

**What is a Krafft point?**

The temperature at which the solubility of an ionic surfactant becomes equal to the critical micelle concentration (CMC) is the Krafft point,  $T_k$  (°C).

**What is a cloud point?**

The definition depends based on the type of surfactant:

*Anionics* - is the temperature at which a product becomes turbid when it is *cooled* under specified conditions.

*Nonionics* - is the temperature at which a product becomes turbid when *heated*.

**Are there other terms for Krafft point and cloud point?**

Krafft point and cloud point are often incorrectly used interchangeably.

**Krafft Point / Cloud Point and Surfactant Properties.**

Krafft Point.

- At a certain temperature, surfactants become insoluble in a solution before the critical micelle concentration and the maximum surface tension reduction is reached. A surfactant with a low Krafft point is more soluble than a surfactant with a high Krafft point. That is, the low Krafft point surfactant became insoluble at a concentration which was only slightly lower than the CMC. By a slight increase in temperature the surfactant can be further solubilized until the CMC is reached. Krafft point can be regarded as the temperature at which micelles become soluble.
- The Krafft point of a mixture of isomeric materials is lower than that of individual components
- Surfactants are effective at temperatures above their Krafft points.
- For surfactants being used below  $T_k$ , the maximum surface tension reduction will be given by the concentration of the surfactant at solution saturation. These materials will show lower effectiveness in reducing surface tension than similar materials used above their Krafft points.

Cloud Point.

**Anionics**

- The shorter the hydrophobic chain, the lower the cloud point of the surfactant.
- Hydrotropes lower the cloud points of surfactants.

**Nonionics**

- The greater the degree of ethoxylation, the higher the cloud point.

**Krafft Point Determination.**

The Krafft point can be estimated by measuring the temperature at which the surfactant (at the CMC concentration) and water form a clear solution.

**Cloud Point Determination.**

Anionics.

A neat surfactant sample is placed into a tube with a thermometer and then immersed into an ice bath. The sample is cooled at a specified rate while stirred (to provide even cooling). When the sample first begins to show slight hazing, the tube is removed from the bath and inspected regularly. The cloud point is that temperature at which the thermometer immersed in the sample is no longer visible when viewed horizontally through the tube and sample.

Nonionics.

A 1% aqueous solution of a nonionic surfactant is heated at a specified rate and monitored for haziness. The cloud point is the temperature at which the first haze is observed.