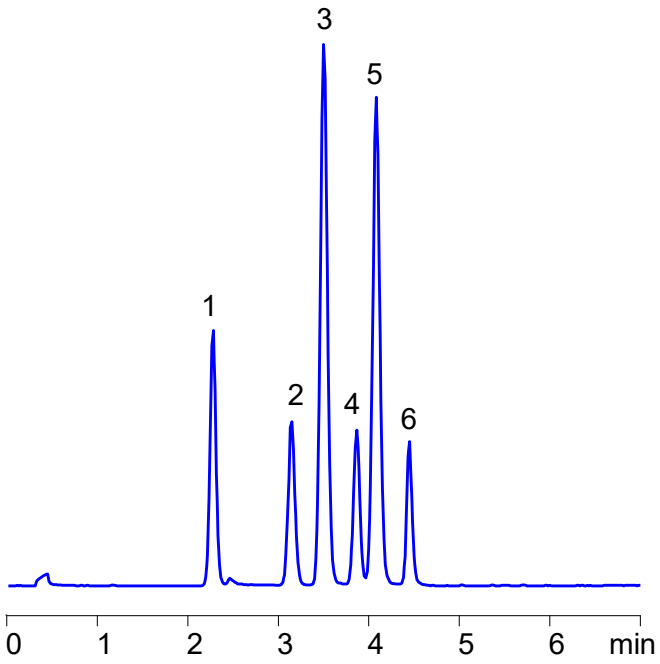
HPLC Separation of Alkylsulfonic and Fluorinated Alkylsulfonic Acids on Amaze HA Mixed-Mode Column



1. Methanesulfonic acid
2. Butanesulfonic acid
3. Hexanesulfonic acid
4. Trifluoromethanesulfonic acid
5. Octanesulfonic acid
6. Perfluorobutanesulfonic acid

Column: Amaze HA
Dimensions: 3.0 x 50 mm, 3 um, 100A
Mobile phase: ACN from 55% to 85% in 4 min, 2 min hold, 20 mM AmFm pH 3
Flow rate: 0.6 ml/min
Detection: ELSD, 40°C

Application Notes

This study presents the separation of methanesulfonic acid, butanesulfonic acid, hexanesulfonic acid, octanesulfonic acid, trifluoromethanesulfonic acid, and perfluorobutanesulfonic acid on the **Amaze HA mixed-mode column**. The **Amaze HA** stationary phase incorporates reversed-phase and anion-exchange functionalities on a single ligand, combining a hydrophobic alkyl chain with a strong anion-exchange group. This dual retention mechanism enables simultaneous separation of highly polar and hydrophobic sulfonic acids within one analytical run.

Methanesulfonic acid, being the smallest and most hydrophilic compound, is retained mainly through anion-exchange interaction with minimal hydrophobic contribution, eluting early in the gradient. Butanesulfonic and hexanesulfonic acids possess increasing alkyl chain lengths, resulting in progressive enhancement of reversed-phase retention while maintaining electrostatic interaction through the sulfonate group. Octanesulfonic acid, with its long hydrophobic tail, exhibits dominant reversed-phase behavior and is significantly delayed in elution. The fluorinated sulfonic acids, trifluoromethanesulfonic acid and perfluorobutanesulfonic acid, display distinct chromatographic properties compared to their hydrocarbon analogs. The strong electron-withdrawing effect of fluorine atoms increases acidity and polarity while reducing hydrophobicity. As a result, these compounds interact more strongly by anion-exchange, but show weaker reversed-phase retention. The interplay of these opposing effects leads to characteristic elution positions between short-chain and long-chain hydrocarbon sulfonic acids.

The **Amaze HA** column provides a balanced selectivity for both alkyl and fluorinated sulfonic acids, yielding sharp peaks and excellent reproducibility. The method demonstrates the column's capability to analyze mixtures spanning a broad hydrophobicity range—ideal for environmental and industrial monitoring of sulfonate-based surfactants, additives, and perfluoroalkyl contaminants.