

What is Osmometry?

Osmometry is an advanced analytical method for determining the osmotic concentration of solutions. The osmotic – or solute – concentration of a colloidal system is expressed in osmoles (Osm) per unit of volume (Osm/L) or weight (Osm/kg). In clinical and formulation contexts, osmolarity/osmolality refers to solutes as small as ions which require exceptional sensitivity down to the milliosmole (mOsm) range. At such scales, the minute physiological conditions of solutions matter greatly.

In this article, KNAUER explores some of the basic principles of osmometry in more detail.

Osmometry: Introducing tonicity

By measuring the total solute concentration of samples, osmometers can define the extent to which a solution can move water through a semipermeable membrane via osmosis. This is called tonicity. There are three underlying types of tonicity in osmometry; each expressed as relative to a solution separated by a semipermeable membrane:

- Hypotonicity: Refers to solutions with lower osmolarity than that on the other side of a semipermeable membrane, typically leading to loss of water from the solution.
- Hypertonicity: Refers to the inverse of hypotonicity, where the solution has a higher osmolarity thus gains water through the membrane.
- Isotonicity: Refers to solutions with equivalent osmolarities across a semipermeable membrane, meaning there is no net transfer of water through the membrane.

Different types of osmometry

Various osmometer configurations have been developed to measure the concentration of solutes in various sample types using a choice of colligative properties. For instance, vapor-phase osmometry exploits the relationship between boiling point and vapor pressure to measure solute concentration.

Membrane osmometry is more conventional in that it employs a physical semipermeable membrane separating two distinct chambers containing solvents. As an osmol refers to the amount of substance in solutions that exert a specific osmotic pressure (~22.4 atmospheres), the measuring value in membrane osmometry is the low-pressure of each chamber. Determining relative pressure offers quantitative insights into osmotic concentration which can, in turn, assist with characterizing tonicity.

The most advanced method of osmometry used today is known as freezing point osmometry. A freezing point osmometer monitors how a sample's freezing point changes according to its solute concentration. With a precisely linear correlation between a sample's freezing point and its osmolality, freezing point osmometry offers one of the most accurate assessments of osmotic concentration.