

SOME APPLICATIONS OF ANALYTICAL CHEMISTRY IN FORENSIC SCIENCES

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Forensic analysis is comparative in nature. Two classes of analysis are recognised at the forensic laboratory: (1) screening and (2) legal analyses. In screening, speed and the order of magnitude of concentration are of the essence. The desired data are to be used for forensic treatment or investigation of the source; thus, speed is of the utmost importance. The first category of samples becomes the second as soon as the treatment begins. All positive samples are handled as legal samples if a positive result is obtained. The second category applies to legal cases, in which qualitative and quantitative information, as well as sample integrity are necessary. Legal cases should be identified as such from the outset in order to preserve this distinction.

One of the powerful applications of electroanalytical chemistry in Forensic Sciences is Capillary electrophoresis (CE). CE has recently become an important technique in the separation and analytical measurement in forensic analysis. So that it covers both the screening and legal analyses. Typical examples for the applications of this technique in our laboratories are the characterisation of soil evidences and screening of toxic substances in samples of human origin. Simultaneous monitoring of some compounds such as methotrexate (MTX) and 6-mercaptopurine (6-MP) in serum, glutathione in red blood cells, Narcotics and other some drugs in urine, and polymer residues in dentistry composite material. MTX is an antifolate drug and has been used together with 6-MP in treatment of acute lymphocytic leukaemia in children as well as in adult and other childhood malignancies. Glutathione is one of the most important antioxidant agents that protect the red blood cells against oxidative stress. Therefore and because of the toxicity, separation and monitoring of these drugs and the polymeric residues have vital importance. In this study a 75 cm long capillary with 70 micrometer ID was chosen to separate MTX and 6-MP mixture. The same CE running buffer was chosen as micellar buffer that contained 30 mM of borate, 30 mM of SDS and 15% acetonitrile with the same mode of the

capillary electrophoresis for all these studies. Soil samples always appear as important criminal evidences. They can be roughly differentiated and distinguished by their gross appearance. Also distinguishable comparison of colours of wet soil offers a logical first step in forensic soil analysis. But it needs additional assays to distinguish the fine structure by advanced analytical techniques. CE is now been used in many scientific fields of application and currently become a powerful technique for the separation and quantification of ionic substances. Separation speed and direct injection of samples to the capillary without labour intensive sample preparation are the major advantages of the method for the wide variety of real samples. A rough description of a procedure for a forensic CE analysis of a soil sample is as follows: Soil samples were dried in an oven at 110⁰C and sieved for excluding the rocky particles bigger diameter than 2 mm. 10 g of dry-sieved soil samples were placed in falcon tubes and 10 mL of HPLC grade deionized water was added to each tube. All the samples were shake for 20 minutes and than centrifuged for 10 minutes at 3000 rpm. Supernatants were removed from the solid phase. Then 1 mL of each supernatant was transferred into ependorf tube and centrifuged for 5 minutes at 12000 rpm. The supernatants were transferred into the autosampler vials of the capillary electrophoresis instrument which were programmed to apply triplicate runs for each set of samples and the standards. A commercial system in combination with an on-column variable wawelength UV visible detector and automated sample injector were used for this purpose. The data that were obtained from the analysis of these soil samples have been evaluated. By application of this method one could compare easily the forensic soil samples at least from the CE screening of the chloride, nitrate, sulphate and phosphate anions. So that if a forensic study needs the differentiation of a sample or unification of a particular place or area, or an unknown compound capillary electrophoresis may easily play the most important role at least for logical first step by the anlalysis of ionic composition of the sample.

Key words: Forensic evidence, CE, organic and inorganic anions.