Backpressure Problems

See note on expected backpressure estimations for tips on how to gauge a reference point.

Classes of backpressure deviations:

1. Fluctuating backpressure
2. Low backpressure
3. High backpressure

Fluctuating backpressure – Generally System Related

A backpressure fluctuation in a repetitive pattern can often be traced to the pump, where one of the pump heads needs to be purged, as often an air-bubble is the inhibiting component. The flow will subsequently pulse, usually visible by removing the column and increasing the flow rate and observing a pattern of eluent pulses that otherwise should be a smooth streaming flow.

A backpressure fluctuation that is erratic can often be traced to a leak somewhere in the system. The injection valve is a common component where a small leak could go unnoticed, and the connection to the column if not sufficiently or properly connected with the nut and ferrule. Under gradient elution, ineffective gradient mixing can sometimes be the source of erratically fluctuating backpressures as well.

Low backpressure – Uncommon

Backpressures significantly lower than what are typically observed are a bit unusual and can often be traced to a simple oversight.

Mobile phase linear velocity is too low

a. Column dimensions (ID is larger than expected or particle size is too large)
b. Flow rate set too low (or otherwise not flowing as intended)
c. Mobile phase composition is incorrect (if running a gradient, possibly pumping from the wrong lines with a higher percentage of organic initially than intended)

High Backpressure – Most common

Backpressures significantly higher than what are typically observed and expected are due to a blockage in the flow path.

If the backpressure is high upon initial installation prior to any injections, find the source of the blockage in the system and purge. If the column is found to be the source, examine the connective tubing and fittings to ensure a proper fit has been applied. See connective fittings and tubing note for further information. Additionally, it is useful to know what solvents were run through the system just prior and ensure that incompatible solvents and buffers were thoroughly flushed out of the system lines.

If the backpressures increase upon successive sample injections, then something from the sample is fouling the column inlet. See column cleaning and regeneration tip for removing sample fouling blockages. For method development cases where the expectations have not yet been thoroughly characterized, a guard column can be particularly useful to protect the analytical column from fouling from unknowns (such as precipitation or chemical attack).

If the backpressure increases unexpectedly during a routine analysis that has already been thoroughly characterized, examining chromatographic symptoms associated with the increase in backpressure can be a clue as to the likely root cause (see various peak shape tech tips for further information).

Key words: HPLC, Backpressure, Troubleshooting

Author: Scott Krepich