What is electrophoresis?

Electrophoresis is an electrokinetic process which separates charged particles in a fluid using a field of electrical charge. It is most often used in life sciences to separate protein molecules or DNA and can be achieved through several different procedures depending on the type and size of the molecules. The procedures differ in some ways but all need a source for the electrical charge, a support medium and a buffer solution. Electrophoresis is used in laboratories for the separation of molecules based on size, density and purity.

How does it work?

An electric field is applied to molecules and as they are electrically charged themselves it results in a force acting upon them. The greater the charge of the molecule the greater the force applied by the electrical field and therefore the further through the support medium the molecule will move relative to its mass.

Some example applications of electrophoresis include DNA and RNA analysis as well as protein electrophoresis which is a medical procedure used to analyse and separate the molecules found in a fluid sample (most commonly blood and urine samples).

Types of electrophoresis

Different types of gels are usually used as the support medium for electrophoresis and this may be in slab or tube form depending on which is more beneficial. Gel slabs enable many samples to be run simultaneously and so are frequently used in laboratories. However, tube gels give a better resolution of the results so are often chosen for protein electrophoresis.

Agarose gel is commonly used for electrophoresis of DNA. It has a large pore structure allowing larger molecules to move easily but it is not suitable for sequencing smaller molecules.

Polyacrylamide gel electrophoresis (PAGE) has a clearer resolution than agarose gel making it more suitable for quantitative analysis. This makes it possible to identify how proteins bind to DNA. It can also be used to develop the understanding of how bacteria is becoming resistant to antibiotics through plasmid analysis.

2D Electrophoresis separates molecules along an x-axis and a y-axis – one separating them by charge and the other by size.