Watercol™
Capillary GC Columns

Convenient Measurement of Water

Sharp Peak Shape
Linear Response
Great Sensitivity
Small Sample Size
Selectivity Options
Applications
Watercol™ capillary GC columns contain innovative ionic liquid stationary phases that produce a sharp peak shape for water, allowing the convenient measurement of water by GC.

### Watercol™ Checklist

**Sharp Peak Shape:** Water can be integrated and quantified – see Figure 1 (page 3) and Figure 3 (page 4).

**Linear Response:** $r^2$ value of 0.9923 achieved from a 5-point calibration curve – see Figure 2 (page 3).

**Great Sensitivity:** 100 ppm using TCD. Anticipate that much better sensitivity can be achieved with other modes of detection, such as with:
- A mass spectrometer (MS) run in SIM mode
- Vacuum ultraviolet (VUV) absorption spectroscopy
- A barrier discharge ionization detector (BID)

**Small Sample Size:** GC results can be obtained using small sample sizes, such as <2 mL gasoline (see page 6) and <0.2 g ibuprofen (see page 7).

**Selectivity Options:** Whether water is an analyte or the injection solvent – see Figure 3 (page 4) and Figure 4 (page 5).

### Suitability

Narrow peak widths and optimal peak heights are also produced for many other small polar analytes. Watercol columns are suitable for applications where:
- Water is an analyte: can be integrated and quantified
- Water is the injection solvent: because it does not tail, it does not interfere chromatographically with other analytes

*sigma-aldrich.com/watercol*
Interaction Strength

The fundamental property driving the performance of Watercol series columns is the proper combination and strength of water: column interactions.

WATER: COLUMN INTERACTIONS

Interaction is just right
Efficient transfer of water molecules from stationary phase into carrier gas

Sharp water peak shape

Interaction is too strong
Water molecules struggle getting from stationary phase into carrier gas

Severe water peak tailing or complete adsorption

Column Selection

Three chemistries are available, each with a different selectivity. Table 1 (page 8) contains complete column specifications. While each of these columns can be used to either quantify water or quantify small polar analytes in water, proper column selection for a particular application depends on the assortment of analytes present in the sample. The chromatograms in this brochure cover a variety of analytes and compound classes. Additional chromatograms, product information, real-time availability, and ordering information is available 24 hours a day at sigma-aldrich.com/watercol.

Figure 1. Water Standard (0.05% in Ethanol) on Watercol 1910

- column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U)
- oven: 80 °C (10 min)
- inj. temp.: 250 °C
- detector: TCD, 200 °C
- carrier gas: helium, 26 cm/sec
- injection: 0.5 µL, 100:1 split
- liner: 4 mm I.D., split type, cup design
- sample: water at 0.05% (v/v) in ethanol

1. Ethanol
2. Water

Figure 2. Water Calibration Curve (0.01–0.5%) on Watercol 1910

- column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U)
- oven: 80 °C (10 min)
- inj. temp.: 250 °C
- detector: TCD, 200 °C
- carrier gas: helium, 26 cm/sec
- injection: 0.5 µL, 100:1 split
- liner: 4 mm I.D., split type, cup design
- sample: 5 standards, water at 0.01, 0.05, 0.1, 0.3, and 0.5% (v/v), each in ethanol

$r^2 = 0.9923$
Figure 3. Water as an Analyte

- **column:** Watercol 1460, 30 m x 0.25 mm I.D., 0.20 µm
- **column:** Watercol 1900, 30 m x 0.25 mm I.D., 0.20 µm
- **column:** Watercol 1910, 30 m x 0.25 mm I.D., 0.20 µm (29711-U)
- **oven:** 96 °C
- **inj. temp.:** 250 °C
- **detector:** TCD, 200 °C
- **carrier gas:** helium, 26 cm/sec
- **injection:** 1 µL, 100:1 split
- **liner:** 4 mm I.D., split type, cup design
- **sample:** 6 analytes in acetone

1. n-Tridecane
2. Water
3. 2-Octanone
4. 1-Heptanol
5. 1-Octanol
6. Naphthalene
Figure 4. Water as the Injection Solvent

column: Watercol 1460, 30 m × 0.25 mm I.D., 0.20 µm
column: Watercol 1900, 30 m × 0.25 mm I.D., 0.20 µm
column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U)
oven: 35 °C, 4 °C/min to 125 °C (2 min)
inj. temp.: 250 °C
detector: TCD, 300 °C
carrier gas: helium, 25 cm/sec
injection: 1 µL, 100:1 split
liner: 4 mm I.D., split type, cup design
sample: 8-component solvent mix in water

1. Acetone
2. Methylene chloride
3. Isopropanol
4. Ethanol
5. Methanol
6. n-Propanol
7. 1,4-Dioxane
8. Water
9. n-Butanol
**Figure 5. Water in Gasoline (Petroleum Application)**

- **Column:** Watercol 1460, 30 m x 0.25 mm I.D., 0.20 μm; two identical columns installed in the same inlet using a 2-hole ferrule, each going to a separate detector.
- **Oven:** 45 °C (4 min), 5 °C/min to 75 °C, 10 °C/min to 220 °C (10 min).
- **Injection Temp.:** 250 °C.
- **Detectors:** FID, 250 °C; TCD, 200 °C.
- **Carrier Gas:** Helium, 20 cm/sec (measured in each column at an oven temperature of 135 °C).
- **Injection:** 1 µl, 50:1 split.
- **Liner:** 4 mm I.D., split/splitless type, wool packed single taper FocusLiner™ design.
- **Sample:** 1.5 mL unleaded gasoline, spiked with water at 0.25 % (v/v).

**Figure 6. Water in a 60-Component Solvent Mix (Chemical Application)**

- **Column:** Watercol 1910, 30 m x 0.25 mm I.D., 0.20 μm (29711-U); two identical columns installed in the same inlet using a 2-hole ferrule, each going to a separate detector.
- **Oven:** 50 °C (1 min), 5 °C/min to 180 °C (5 min).
- **Injection Temp.:** 250 °C.
- **Detectors:** FID, 250 °C; TCD, 200 °C.
- **Carrier Gas:** Helium, 25 cm/sec (measured in each column at an oven temperature of 125 °C).
- **Injection:** 1 µl, 100:1 split.
- **Liner:** 4 mm I.D., split/splitless type, wool packed single taper FocusLiner™ design.
- **Sample:** Mixture of 60 solvents, each at 0.2 % (v/v), and water at 0.3% (v/v), in pentane.
Figure 7. Water in Ibuprofen (Pharmaceutical Application)
column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U)
oven: 35 °C (4 min), 8 °C/min to 130 °C (1 min)
inj. temp.: 250 °C
detector: TCD, 200 °C
carrier gas: helium, 11.40 psi constant pressure (equal to 25 cm/sec), measured with oven at 35 °C
injection: 1 µL, 100:1 split
liner: 4 mm I.D., split/splitless type, wool packed single taper FocusLiner™ design (2879925-U)
sample: 0.198 g ibuprofen weighed into a 1 mL volumetric flask, 0.5 mL acetone added, vortexed slowly for 30 seconds, acetone added to the 1 mL line, vortexed, transferred to an autosampler vial

Figure 8. Water Impurity in C1-C6 Alcohol Mix
column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U)
oven: 40 °C (2 min), 4 °C/min to 125 °C (1 min)
inj. temp.: 300 °C
detector: MSD, m/z = 18–500
MSD interface: 260 °C
carrier gas: helium, 11.1 mL/min
injection: 1 µL, 100:1 split
liner: 3.4 mm I.D., split/splitless type, wool packed straight FocusLiner™ design (2877601-U)
sample: 10-component alcohol mix in methylene chloride, 500 µg/mL total concentration (mixture adsorbed some water during storage)

Figure 9. Aroma Fusel Alcohols in Tequila (Food and Beverage Application)
column: Watercol 1910, 30 m × 0.25 mm I.D., 0.20 µm (29711-U); two identical columns installed in the same inlet using a 2-hole ferrule, each going to a separate detector
oven: 50 °C (1 min), 5 °C/min to 180 °C (3 min)
inj. temp.: 250 °C
detector: FID, 200 °C
detector: TCD, 200 °C
carrier gas: helium, 11.40 psi constant pressure (equal to 25 cm/sec), measured with oven at 125 °C
injection: 1 µL, 100:1 split
liner: 4 mm I.D., split/splitless type, wool packed single taper FocusLiner™ design
sample: neat tequila
Watercol™ capillary GC columns contain innovative ionic liquid stationary phases that produce a sharp peak shape for water, allowing the convenient measurement of water by GC.

Table 1. Watercol Series Column Specifications

<table>
<thead>
<tr>
<th>Watercol</th>
<th>USP Code</th>
<th>Phase</th>
<th>Temp. Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1460</td>
<td>None</td>
<td>Non-bonded; tri(tripropyolphosphoniumhexanamido) triethylamine trifluoromethanesulfonate</td>
<td>30 °C to 260 °C (isothermal or programmed)</td>
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<tr>
<td>1900</td>
<td>None</td>
<td>Non-bonded; 1,11-Di(3-methylimidazolium)3,6,9-trioxaundecane trifluoromethanesulfonate</td>
<td>30 °C to 180 °C (isothermal or programmed)</td>
</tr>
<tr>
<td>1910</td>
<td>None</td>
<td>Non-bonded; 1,11-Di(3-hydroxyethylimidazolium)3,6,9-trioxaundecane trifluoromethanesulfonate</td>
<td>30 °C to 180 °C (isothermal or programmed)</td>
</tr>
</tbody>
</table>

Did you know…?

The descriptive numbers (1460, 1900, and 1910) indicate the Kovats Retention Index (KRI) value of water at 100 °C isothermal oven temperature. KRI values indicate the elution location of the analyte relative to n-alkanes, in which the n-alkane carbon number is multiplied by 100. For example, a KRI of 1460 indicates that water elutes after tetradecane (nC14) and 60% of the interval before pentadecane (nC15) elutes.

Ordering Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Cat. No.</th>
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<tbody>
<tr>
<td>Watercol 1460 Capillary GC Columns</td>
<td>Inquire</td>
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<tr>
<td>20 m × 0.18 mm I.D., 0.14 µm</td>
<td>Inquire</td>
</tr>
<tr>
<td>30 m × 0.25 mm I.D., 0.20 µm</td>
<td>Inquire</td>
</tr>
<tr>
<td>30 m × 0.32 mm I.D., 0.26 µm</td>
<td>Inquire</td>
</tr>
<tr>
<td>Watercol 1900 Capillary GC Columns</td>
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<td>20 m × 0.18 mm I.D., 0.14 µm</td>
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</tr>
<tr>
<td>30 m × 0.25 mm I.D., 0.20 µm</td>
<td>Inquire</td>
</tr>
<tr>
<td>30 m × 0.32 mm I.D., 0.26 µm</td>
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</tr>
<tr>
<td>Watercol 1910 Capillary GC Columns</td>
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<tr>
<td>20 m × 0.18 mm I.D., 0.14 µm</td>
<td>Inquire</td>
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<tr>
<td>30 m × 0.25 mm I.D., 0.20 µm</td>
<td>29711-U</td>
</tr>
<tr>
<td>30 m × 0.32 mm I.D., 0.26 µm</td>
<td>29714-U</td>
</tr>
</tbody>
</table>

Related Information

Additional chromatograms, product information, real-time availability, and ordering information is available 24 hours a day at sigma-aldrich.com/watercol