An Introduction to Cogent TYPE-C Silica™ HPLC Columns

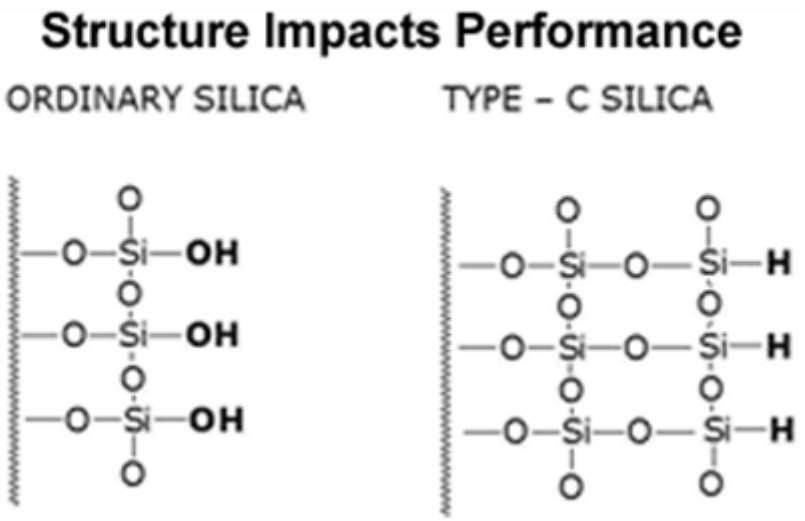
Cogent TYPE-C™ Silica HPLC columns, are an improvement from older, standard chromatographic supports and phases for polar compounds and were introduced in 2001. The silica hydride surface is populated with very stable, silicon-hydride groups (Si-H). This surface of the particle is slightly hydrophobic where all other silica used in HPLC, are well known to be extremely hydrophilic. What makes the TYPE-C™ Silica Columns valuable to chromatographers is that in the presence of 2% water or more in the mobile phase, the surface becomes charged by the adsorption of H+ ions produced from the auto-dissociation of water from the mobile phase. Very polar compounds will be selectively precisely retained when the mobile phase content is largely organic. Less polar compounds will be retained even at low concentration of organic solvents (as low as 20% organic).

The TYPE-C™ Silica particles retain all the physical advantages of ordinary, standard silica such as spherical shape, a low metal content, high purity, high mechanical strength, narrow pore size distribution, wide range of pore sizes, easily chemically modified, no swelling in the presence of solvents for stable packed beds.

One of the major advantages of using Cogent TYPE-C™ HPLC Columns, compared with industry leading standard columns, is that one single TYPE-C™ column can be used for 3 different modes of HPLC including Reversed Phase, Normal Phase and Aqueous Normal Phase / HILIC. No other column on the market can produce such selectivity power.

Another major advantage is that on one single column you can separate some polar and non-polar compounds at the same time or in different runs with different mobile phases. This helps speed up method development, scouting for impurities or other degradation products among many other needs.

Since one column can be used for Reversed Phase, Normal Phase (with non-polar solvents such as, hexane) and for Aqueous Normal Phase (ANP) these columns bring added advantages over HILIC Columns including but, NOT limited to: precision, fast equilibration including gradients, uses much lower salt to retain polar compounds, smaller sample sizes and elution and resolution differences with bonded phases such as Bidentate C18, Phenyl, Diol, Amide, Bidentate C8, UDC-Cholesterol, UDA (wcx) and the most popular, Diamond Hydride.

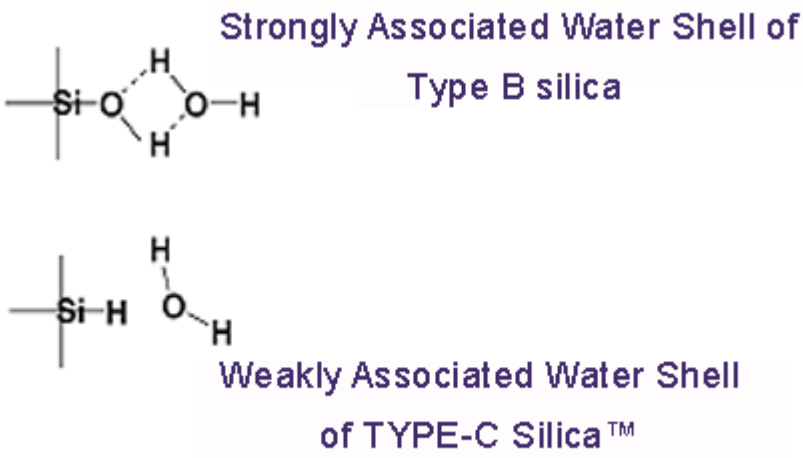


The structural differences between Ordinary Silica and TYPE-C Silica. The "Hydride Surface" is exclusive to TYPE-C™ and is responsible for most of the uniqueness of Cogent TYPE-C Columns.

Comparing Standard, Ordinary Columns and Cogent TYPE-C™ Silica Column Chemistries.

TYPE-C™ Silica has a weak association with water due to the hydrophobic nature of the Silica-Hydride particle in the presences of high levels of organic solvents with at least 2% water. Even with H+ ions adsorbed to the surface, TYPE-C™ Silica will not adsorb or develop a water layer which occurs with ordinary silica. The “water shell” associated ordinary silica is semi-permanent and becomes an integral part of standard, everyday HPLC mechanisms as partitioning.

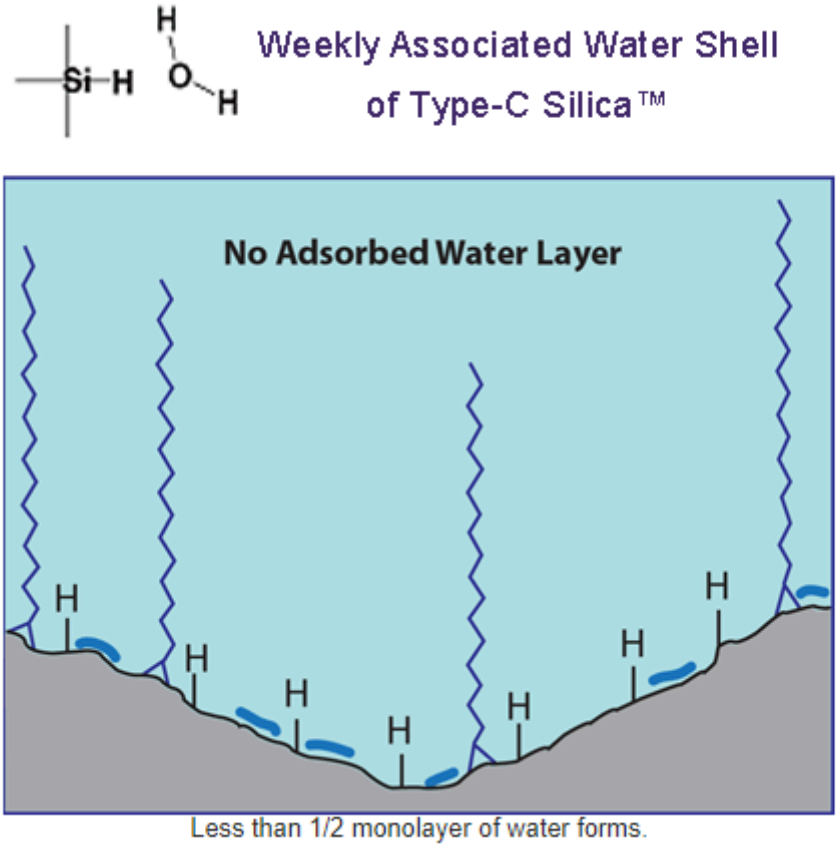
NOTE*: Since TYPE-C™ Silica does not adsorb water, there is no partitioning mechanism at play and method development is simplified and the method can be more robust.*



Unique Surface Chemistry of TYPE-C Silica™ Stationary Phases.
The surface of Cogent TYPE-C™ Silica is predominantly populated with non-polar, silicon-hydride (Si-H) groups instead of the polar, silanol groups (Si-OH) that are prevalent on the surface of ordinary varieties of silica. This feature gives the Cogent TYPE-C™ columns many unique, useful and helpful chromatographic qualities, especially for polar & water labile compounds, including metabolites and peptides. The Cogent TYPE-C™ columns overcome some of the inherent limitations of ordinary silicas associated with free silanols:

- Surface acidity is reduced
- Improved low pH stability
- Less hydroscopic - no water shell

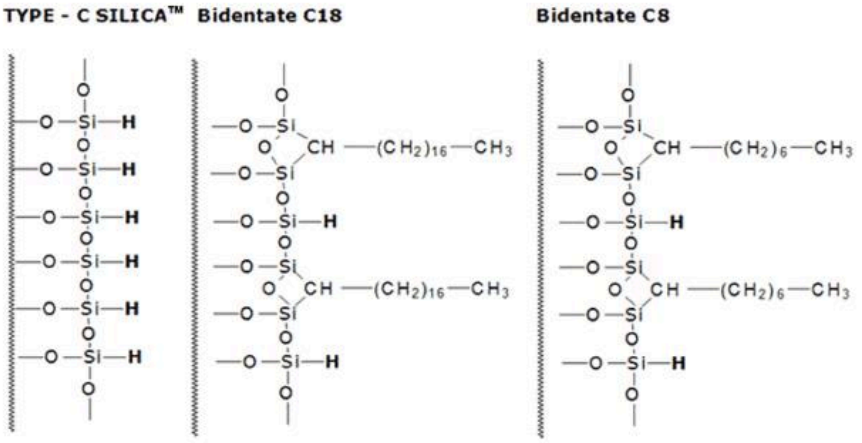
***No Adsorbed Water on TYPE-C™ HPLC Column*s makes them Different.**



Less than 1/2 monolayer of water forms.

Strong adsorption of water to ordinary silica is well known and well documented. However, the silicon-hydride groups (Si-H) found on the surface of Cogent TYPE-C Silica™ Phases are not prone to such strong water retention (shown above). The weaker water adsorption also accounts for the little to no hysteresis observed when changing from Organic-Normal to Aqueous-Normal to Reversed Phase methods and also, when changing your sample pH and pH of the mobile phase or when equilibrating between gradient runs.
NOTE: *TYPE-C™ Silica columns also, extend the useful range of Normal Phase from Hexane/Ethyl Acetate all the way to Water/Acetonitrile with excellent precision. Not having a strong association with water makes the TYPE-C™ columns preferred over HILIC phases which often exhibit long-term memory and equilibration effects.*

Cogent TYPE-C™ Bonded Phases Have a Unique Attachment to the Silica.



A few examples of the unique bonds formed on Cogent TYPE-C™ Silica, the only direct Silicon to Carbon bonds which are extremely stable.

Cogent TYPE-C™ Silica can be bonded with different ligands to create distinctive stationary phases with extremely durable points of attachment. These direct silicon-carbon, ligand bonds (without the ordinary, intermediary, functional group) create bonded phases that are stable and resistant to conditions that can normally cause hydrolysis of ligands in ordinary HPLC phases. This bonding technology produces columns with much longer and useful lifetimes and are more resistant to paired ion reagents, low pH and other harsh mobile phase conditions.
The variety of TYPE-C™ stationary phases offer differences in Selectivity for different samples and sample matrices.

Three Different Mechanisms for Separations on One Column is Helpful.

Another unique feature of the Cogent TYPE-C Silica™ based columns is the Silica Hydride surface can act independently of the bonded phase giving it the ability to interact differently with non-polar to mid-polar compounds.
An example of this mechanism is work done by MicroSolv™ on Metformin and Glyburide, two anti-diabetic drugs of vastly different partition coefficients. When separating these two compounds from a single mixture, the Silica-C™ Column (unmodified Silica-Hydride) produced good separation of the compounds with good peak shape for Glyburide and a slightly tailing peak shape for Metformin.

When the Cogent UDC-Cholesterol™ Column is used instead of the Silica-C™ column, the peak shape is excellent for both compounds. This suggests the bonded phase interacts differently from the silica surface and that the silica surface is acting on the compounds similarly in both columns.

Some Features of TYPE-C™ Columns:	Chromatographer's Benefits
Silicon-Carbon Bonds instead of Siloxane	**More Stable and Durable. Low pH Mobile Phases.**
Si-H Replaces Si-OH	Rapid Equilibration between Gradients.
Temperature Stability Increased	Use Temperature as a Selectivity Tool.
Can be used with Hard Lewis Acids	Use Hard Lewis Acids as Mobile Phase Additives with anticipated interferences.
Free of Salts	Contaminant Free Surface will not adulterate your samples.
Bonded to a Silicon-Hydride Surface	Will not strongly bind Carboxylic Acids or Sulfonic Acids which alters your standard columns. Stable at high Flow Rates (up to 3ml/minute).
Weakly Associated Hydration Shell	Mobile Phase with Water Friendly Columns, easy to use and develop methods. Very rapidly removes Water from the Stationary Phase.
Use 100% Water on the Bidentate C18	Without loss of Retention over Time for more Reliable Data.
Lack of pH Hysteresis	Quickly change Mobile Phases and pH Buffers even between Gradients.
Perform ANP & RP at the same time one method	Separate Polar & Non-Polar Compounds in the Same Run.
Retain Polar compounds at extremely high Organic Content	Increases Sensitivity of Mass Detectors using ESI.
Use Non-Polar Solvents	Retain & Separate Compounds which are non-soluble in Water and still use bonded phases.
Low Affinity to adsorb Water from Mobile Phases	Run Normal Phase Separations on these "Bonded TYPE-C" Columns without the hassles of removing moisture in solvents.
Use high Organic % Content in Mobile Phases	SPE Improvement. Shorten Sample Prep Time no need to dry down Samples after SPE. Inject Sample Diluent (high organic) right on the Column.
Retain Polar Compounds with high Water Mobile Phase	Retain and Separate Slightly Polar Compounds not easily retained on HILIC or RP.
High Efficiency & Stability	Great Peak Shapes & Columns that last a Long Time.