

Ion-chromatography (IC) is an established technique for analysis of inorganic and some organic ions. An IC column is an ion-exchange resin made of polar ionic groups chemically attached to the stationary support. A typical mobile phase for ion chromatography is water based with no or very little organic concentration. The stationary phase is completely wetted, and ion-exchange groups form solvated ions on a surface of the stationary support.

A significantly different interaction of the stationary phase with analytes is observed when ion-exchange groups are shielded from direct interaction with aqueous mobile phase by a hydrophobic layer. This hydrophobic layer can be formed by brush type long alkyl chains attached to the same support.

We called the separation of ions on this covered hydrophobic ion-exchange stationary support the Shielded Ion-Exchange Liquid Chromatography (SIELC).

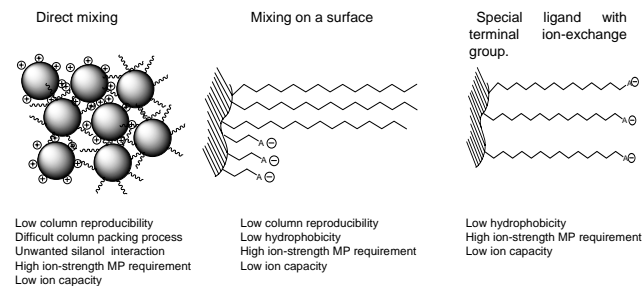
As opposed to traditional ion chromatography:

- SIELC columns offer better selectivity and separation power due to a different type of ion interaction;
- SIELC usually requires less buffer concentration in the mobile phase to perform an ion-exchange process;
- SIELC can operate both in low organic and high organic mobile phases;
- SIELC selectivity and retention strongly depend on organic concentration in the mobile phase, which makes it possible to fine tune separations;
- SIELC is compatible with a variety of detection techniques such as UV, IR, conductivity, electrochemical, MS and ELSD providing a great detection range and convenience of operation;
- SIELC demonstrates a higher ion loading capacity with a less concentrated buffer which is important for preparative applications and trace analysis;
- Strong interaction of charged analytes with SIELC support allows retaining and analyzing polar charged compounds in reverse mode without ion-pairing reagents;
- SIELC does not require any special IC equipment to analyze ions and can be performed using regular HPLC instrumentation.

Columns based on SIELC technology are, in fact, the reverse phase columns suitable for traditional RP separation. They also suitable for normal and HILIC separation.

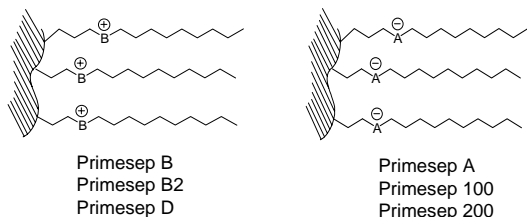
## Combining of two mechanism on one column

There are several ways of combining of two interactions on a single column



## Chemical Structure of SIELC Based Columns

Special ligand with ion-exchange group in the middle of the alkyl chain  
High column reproducibility  
High column efficiency up to 100,000 plate/meter  
No silanol interaction, no high ion-strength MP requirement, high ion capacity, high hydrophobicity.



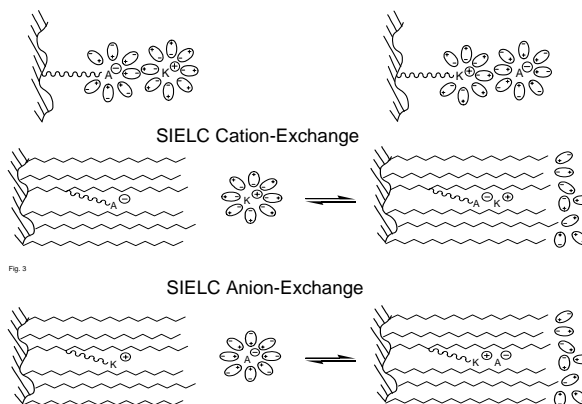
# SIELC – New Approach to Ion Separations

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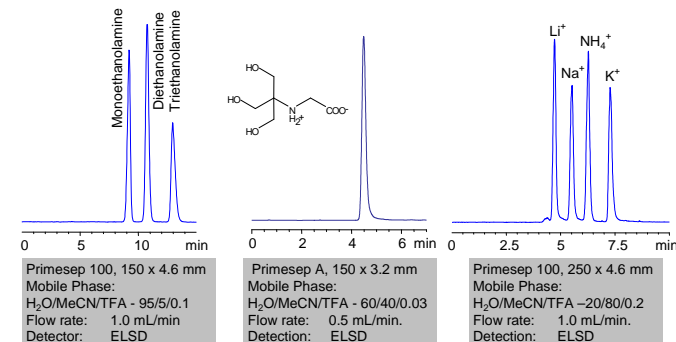
Conventional Cation-Exchange

Conventional Anion-Exchange



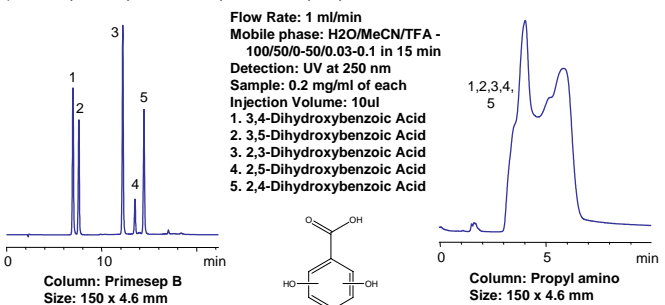
## Separation of Ions in High Organic and Low Organic MP

SIELC technology allows to perform ion analysis in the mobile phase with high and low organic modifier concentration. This is important for analysis of complex mixtures where solubility of the sample can be a problem. Type and amount of organic modifier usually effect selectivity and retention.



## SIELC vs. IC Chromatography

When surface charge is not sufficiently solvated and interaction with ions occurs within non-polar environment it does not require high ion-strength mobile phase to provide efficient chromatography. Primesep B and Propyl amino columns have the same surface charge similar pK<sub>b</sub> of the ligand and similar density of the ligand on the silica surface, but they perform very differently with acidic analytes such as dihydroxybenzoic acids.

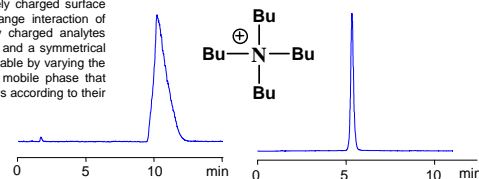


## Column surface and analyte have the same charge

Leading brand C18 column  
150 x 4.6 mm x 3.5 um  
Mobile Phase: H<sub>2</sub>O/MeCN/TFA - 70/30/0.1  
Flow rate: 1.0 mL/min  
Detector: ELSD  
Peak plate count 640  
Peak symmetry 0.37

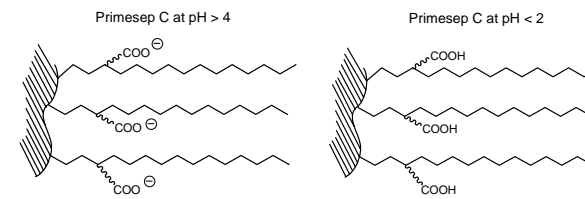
Primesep B, 150 x 4.6 mm  
Mobile Phase: H<sub>2</sub>O/MeCN/TFA - 70/30/0.15  
Flow rate: 1.0 mL/min  
Detector: ELSD  
Peak plate count 5200  
Peak symmetry 0.70

Primesep B column with a positively charged surface completely eliminates any ion-exchange interaction of the stationary phase with positively charged analytes and, thus, offers efficient separation and a symmetrical peak shape. Retention is still controllable by varying the amount of organic modifier in the mobile phase that provides separation of the compounds according to their hydrophobic properties.



## SIELC Switch Phase™ Technology

Columns based on SWITCH Phase™ technology change their properties depending on pH of the mobile phase. Embedded carboxylic acid is fully ionized at the pH above the transition point and loses charge when the pH of the mobile phase goes below the transition point. By controlling the pH of the mobile phase, the polar properties of the stationary phase can be altered to tune your separation needs.



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