

Difference Between Capillary Electrophoresis and Gel Electrophoresis

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Key Difference – Capillary Electrophoresis vs Gel Electrophoresis

Electrophoresis is a technique that is used to separate biomolecules based on the particle charge, particle size, and the particle shape. The migration of the molecule, known as electrophoretic mobility, depends on the type of polymer/gel used, its pore size, the voltage provided, running time and the surface to volume ratio. There are different types of electrophoresis techniques based on the type of biomolecule used. The first type of electrophoresis invented was paper electrophoresis where a nitrocellulose paper was used as the medium for separation of biomolecules. The principle of gel electrophoresis where different pore sized gels were used to separate biomolecules, was invented later. Gel electrophoresis technique was further modified to improve the accuracy of the technique, and one such modification is capillary electrophoresis. The key difference between gel electrophoresis and capillary electrophoresis is that **gel electrophoresis is performed in a vertical or horizontal plane using a polymer gel of standard pore size whereas capillary electrophoresis is performed in a capillary tube with a polymer liquid or a gel.**

What is Gel Electrophoresis?

Gel electrophoresis is a technique used to separate mainly nucleic acids, proteins or amino acids based on its charge, size, and shape. This technique uses a physical gel, which is a polymer substance, as the separation medium. Most commonly utilized gels are Agarose (for nucleic acid separation) and Polyacrylamide (for protein separation). The gel electrophoretic apparatus contains the gel casting tray to prepare the gel, casting combs to prepare the wells, buffer tank, electrodes – positive (anode) and negative (cathode) and the voltage supply unit. Molecules like DNA or RNA, which are negatively charged, move from the cathode to the anode and molecules which are positively charged move vice versa. Gel preparation is done according to the requirement. If a high resolution or separation of molecules is required, a high concentration gel with a lesser pore size should be prepared. The molecules separated on the gel matrix are observed after a staining technique. The separated molecules appear as bands on the gel matrix.

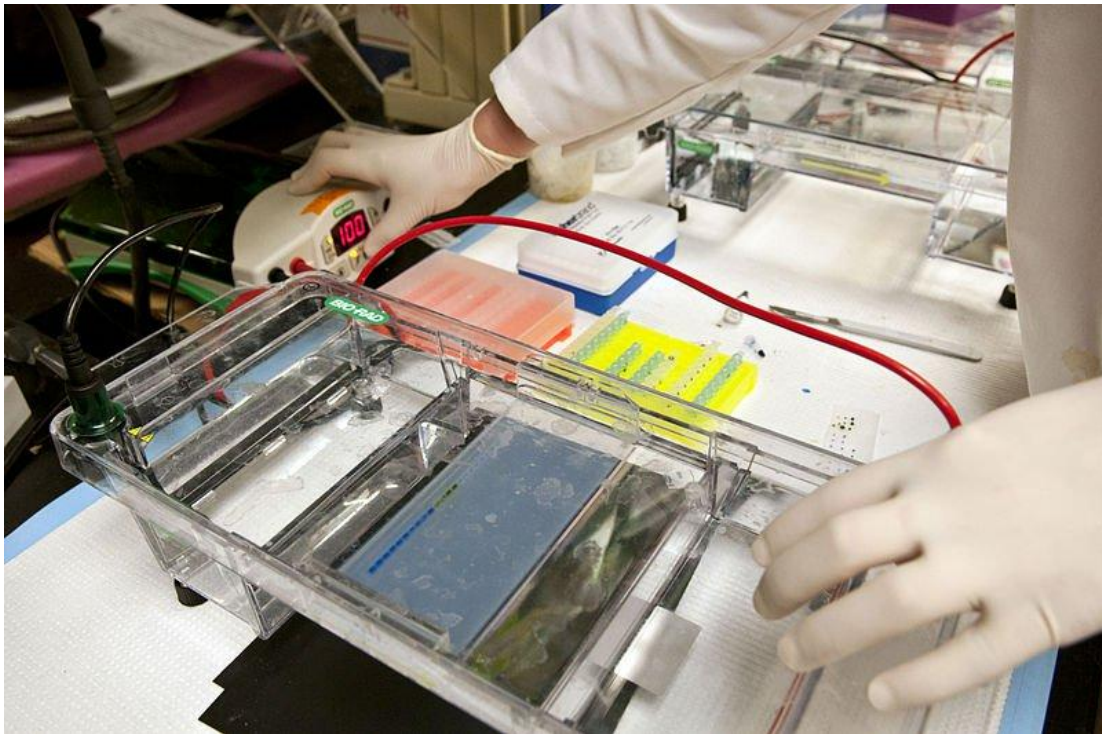


Figure 01: Gel Electrophoresis

Gel electrophoresis is used in molecular diagnostics such as DNA fingerprinting to determine the presence of a particular DNA/RNA fragment or a protein. Gel electrophoresis also determines the purity of the extracted biomolecule sample. Gel electrophoresis is performed as a preliminary step for in and [hybridization](#) and as a confirmatory analysis after sequencing.

What is Capillary Electrophoresis?

Capillary electrophoresis is a modification of gel electrophoresis which uses the same principle of separation based on charge, size of the molecule, but is performed in a capillary tube with either a gel substance or a liquid polymer. Capillaries are prepared of fused silica, and each capillary tube has an internal diameter of 50-100 μ m and is 25-100cm in length. Samples are injected into the capillary tube containing the polymer material and are separated much rapidly than the conventional gel electrophoresis. The capillary system is well protected inside an insulator jacket which protects the sample from any contamination. Capillaries can be filled with liquid polymers such as hydroxyethyl cellulose or high-resolution gels such as polyacrylamide. Capillary electrophoresis provides greater resolution; hence separation is more accurate. Capillary electrophoresis uses an automated detector system via spectrophotometric analysis. This is due to the higher surface area to

volume ratio. Capillary electrophoresis is used in situations such as in forensics where higher accuracy is required and is not commonly used as it is costly technique.

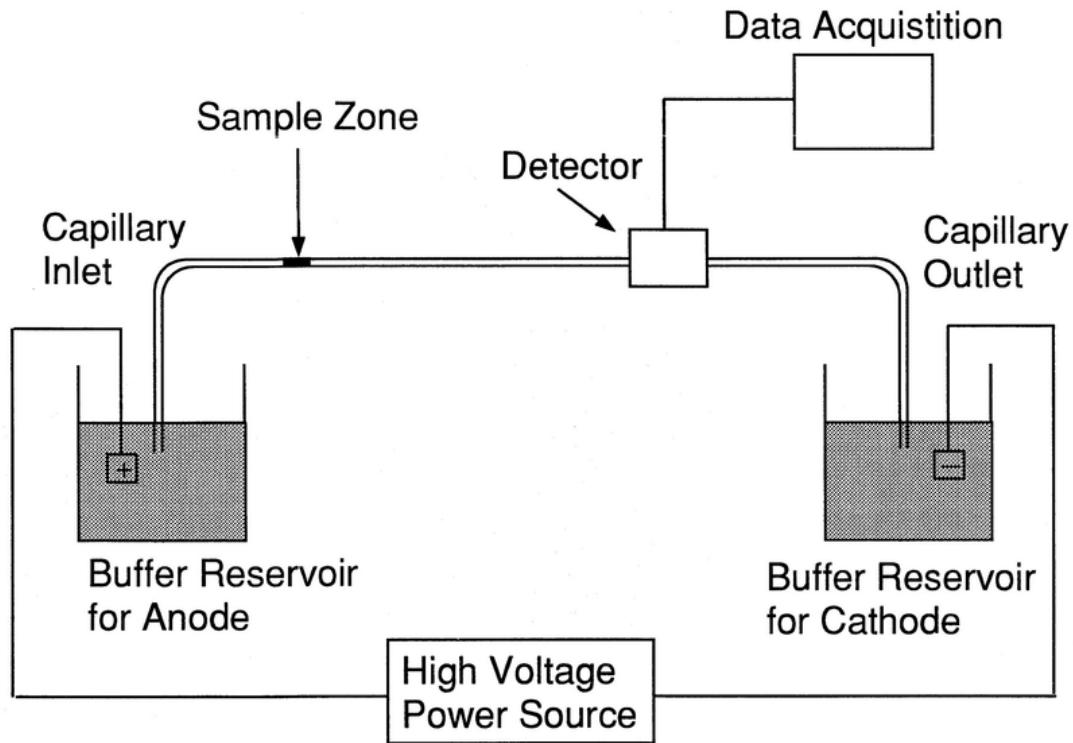


Figure 02: Capillary Electrophoresis

What are the similarities between Gel Electrophoresis and Capillary Electrophoresis?

- Separation of molecules in both techniques is based on the charge and size of the molecule.
- Both techniques can be used to separate both nucleic acids and proteins.
- The sample volume of the both techniques is the same.
- Both techniques use a buffer to facilitate separation.

What is the difference between Gel Electrophoresis and Capillary Electrophoresis?

Gel Electrophoresis vs Capillary Electrophoresis

Gel electrophoresis is a technique which separates biomolecules on a vertical or

Capillary electrophoresis is a technique which separates biomolecules on a capillary tube

horizontal plane using a polymer gel medium.	using a liquid or gel polymer medium.
Separation	
In gel electrophoresis, separation is done on a vertical or horizontal plane.	In capillary electrophoresis, separation is done inside a capillary tube.
Medium of Separation	
Gels, either agarose or polyacrylamide, are used as a medium in gel electrophoresis.	Liquid polymers like hydroxyethylcellulose are used in capillary electrophoresis.
Cross Linkage	
Resolution is low in gel electrophoresis.	High resolution can be obtained from capillary electrophoresis.
Surface Area to Volume Ratio	
Surface to volume ratio is low in gel electrophoresis.	Surface to volume ratio is high in capillary electrophoresis.
Detection Technique	
Staining and observing through UV transilluminator are done as detection techniques in gel electrophoresis.	Detection is done through spectrophotometric automated detectors in capillary electrophoresis.

Summary – Gel Electrophoresis vs Capillary Electrophoresis

Molecular diagnostics plays a major role in the scientific world. Identification and purification of DNA, RNA, and Proteins are critical steps in the diagnostic procedures. Electrophoresis is a technique which separates and identifies biomolecules in both gel electrophoresis and the much advanced capillary gel electrophoresis. Gel electrophoresis is performed in a vertical or horizontal plane using a polymer gel of standard pore size whereas capillary electrophoresis is performed in a capillary tube with a polymer liquid or a gel. This is the difference between gel electrophoresis and

capillary electrophoresis. Upon completion of the electrophoresis technique, the biomolecules are further processed to obtain higher level information via hybridization or through techniques such as fingerprinting.

References:

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