# Sustainability and Mechanical Stability

The use of mechanically stable, spherical particles is an important economic aspect in a chromatographic process and also a matter of sustainability. A rigid resin can be used longer and re-packed more often before it requires replacement.

The mechanical robustness directly determines the longevity of the packed column bed. Naturally, particles that are damaged by pressure or sheer forces over the course of time will release fines. These clog not only the column frits but also the flow channels of the packing materials, resulting in a constant increase in backpressure. This effect is even more pronounced during the repacking of stationary phases. The comparison shows nicely the effects described below.

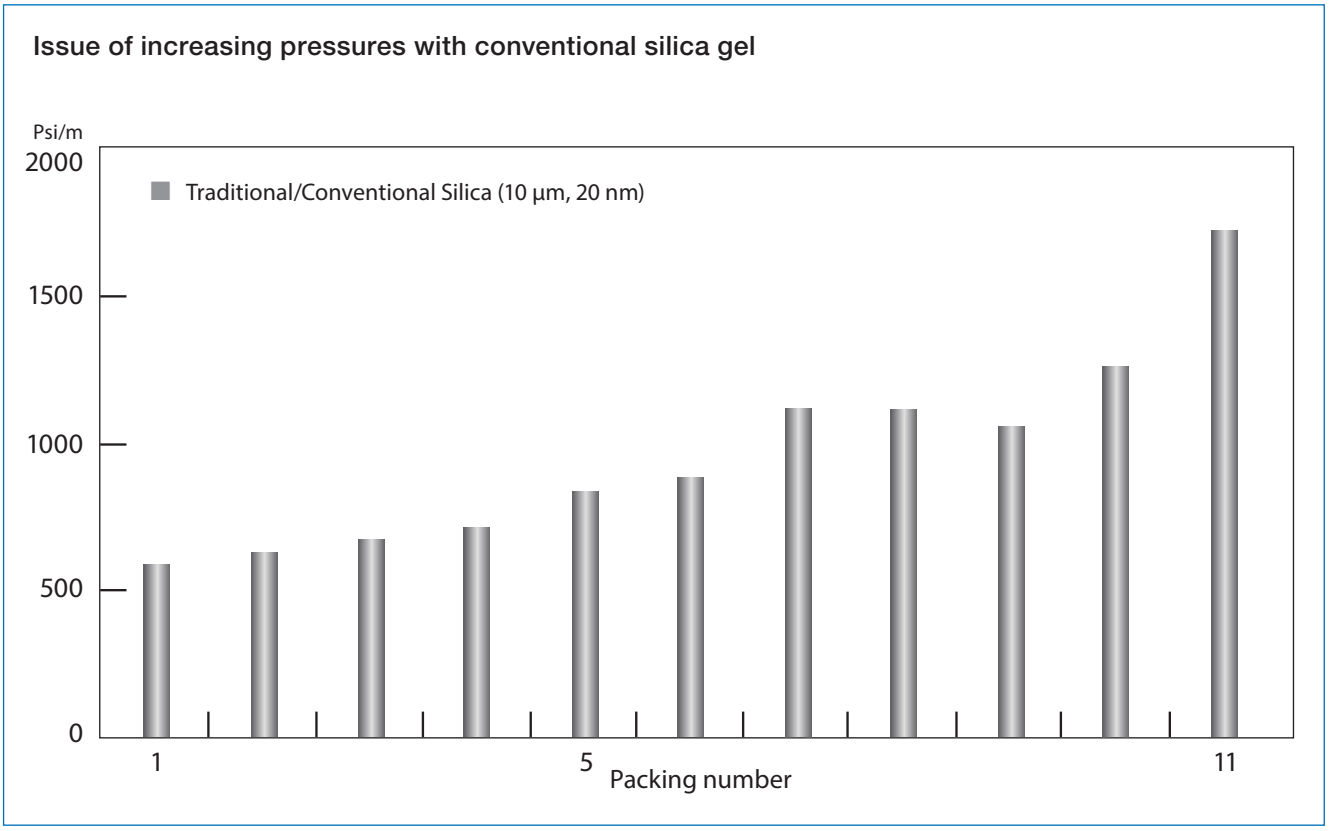



*Figure 1: Pressure vs. number of packing cycles for a conventional silica*

In the first example a conventional silica resin has been packed into a preparative scale column. After usage, the column was unpacked, the gel cleaned and repacked. How do these particles behave under subsequent repacking cycles? After every repacking cycle the back pressure was monitored. The traditional silica shows a significant increase in back pressure after only a few cycles.

The second example relies on a modern state-of-the art resin. The resin undergoes numerous repacking cycles. In contrast to the conventional silica, the monitored back pressure for modern YMC-Triart Prep shows a constant low pressure curve. This allows extended use of the packing material.

In addition to the continued and constantly low pressure curves, the initial back pressure is approx. 20–30% lower compared to conventional silica gels. Thereby, higher flow rates and a longer lifetime of the packed column can be achieved.

**The solution is for continuous repackings with the state-of-the-art YMC-Triart Prep**

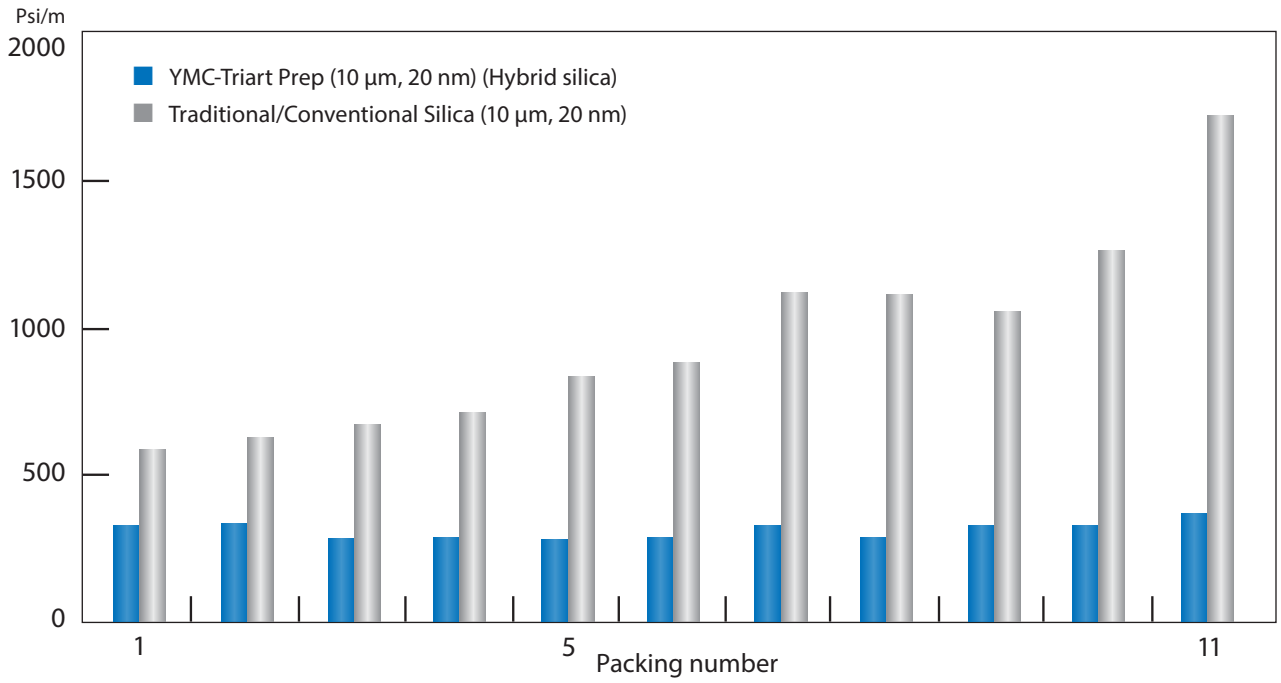
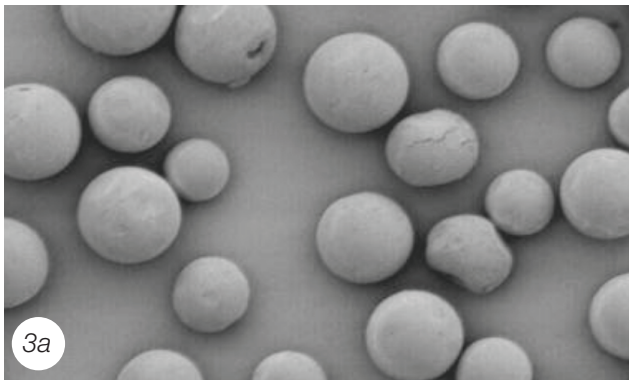



*Figure 2: Pressure vs. number of packing cycles for YMC-Triart Prep*

- Constant low back pressures with repeated repacking
- Lower back pressures at initial conditions
- Increased flow rates and longer lifetimes

## How to understand these findings?

The best insights are gained by SEM-scanning of resins. Firstly the traditional silica packing has been analysed. In Figure 3a and Figure 3b the conventional silica is shown after the first packing process and after the 11th packing process.



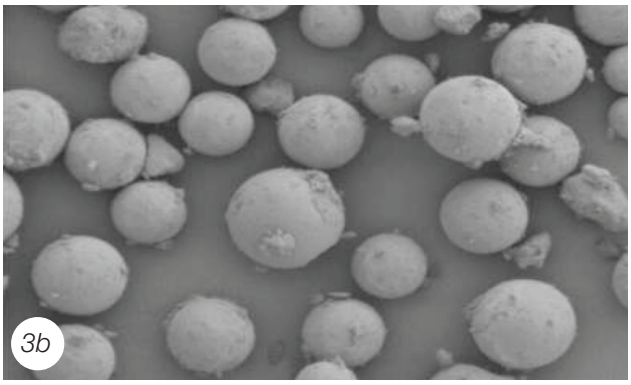
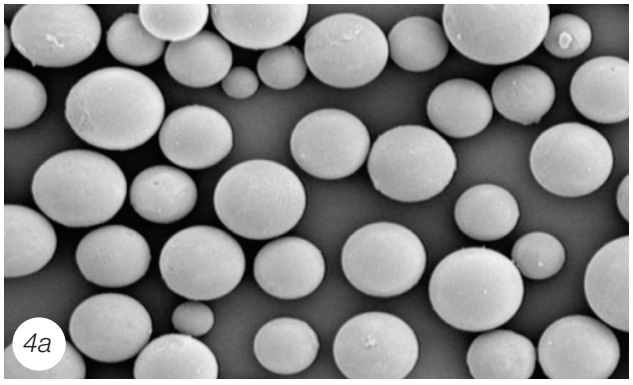




*Figure 3a and 3b: Conventional silica during repacking: 3a after packing process No. 1 and 3b after packing process No. 11.*

With Figure 3a it becomes obvious that the particles are irregularly shaped. Figure 3b showing the same resin after the 11th packing proves that more fines haven generated. Over the course of time such fines will accumulate within the flow channels. They increase the operating backpressure. But even more profound, the irregular shaped particles are stressed by shear-forces, which cause an increase of fines.

## When the modern stationary phase is examined it clearly shows the differences.



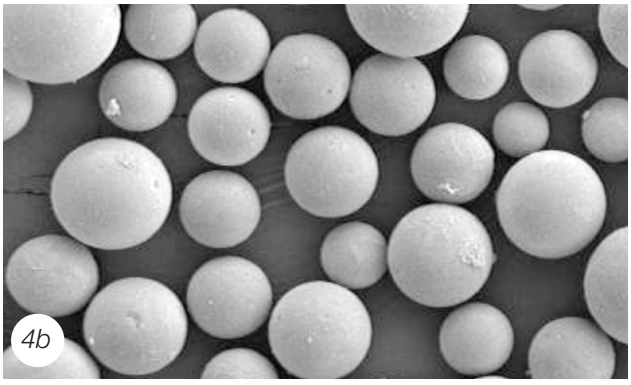




*Figure 4a and 4b: Modern YMC-Triart Prep during repacking: 4a after packing process No. 1 and 4b after packing process No. 11.*

First of all, the modern YMC-Triart Prep consists of regular shaped particles. Fines are absent. The optimal particle shape of YMC-Triart Prep enables a uniform packed bed. Consequently, evenly distributed flow channels are created.

This has a direct influence on the system backpressure, which is lower compared to other silicas. In addition, the repacking process is less harmful to the particles. The particles are exposed to lower shear forces and can be ultimately used longer.