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Editorial

Editorial on Chemical Analysis and its Methods

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EDITORIAL

Electrophoresis is a technique used for separating molecules through migration on a support medium while under the influence of an electrical charge. It was first used as a separation technique [1]. He described the separation of proteins which were placed in a buffer in a tube and an electric field was applied. Initially the technique was carried out on a stationary flat solid phase (slab gel technique). This technique was slow and cumbersome and required long analysis times and had low efficiencies [2]. Hjerten describes the separation of many different types of molecules, inorganic ions, nucleotides, proteins and viruses in tubes only a few millimeters thick. The technique was further refined [3] and resulted in the separations taking place in narrow bore tubes. This pioneering work led to the development of a technique known as capillary electrophoresis (CE).

Capillary Electrophoresis is used in a wide variety of analytical applications. Tavares (2003) describes it use and versatility in areas such as clinical, forensic, cosmetological, environmental, nutritional and pharmaceutical samples. The first use of CE for forensic analysis was demonstrated [4]. They describe the use of CE in the analysis of illicit drugs in synthetic mixtures.

Forensic analysis of samples

Traditionally forensic samples were analysed using instruments available in an analytical chemistry laboratory. The main instruments used were based (and in some cases still are) on chromatographic techniques. Gas Chromatography and High Performance Liquid Chromatography HPLC are the two major type of analytical techniques conventionally used for forensic samples. Currently in forensic science laboratories there is a preference/trend to use CE techniques over the traditional chromatographic technique.

There are many reasons for this changeover. Chromatographic techniques usually require pre-treatment of the sample which can be very time consuming. Also some compounds are thermally unstable and are not suitable to GC analysis.

On the other hand the separations that can be achieved by CE are highly efficient, have a rapid analysis time and can be applied to neutral and non-neutral species.

Other advantages of CE are that it requires low sample and low solvent amounts, has low limits of detection and is a relatively simple, inexpensive technique to carry out.

Types of capillary electrophoresis

The term CE really describes a number of related techniques in which separations are carried out in narrow bore capillaries under the influence of an electric field. Other techniques include;

Capillary Zone Electrophoresis – CZE

Micellar Electrokinetic Chromatography – MEKC

Capillary Gel Electrophoresis – CGE

It is beyond the scope of this essay to describe each of these in detail. It should be noted that they all operate on the principle of separation of molecules in narrow bore capillaries with an applied electric field.

Applications of CE in forensic science

Drug anyalsis: CZE technique for the analysis of amphetamines and compared the results obtained with HPLC analysis. The conclusion was that the CE method provided greater peak symmetry and shorter run times than the HPLC method. CZE and HPLC for the determination of opium alkaloids in opium gum and opium latex. [5]

Toxicology: Shorter run times, small sample requirements, and lower limits of detection. The analysis of amphetamines in blood using a CZE method is described [6]. A detection limit of between 10 and 30 ng/ml was recorded and a run time of 7 minutes.

Gun Shot Residues: MEKC technique can be applied to the analysis of gunshot residues from tape lifts and swabs. A number of other studies [7,8] all describe the suitability of using MEKC in the characterization of organic gunpowder components.

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CONCLUSION

Capillary electrophoresis is widely used in forensic laboratories for the routing analysis of a variety of samples typically found at a crime scene. It offers many advantages over chromatographic techniques for the analysis of these samples. These advantaged include, quicker analysis time, the requirement of less ample and solvents, lower limits of detection and less expensive equipment. These advantages will ensure that analysis of forensic samples using CE techniques will continue to grow and develop in the coming years.

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