Hydrophobicity of Cogent TYPE-C Silica HPLC Columns - Tech Information

Date: 31-AUGUST-2013   Last Updated: 9-FEBRUARY-2026

Understanding Cogent TYPE-C™ Silica Hydride HPLC Columns by Hydrophobicity

When selecting a Cogent TYPE-C™ silica hydride HPLC column for method development, one of the most important considerations is the hydrophobicity of the stationary phase, which strongly influences both Reversed-Phase (RP) and Aqueous Normal Phase (ANP) retention behavior.

Each TYPE-C bonded phase exhibits a unique balance of hydrophobic and hydrophilic interactions, enabling highly tunable selectivity across polar, moderately polar, and hydrophobic analytes.

This guide outlines the relative hydrophobicity order of Cogent silica hydride stationary phases and explains how analyte class, pH, and desired retention mode affect column choice.

Stationary Phases Ranked by Hydrophobicity

From most hydrophobic to most hydrophilic, Cogent TYPE-C phases are ordered as follows:

Bidentate C18 > UDC-Cholesterol > Bidentate C8 > Phenyl Hydride > UDA > Diol > Amide > Diamond Hydride > Silica-C

How to Interpret This Ranking

- Left → Right = Increasing Hydrophilicity, greater retention in ANP mode.
- Right → Left = Increasing Hydrophobicity, greater retention in RP mode.

This allows analysts to easily map a bonded phase to the most appropriate starting method conditions.

Important Notes for Method Development

1. Special Selectivity Based on Analyte Chemistry

Certain ligands exhibit enhanced interactions depending on analyte structure:

- Phenyl Hydride often provides stronger retention for aromatic and conjugated systems.
- UDA (Undecanoic Acid) becomes more polar at higher pH, shifting its selectivity toward ANP behavior.

These nuances make TYPE-C phases highly versatile when developing methods for chemically diverse sample sets.

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2. ANP vs. RP Behavior for Acids vs. Bases

Acids:

- Can typically be analyzed in both RP and ANP, depending on pH.
- At low pH, acids are more suitable for RP.
- At pH 6–7, ANP retention becomes favorable.

Bases:

- Switching between RP and ANP is generally not recommended.
- To retain bases in RP, high mobile-phase pH (≥8–9) would be required, which is not advisable for silica.
- Therefore, ANP is the recommended approach for basic analytes.

Choosing a Column Based on Analyte Class

Analyte Type	Recommended Selectivity Consideration
Non-polar / hydrophobic compounds	More retentive phases such as Bidentate C18, UDC-Cholesterol, C8
Aromatic compounds	Phenyl Hydride (π–π and conjugation interactions)
Polar compounds	Diamond Hydride, Amide, Diol, or Silica-C
Weak acids	RP at low pH, ANP at pH 6–7
Bases	ANP strongly preferred (avoid high-pH RP)

Why TYPE-C Columns Offer Unique Dual-Mode Capabilities

TYPE-C silica hydride surfaces allow for operation in:

- Reversed Phase (RP)
- Aqueous Normal Phase (ANP)
- Normal Phase (NP)

Because the hydride surface does not form a thick hydration shell and retains very low silanol activity, retention mechanisms remain:

- Highly stable
- Low in hysteresis
- Reproducible across days and instruments

This gives TYPE-C phases distinct advantages compared to conventional silica or HILIC materials.

NOTE 1: *Various factors may influence the retention; ie for the Phenyl Hydride, greater retention may be observed for aromatic and conjugated double bond compounds. Likewise, the Cogent UDA ligand becomes more polar as pH is increased.*

NOTE 2: *Aqueous Normal Phase HPLC ANP is typically used for polar compounds however, some compounds may be amenable to both methods. Acids are the most common of the compounds that can be done in RP and ANP. Here the change occurs at a reasonable pH so at low pH they are done by RP and at higher pH values (6–7) they can be done by ANP.*

NOTE 3: *For Bases this approach is not used because to do them in RP you have to have high pH (at least 8 - 9). Therefore for bases, only ANP methods are generally recommended.*

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