

Dursan®-Coated HPLC Columns Improve Chiral Separations of Metal-Sensitive Analytes

A SilcoTek® Case Study:

From an article published in the Journal of Chromatography.

Maalouf, M.; Janek, M.; Friedrich, S.; Hausser, N.; Bischof, J.; Lämmerhofer, M. Bioinert Chiral Columns with Dursan-Coated Stainless-Steel Hardware for Enantioselective Liquid Chromatography of Polar Analytes. Journal of Chromatography Open 2026, 9, 100347. https://doi.org/10.1016/j.jcoa.2026.100347.

The Objective:

In this case study, SilcoTek examines what happens when the column hardware is part of the separation problem.

- For difficult chiral HPLC separations, analysts typically optimize the stationary phase, particle size, mobile phase, temperature, and flow rate. Yet stainless-steel hardware can also interact with polar and metal-sensitive analytes, contributing to peak tailing, adsorption, band broadening, reduced recovery, and loss of resolution.
- A 2026 study published in the Journal of Chromatography Open compared conventional stainless-steel column hardware with Dursan-coated hardware using CHIRALPAK® ZWIX(+) and QN-AX columns. The results show that replacing the reactive metal surface with an inert Dursan surface can improve chromatographic performance for analytes particularly susceptible to metal interactions.

The Challenge:

Stainless steel can interact with the analyte.

Metal surfaces within an HPLC flow path can interact with analytes through adsorption, electrostatic interactions, and metal chelation. Amino acids, phosphonic acids, phosphinic acids, and hydroxy carboxylic acids can have a high affinity for metal surfaces, and adsorption/desorption can introduce additional dispersion and peak tailing. Conventional workarounds include acid passivation or adding metal-chelating compounds such as EDTA or citric acid. These approaches can be temporary or create complications for LC-MS, including ion suppression and source contamination. All of these challenges ultimately lead to inefficiencies which cost labs time and money due to decreased daily yield.

The Solution:

An inert surface on stainless steel hardware.

Dursan is a functionalized amorphous silicon oxide-like coating applied to stainless-steel hardware using a thermal chemical vapor deposition process. The coating is typically 400–1600 nm thick, hydrophobic, and stable across a pH range of 0–14. It creates an iron-free, bioinert surface while retaining the mechanical strength and pressure capability of stainless steel. The bioinert surface allows scientists to preserve the existing analytical workflow while reducing the opportunity for analyte interaction. Solving the source of metal interaction helps to create a more accurate and efficient analytical system.

The Results and Benefits:

Sharper peaks and better resolution.

The researchers evaluated similarly packed Dursan-coated and conventional stainless-steel versions of two chiral stationary phases. Their comparable quality-control performance helped isolate the effect of the coated hardware.

Analyte/Test	Metric	Dursan-coated Hardware
Glutamic Acid	Resolution	+ 28%
Aspartic Acid	Resolution	+ 36%
2-Hydroxyglutarate	Reduced plate height	- 22%
2-Hydroxyglutarate	Resolution	+10%
Lactate	Reduced plate height	- 35%
Lactate	Resolution	+ 17%

For many amino acids analyzed on ZWIX(+), Dursan-coated hardware improved peak symmetry, reduced plate height, and increased resolution. The improvement was particularly notable for glutamic acid and aspartic acid. Highly metal-sensitive compounds like amino phosphonic acids showed some of the most pronounced benefits. Their strong metal-binding properties make them especially susceptible to adsorption on metal surfaces; eliminating available metal binding sites improved peak symmetry, reduced plate height, and enhanced resolution. (See Figure 1 for full plate height and resolution comparisons between uncoated and Dursan-coated hardware.)

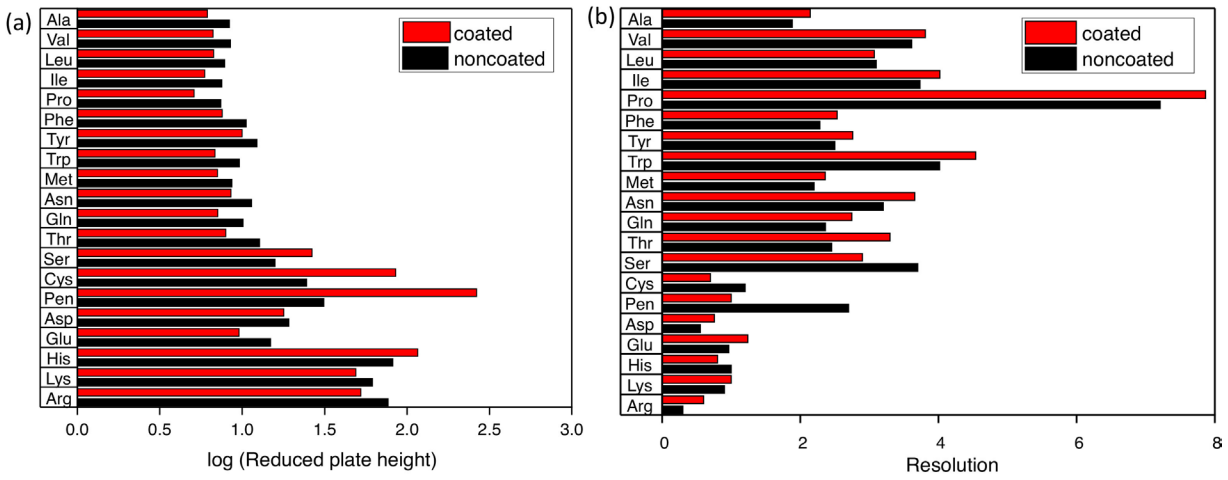


Figure 1. Chromatographic performance of ZWIX(+) column for the enantiomer separation of amino acids on coated vs uncoated hardware using optimized conditions as shown in Table 1. (a) log reduced plate height, (b) resolution.

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The Results and Benefits:

The study also evaluated hydroxy carboxylic acids using QN-AX. For two particularly hydrophilic analytes, Dursan-coated hardware produced measurable improvements. See Figure 2 below. Less hydrophilic hydroxy carboxylic acids showed little improvement, reinforcing that the value of Dursan is strongly related to an analyte's susceptibility to surface interactions. The more susceptible an analyte is to metal-surface interactions, the greater the potential value of an inert column surface.

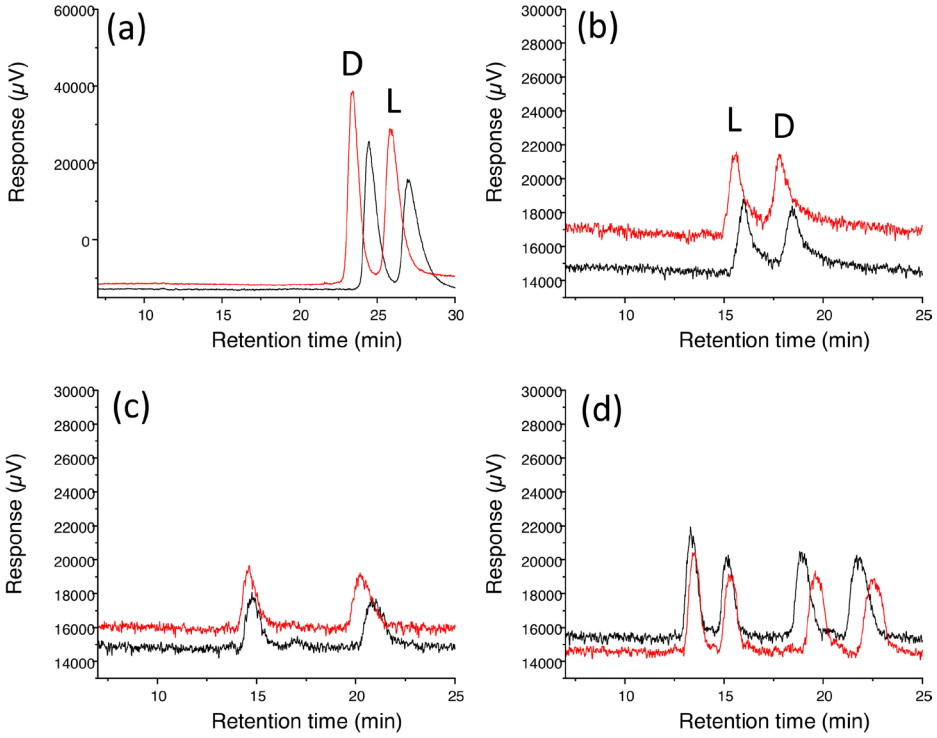


Figure 2. Chromatograms of 2-hydroxycarboxylic acids. (a) 2-Hydroxyglutarate (with MP-6), (b) lactate (with MP-5), (c) 2-hydroxy-3-methylbutyrate (with MP-5) and (d) 2-hydroxy-3-methylpentanoate (with MP-5), tested on coated (shown in red) vs uncoated (shown in black) QN-AX column

Metal–analyte interactions can produce adducts and distribute analyte signal across multiple ion species, potentially reducing effective MS sensitivity. The study notes that Dursan-coated column hardware and tubing can reduce metal leaching and associated adduct formation for polar, chelating analytes. As column efficiency increases, extra-column contributions become increasingly important. Connecting tubing and other stainless-steel components can contribute to band broadening and analyte adsorption. The study therefore suggests that additional performance gains may be possible by extending Dursan-coated surfaces throughout the flow path.

For laboratories performing challenging separations of metal-sensitive analytes, the cost of uncoated stainless-steel hardware can extend well beyond chromatographic performance. Analyte adsorption, peak tailing, and poor resolution can lead to troubleshooting, repeated analyses, and wasted samples and analyst time. By creating an inert surface on stainless-steel hardware, Dursan can help reduce these sources of inefficiency while improving chromatographic performance. The resulting sharper peaks and increased resolution can help labs obtain reliable results with fewer repeated runs and streamline analytical workflows. For labs where difficult separations are a routine part of daily testing, these gains can translate into greater productivity, improved daily sample throughput, and lower overall analytical costs.

- Improved peak symmetry
- Lower reduced plate height
- Higher chromatographic resolution
- Reduced analyte–metal interactions
- Potentially improved LC-MS compatibility
- Broad solvent and pH compatibility
- No pressure limitations associated with polymer-lined hardware