# PRP-Z2 HPLC Column Data Sheet

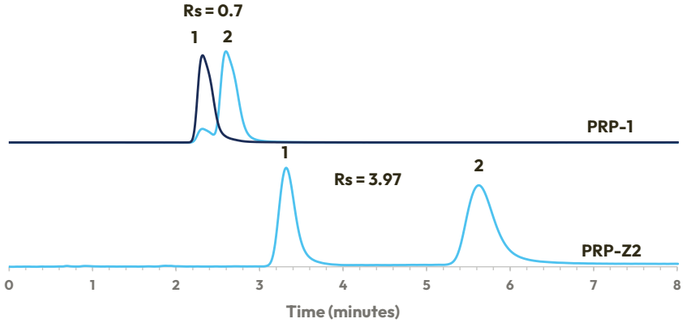

PRP-Z2 was specifically engineered to maximize polar retention through a combination of deeper pores, higher surface area, and embedded polar moieties. These features improve retention and selectivity for highly polar and cationic analytes. PRP-Z2 particles have a (160 Å) pore size that is suitable for the separation of some large molecules such as small proteins, peptides, oligonucleotides, as well some small polar compounds.

## PRP-Z2 Benefits

- Enhanced polar analyte retention for both small molecules and biologic large molecules
- High surface area and large pore size/volume
- Mechanical rigidity and longevity
- Full chemical and thermal stability

# Enhanced Polar Analyte Retention

The PRP-Z2's increased crosslinking density and purposeful incorporation of varied pore sizes create a uniquely hydrophobic yet structurally accessible surface. This architecture enables strong retention of compounds that elute at or near the void volume on traditional C18 phases, including quaternary ammoniums (paraquat, diquat), nucleobases, and zwitterionic metabolites.




## Column Conditions

- **Column:** PRP-1 5 µm (top) PRP-Z2 5 µm (bottom)
- **Dimensions:** 4.1 x 150 mm
- **Mobile phase:** A: 14 mM HAS
- **Isocratic:** 0 to 8 min
- **Flow rate:** 2.0 mL/min
- **Column Temp:** Ambient
- **Detection:** UV at 257/308 nm

**Figure 1:** Comparison of paraquat/diquat using 14 mM hexane ammonium sulfonate (HAS) * at 2mL/min. Peak #1 257 nm and Peak #2 308 nm. 1. Paraquat, 2. Diquat
* The same mobile phase used in EPA Method 549.2

Compared to the legacy PRP-1 column, the PRP-Z2 provides markedly improved resolution for diquat and paraquat under EPA 549.2 parameters. Using a 4.6 × 150 mm format at 2.0 mL/min, the PRP1 column achieves only partial separation of paraquat and diquat, with a resolution of -approximately Rs ≈ 0.70 between the two analytes. Due to limited separation, the quantitation of both compounds must be done by monitoring at different UV wavelengths, 257 nm for paraquat and 308 nm for diquat. In contrast, the PRP-Z2 column, operated under the same mobile phase composition and flow rate, delivers Rs = 3.97, corresponding to excellent baseline separation and a significantly greater margin between the critical peaks. Thus, the compounds can be observed in the same wavelength. This improvement directly reduces the risk of coelution in complex matrices and increases confidence in routine, high throughput compliance testing (Figure 1). For laboratories currently running PRP-1–based methods, PRP-Z2 offers a highly attractive upgrade path with substantially improved method robustness.

## High Surface Area and Large Pore Size/Volume

PRP-Z2 was specifically engineered to maximize polar retention via a combination of deeper pores, higher surface area, and embedded polar moieties.

- **Optimized Pore Size:** Designed at 160 Å, the PRP-Z2 provides excellent accessibility for small molecules and smaller peptides, enabling superior flexibility across diverse analyte classes.
- **Expanded Pore Volume:** With a 0.9 $cm^3/g$ pore volume, the particle accommodates larger molecules, allowing them to penetrate deeply into the stationary phase for improved interaction and retention.
- **Unmatched Surface Area:** The PRP-Z2 achieves a surface area of 582 $m^2/g$, a significant increase from the PRP-1's 401 $m^2/g$. This enhanced surface roughness promotes stronger analyte-stationary phase interactions, translating into higher resolution and improved separation efficiency.

The result is a particle engineered for maximum retention, resolution, and versatility, setting a new benchmark for polymer-based chromatography media.



**Table 1: Comparison of Particles between PRP-Z2 and PRP-1**

| | Surface Area | Pore Size | Pore Volume |
|---|---|---|---|
| PRP-Z2 | 582 $m^2/g$ | 160 Á | 0.901 $cm^3/g$ |
| PRP-1 | 401 $m^2/g$ | 100 Á | 0.762 $cm^3/g$ |

## Thermal Robustness

Elevated temperatures (>60 °C) are often essential for oligonucleotide analysis to denature secondary structures and improve peak shape. The additional crosslinking facilitates a more rigid bead structure, decreases particle swelling, and increases eluent response time. PRP-Z2 maintains mechanical integrity and chromatographic performance at temperatures that would normally compromise the silica phase.

## Universal pH Stability (pH 1 – 13)

Unlike silica-based phases that typically hydrolyze above pH 8 or start to dissolve below pH 2, the PRP-Z2's 100% polymeric backbone withstands the full pH spectrum. Structural rigidity was designed into the particle and adds exceptional performance with all common chromatographic eluents, including highly alkaline and acidic additives, enabling a complete pH window for the isolation of any analyte.

## Mechanical Rigidity and Longevity

Solvent swelling and compression are kept at a minimum due to the proprietary crosslinked structure. Likewise, structural formulations help to resist degradation with aggressive cleaning protocols, allowing enhanced usability and longevity. Longevity testing demonstrates consistent retention times, resolution, and plate counts. As shown in Figure 2, the retention times of both diquat and paraquat are closely lined up throughout all injections up to 600, even after multiple batches of mobile phase were used.

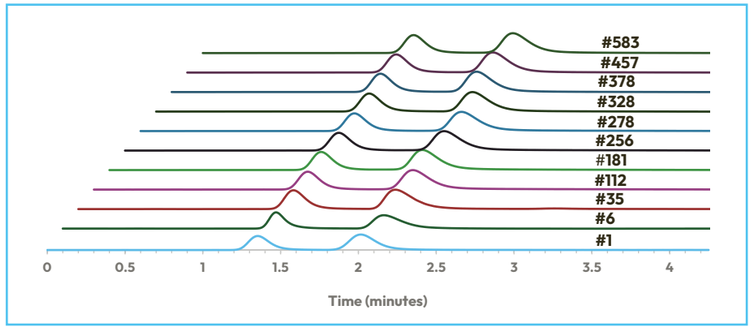



**Figure 2:** Overlay of representative chromatograms obtained at different points during the longevity study on the PRP-Z2 2.1 × 50 mm column. Peaks for paraquat (1) and diquat (2) remain well resolved with minimal shifts in retention time over 583 injections and multiple mobile phase batches, confirming method repeatability and column robustness.

## Column Conditions

- **Column:** PRP-Z2 5 µm, 2.1 x 50 mm
- **Mobile phase:** A: 0.1% formic acid
- **Mobile phase:** B: acetonitrile
- **Isocratic:** 1% B 0 to 8 min
- **Flow rate:** 1.0 mL/min
- **Column Temp:** Ambient
- **Detection:** UV at 256 nm

In addition to the consistency of retention times, the chromatographic performance among all injections was excellent, as demonstrated by the column efficiency and the resolution between diquat and paraquat as seen in Figure 3.

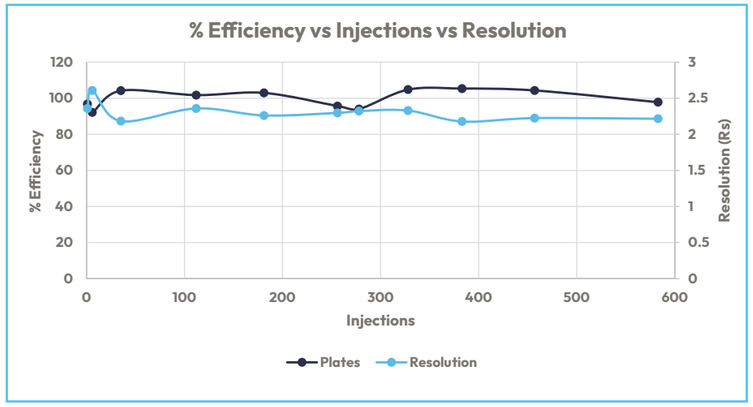
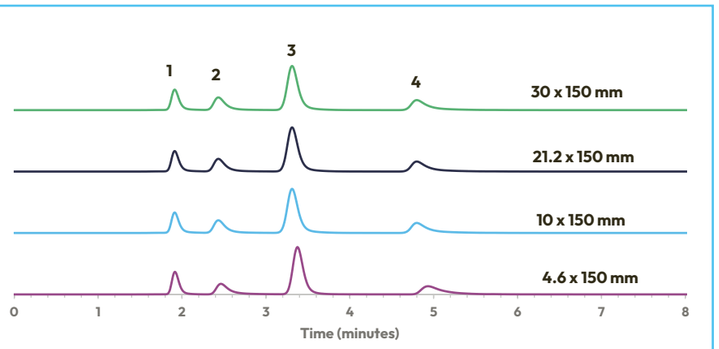



**Figure 3:** Column efficiency and resolution as a function of injection number for the PRP-Z2 2.1 × 50 mm column. Conditions as in Figure 2. Plate counts (% of initial efficiency) and resolution between paraquat and diquat remain stable over 583 injections, indicating excellent long-term column stability under routine analytical conditions.

## Built for Easy Scale-Up

PRP-Z2 isn't limited to analytical separations—it's engineered for seamless scale-up to semi-preparative and preparative workflows. In this example, an analytical column (4.6 × 250 mm) was used to isolate polar molecules, then scaled up to 10 mm, 21.2 mm, and 30 mm diameters while maintaining consistent performance. Even at larger sizes, PRP-Z2 delivers low backpressure and stable operation, ensuring predictable retention and resolution across all scales. This versatility makes PRP-Z2 the ideal choice for efficient method transfer and high-throughput purification.




**Compounds**

1. Thiourea
2. Guanosine 5'-monophosphate (GMP)
3. Flurorouracil
4. Nicotinamide

## Column Conditions

- **Column:** PRP-Z2 5 µm, 150 mm with various IDs
- **Mobile phase A:** 0.1% Formic Acid
- **Mobile phase B:** $CH_3CN$
- **Isocratic:** 1% B 0.0 - 8.0 min
- **Flow rate:** 1.0 mL/min
- **Column Temp:** Ambient
- **Detection:** UV at 256 nm

**Figure 4:** Chromatogram comparison of columns with various internal diameters from analytical scale (4.6 mm) to semi-prep scale (10 mm) to prep scale (21.2 and 30 mm)

## MS-Compatible Chemistry

The location of the embedded polar groups in the PRP-Z2 matrix minimizes ion suppression and background noise in electrospray ionization (ESI) mass spectrometry. Methods can be developed using volatile, MS-friendly buffers (ammonium formate, ammonium acetate, TEAA) without the ion-pairing reagents that complicate LC-MS workflows.



# Technical Data

| PRP-Z2 Specifications | |
|---|---|
| Materials | Cross-linked poly(styrene-co-divinylbenzene) polymer |
| Particle size | 5, 10 and 12 -20 µm |
| Pore size | 160 Å |
| Surface area | 582 $m^2/g$ |
| Pore volume | 0.901 $cm^3/g$ |

# Ordering Information

## HPLC Columns

| PRP-Z2 HPLC Columns | |
|---|---|
| **Description** | **Part Number** |
| 2.1 x 50 mm, 5 µm | 79925 |
| 2.1 x 150 mm, 5 µm | 79926 |
| 2.1 x 250 mm, 5 µm | 79927 |
| 4.6 x 50 mm, 5 µm | 79928 |
| 4.6 x 150 mm, 5 µm | 79929 |
| 4.6 x 250 mm, 5 µm | 79930 |
| 10 x 150 mm, 5 µm | 79931 |
| 10 x 250 mm, 5 µm | 79932 |
| 21.2 x 75 mm, 5 µm | 79933 |
| 21.2 x 150 mm, 5 µm | 79934 |
| 21.2 x 250 mm, 5 µm | 79935 |

## Guard Columns

| PRP-Z2 Guard Columns | |
|---|---|
| **Description** | **Part Number** |
| Guard Analytical, PRP-Z2 | 79936 |
| Guard Prep, PRP-Z2 | 79937 |

## Bulk Resin

| PRP-Z2 Bulk Resin | |
|---|---|
| **Description** | **Part Number** |
| Bulk Resin, PRP-Z2, 5 µm | 79938 |
| Bulk Resin, PRP-Z2, 10 µm | 79939 |
| Bulk Resin, PRP-Z2, 12 - 20 µm | 79940 |

## About Hamilton

Hamilton Company is a global manufacturer and supplier of world-class analytical components, medical instrumentation, temperature control systems, laboratory robotics and automated liquid handling equipment. For more than 35 years, Hamilton Company has developed and manufactured pressure-stable, polymeric polystyrenedivinylbenzene (PS-DVB) HPLC columns that are used in most of the world's top chromatography labs. With a wide range of particle sizes, pore sizes, pH stability from 1 to 14, temperature resistance over 100°C, and chemistries to match most analyte types, Hamilton polymeric columns are the chromatographer's choice for challenging separations.



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