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SunFire™ C_{18}: A Unique RPLC Stationary Phase for Higher Loading and Improved Peak Shapes

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The new SunFire™ C_{18} columns are reversed-phase HPLC columns designed for high preparative mass loading, excellent efficiency and peak shapes, and stability under low pH conditions.

Today's chromatographers often struggle with tailing peaks that limit resolution and mass loading. High silanol activity contributes significantly to peak tailing in reversed-phase liquid chromatography (RPLC) columns. Other factors, such as the purity of the silica, are also keys to reducing peak tailing. SunFire™ C_{18} columns are engineered with highly pure raw materials and a tightly controlled synthesis process. They provide high efficiencies and symmetric peak shapes for the analysis of acids, neutrals, and bases and they exhibit superior lifetimes under low pH conditions. The SunFire™ C_{18} preparative columns are manufactured with the patent pending OBD™ design to ensure ease of scale-up as well as the same efficiency, stability, and reliability as the analytical columns.

Experimental Conditions

Scale-up Conditions

Columns: SunFire™ C_{18} 4.6 × 50 mm, 5 µm and 19 × 50 mm, 5 µm
Mobile Phase A: 0.1% trifluoroacetic acid in water
Mobile Phase B: 0.1% trifluoroacetic acid in acetonitrile
Flow Rate: 1.4 mL/min analytical, 23.9 mL/min preparative
Analytical Gradient: 5 min linear from 5% to 30% B, with 1 min initial hold time
Preparative Gradient: 5 min linear from 5% to 30% B with 1.79 min initial hold time
Injection Volume: 23 µL (analytical) and 400 µL (preparative)
Sample Mixture: nadolol (100 mg/mL), metoprolol (100 mg/mL), and propranolol (50 mg/mL) prepared in DMSO
Detection: UV at 270 nm

Loadability Conditions

Column Dimensions: 4.6 × 150 mm, 5 µm (all silica-based C18)
Mobile Phase A: 0.1% trifluoroacetic acid in water
Mobile Phase B: 0.1% trifluoroacetic acid in acetonitrile
Flow Rate: 1.0 mL/min analytical
Gradient: 15 min linear from 20% to 85% B, with 2 min initial hold time
Injection Volume: 10 µL
Sample Mixture: ketoconazole (25 mg/mL), econazole (50 mg/mL), and miconazole (50 mg/mL) prepared in DMSO
Mass Loading: 1250 µg
Detection: UV at 254 nm
Instrument: Waters® AutoPurification™ System

Results

The retention and separation of the three β-blockers on the analytical column is shown in Figure 1a. The total load is 5.75 mg, and the flattened profiles reflect the saturation of the PDA detector. The mass load was proportionally scaled-up and run on the preparative column as shown in Figure 1b. Note the direct scale up, excellent peak shapes and total mass load of 100 mg.

The separation and loadability of the three antifungal drugs on SunFire™ C_{18} and two competitive silica-based C_{18} columns is shown in Figure 2. Under the same high mass loading, only SunFire™ C_{18} columns provide baseline resolution and excellent peak shapes for this separation.

Conclusions

New SunFire™ C_{18} columns provide excellent efficiency and peak shape, high mass loading, and ease of scale-up.

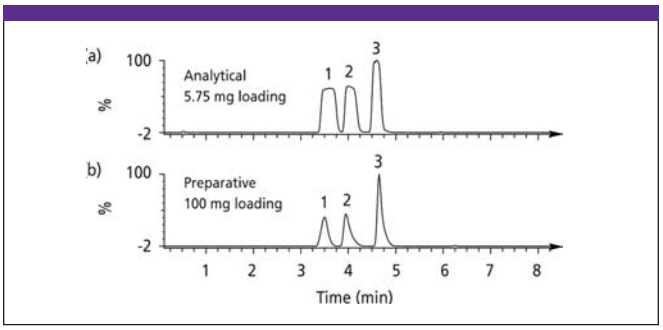

Figure 1: Scale-up of the β-blockers separation from analytical to preparative SunFire™ C_{18} columns. (a) SunFire™ C_{18}, 4.6 × 50 mm, 5 µm and (b) SunFire™ C_{18} Prep, 19 × 50 mm, 5 µm. Analytes: (1) nadolol, (2) metoprolol, and (3) propranolol.

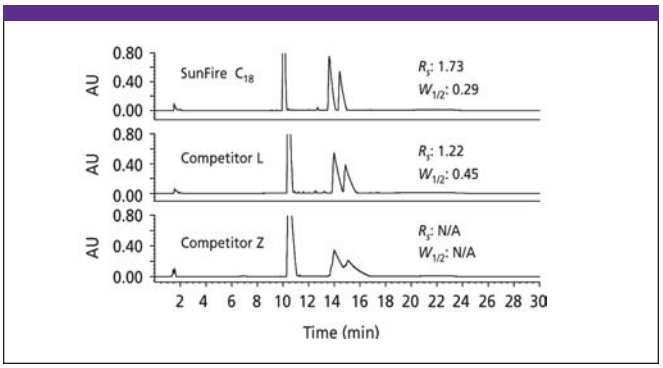

Figure 2: Separation of basic antifungal drugs on SunFire™ C_{18} column compared to two competitors' silica-based C18 columns. Analytes in order of elution: ketoconazole, econazole, and miconazole. Resolution (R_s) values are calculated based on the last two peaks. $W_{1/2}$ values are calculated based on the width at half-height of the last peak.

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