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Organic Solvent Compatibility of Zero and Controlled Flow Capillaries - Tech Information

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Overview

This article explains how Zero Flow™ and Controlled Flow™ CE capillaries interact with organic solvents. These capillaries use covalently bonded internal coatings—either linear polyacrylamide (LPA) or sulfonic acid polymer—to control electroosmotic flow characteristics. Because these coatings are permanently bonded to the fused silica wall, they are stable in most common organic solvents.

However, as with silica-based HPLC bonded phases, extreme pH or high temperatures can reduce lifespan. This guide outlines solvent compatibility, performance expectations, and recommended operating conditions.

Organic Solvent Compatibility

The internal coatings used in Zero Flow™ and Controlled Flow™ capillaries—either sulfonic acid polymer or linear polyacrylamide (LPA)—are covalently bonded to the inner surface of the fused silica. Because these coatings are firmly attached at the molecular level, they are inherently compatible with a wide range of organic solvents, including:

- Acetonitrile (ACN)
- Dimethylformamide (DMF)
- Most common organic modifiers used in CE

These solvents do not disrupt, dissolve, or detach the bonded coatings, making the capillaries reliable for methods that require organic additives or organic-rich buffers.

Comparison to Silica-Based HPLC Bonded Phases

In terms of chemical stability, these capillaries behave similarly to silica-based HPLC bonded phases. This means:

- They tolerate most organic solvents without degradation.
- The main risks arise under strongly acidic conditions, where hydrolysis may occur.
- Under appropriate pH and temperature control, the coating remains stable.

Just like HPLC bonded phases, overly harsh conditions—especially low pH combined with elevated heat—can break down the covalent bonds attaching the coating to the silica surface. This impacts electroosmotic flow characteristics and capillary lifespan.

Expected Capillary Lifetime

With proper care and operation within recommended limits, users can expect approximately:

➡ About 80 hours of analytical use

Lifespan may vary based on:

- Buffer composition
- Frequency of rinsing
- Sample cleanliness
- Temperature exposure
- pH conditions

Staying within the operating guidelines below helps ensure consistent performance and coating stability.

Recommended Operating Conditions

To maximize the lifespan of Zero Flow™ and Controlled Flow™ capillaries, follow these guidelines:

• **Temperature Limit**

Do not exceed:

➡ 60°C

Higher temperatures accelerate degradation of both the silica surface and the polymer coating.

• **pH Range**

Operate within:

➡ pH 2.0 – 8.5

Below pH 2.0, hydrolysis becomes more likely.
Above pH 8.5, silica dissolution may occur.

These limits mirror the constraints of many silica-based chromatographic phases.

Click HERE for ordering information and pictures

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