of Analytical Chemistry, Faculty of Chemistry, VNU University of Science, Vietnam National University, Vietnam. [3]Hanoi Medical University, Vietnam

Objective: This study aimed to investigate the optimal conditions of CE-C^4D for clinical screening of paraquat in plasma samples and applying this procedure for quantifying paraquat (PQ) plasma concentration in paraquat poisoned patients.

Methods: The procedure for treatment of plasma samples involved precipitation of protein by TCA and then extraction on a C18 column using sodium 1-heptanesulfonate as the ion-pair substance. The HPLC method was used as a cross check. Chromatographic separation of PQ was carried out using the isocratic mode at a flowrate of 0.5 mL/min using a mobile phase composed of 5% ACN and 95% buffer with pH 2.5. Detection was performed at 259 nm. Plasma samples from 31 patients with PQ poisoning were collected on admission and after each episode of hemoperfusion for analysis.

Results: Optimal of conditions for determination of paraquat in human plasma by CE-C^4D included: Detector C^4D; Separation column: Fused silica capillary with length of 60 cm, efficient length of 50 cm, inner diameter of 75µm; Electrolyte solution: His/ace (10mM), pH 4,0; Injection time: 30s; Separation voltage +20kV; Injection method: hydrodynamic injection at height of 10cm

The calibration curves of standard paraquat were established in the concentration range 1.00 - 10.00 µg/ml, R value was higher than 0.998. Optimal conditions for extraction of paraquat in human plasma included using C18 SPE column based on ion – pair mechanism with sodium heptansulfonate 100 mM. Good recovery of PQ in human plasma (80%) was achieved. The detection limit of method (MDL) was 0.50 µg/ml. The PQ contentration of patients were calculated in the range from < LOD (0.5 µg/ml) – 125.77 µg/ml. The obtained results have been compared with those measured by HPLC. The difference between the two methods was insignificant (<25%). Good correlation coefficient of 0.9993 between CE-C^4D and HPLC proved.

Conclusion: A purpose-made portable CE instrument coupled with a miniaturized C^4D cell was successfully applied to the determination of paraquat in plasma samples collected from poisoned patients in Vietnam. Crosscheck with the reference method (HPLC-UV) proved the reliability of the results obtained with CE-C4 D. With the robustness and high portability of the CE-C^4D system, simplicity of operation and the easy availability of the components used in the BGE, the CE-C^4D method can be seen as a straightforward and cost-effective option for screening of plasma paraquat concentrations for immediate diagnosis of paraquat poisoning.