

## Analysis of Hydrophilic Compounds and their Detection Capabilities

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### ABOUT THE STUDY

Hydrophilic Interaction Liquid Chromatography (HILIC), is particularly useful for compounds that might not be well-retained or separated by traditional reversed-phase chromatography methods. It is an alternative to other chromatographic methods like reversed-phase chromatography, which is commonly used for hydrophobic compounds.

In HILIC, the stationary phase is typically a hydrophilic material, such as a silica-based material functionalized with polar groups like amino or diol groups. The mobile phase, on the other hand, is a mixture of water and a water-miscible organic solvent, with the water content being relatively high compared to traditional reversed-phase chromatography. This high water content creates a polar environment that allows for the separation of polar compounds based on their differences in hydrophilicity and polarity. The separation mechanism in HILIC is based on the partitioning of analytes between the hydrophilic stationary phase and the water-rich mobile phase. Compounds with higher hydrophilicity will spend more time interacting with the stationary phase, leading to slower elution times, while less hydrophilic compounds will be eluted more quickly. HILIC is particularly useful for the separation of polar and hydrophilic compounds such as amino acids, peptides, nucleotides, organic acids, and other similar analytes. It is also often used in combination with other chromatographic techniques or mass spectrometry for enhanced separation and detection capabilities.

Its compatibility with highly polar compounds, its ability to provide improved peak shapes for polar analytes, and its potential for complementary separations when used alongside other chromatographic methods. In HILIC, the stationary phase is polar and the mobile phase is relatively less polar, which is opposite to the configuration in reversed-phase chromatography. This allows for the retention and separation of compounds based on their differing degrees of polarity and hydrophilicity. The separation mechanism in HILIC is thought to involve a combination of partitioning and adsorption effects. When a sample is injected into the column, polar compounds have a

tendency to interact with the polar stationary phase more strongly than less polar compounds. This interaction results in differential retention times for different analytes, leading to their separation. HILIC chromatography is particularly useful for the separation of highly polar compounds, such as organic acids, amino acids, peptides, nucleotides, and other hydrophilic molecules. It can also be advantageous for the analysis of compounds that are not amenable to separation by reversed-phase chromatography.

HILIC is excellent for the separation of highly polar and hydrophilic compounds, which may not be well-suited for other chromatographic methods. Compared to reversed-phase chromatography, HILIC often requires a higher percentage of aqueous mobile phase, reducing the need for organic solvents. The separation mechanism of HILIC complements other chromatographic techniques, providing an additional tool for method development. HILIC is often coupled with Mass Spectrometry (HILIC-MS) due to its ability to handle polar compounds, making it valuable in metabolomics and proteomics studies. However, it's important to note that HILIC can be more challenging to optimize and requires careful attention to column selection, mobile phase composition, and method development. The choice of column, mobile phase additives, and gradient conditions can significantly impact the separation and elution profiles of analytes.

### CONCLUSION

In conclusion, HILIC is a specialized chromatographic technique used for the separation of polar and hydrophilic compounds, providing a valuable option for analytical and research applications in various fields including pharmaceuticals, metabolomics, environmental analysis, and more. It's worth noting that chromatography techniques, including HILIC, continue to evolve, so there might be more recent developments or variations in the field of Hydrophilic Interaction Chromatography.

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