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Understanding Ion-Exchange Retention with Cogent UDA and UDA 2.o HPLC Columns - Tech Information

Date: 25-NOVEMBER-2014 Last Updated: 4-MARCH-2026

Overview

This post introduces the ion-exchange functionality of Cogent UDA-series columns, explains how mobile phase pH controls the charge state of the carboxylic acid ligand, and highlights how weak cation-exchange interactions provide additional selectivity in ANP separations. Test solutes demonstrate how analytes with amine groups interact with the column via electrostatic attraction, broadening the applicability of TYPE-C silica for challenging mixtures.

Ion-exchange chromatography serves as an important tool for analytical chemists when resolving compounds that are otherwise difficult to separate using standard reversed-phase or HILIC techniques. This separation mode relies on electrostatic attraction between an ionized functional group on the stationary phase and an oppositely charged analyte. Depending on the desired interaction, chemists can choose strong or weak anion exchange, or strong or weak cation exchange phases.

The Cogent UDA™ and Cogent UDA 2.o™ columns are designed specifically to provide weak cation-exchange selectivity through a C11 alkyl chain terminated with a carboxylic acid group. A key advantage of this ligand is its tunable charge state:

- Under acidic mobile-phase conditions, the carboxyl group is protonated and neutral, minimizing ion-exchange interactions.
- At near-neutral pH and above, the ligand becomes deprotonated and negatively charged, enabling electrostatic retention of positively charged analytes.

Like all TYPE-C Silica™ phases, UDA columns operate efficiently in the Aqueous Normal Phase (ANP) mode, retaining analytes based on polarity. However, the UDA phases add a second retention mechanism—weak cation exchange—making them a true multimode stationary phase. This dual mechanism offers enhanced selectivity when ANP alone cannot fully resolve closely related analytes.

To evaluate the ion-exchange contribution, three amine-containing test solutes were analyzed on the UDA column. These compounds were selected because their protonated amine groups readily interact with the deprotonated UDA ligand. The resulting separations illustrate how ion-exchange retention can strengthen resolution, shift selectivity, and help distinguish analytes that would otherwise co-elute under purely polar-based retention.

This combination of ANP and weak cation-exchange modes provides analysts with greater flexibility in method development, especially when working with polar pharmaceuticals, metabolites, or other

positively charged compounds. The downloadable extended study includes chromatograms, retention evaluation, and full experimental details.

Cogent UDA™ Product Page

Attachment: MTC Cogent UDA HPLC Column Use - **Extended AppNote** pdf 0.5 Mb Download File

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