Agilent Premium Septa for Contaminant-Free Inlet and Reduced Bleed

Technical Overview

Introduction

Choosing the right injection port septum for your GC is not as simple as picking up any supplier's catalog, looking at the temperature range stated for the septum, and assuming that it is made to the same specifications as any other septum. While it is true that there are a limited number of manufacturers of GC injection port septa, the specifications that are applied to one retail supplier are more likely not going to meet the same specifications of another. It would be true to say that only the design engineers of the specific GC's injection port will know what specifications are needed for the best operation of the inlet as its intended design.

Among other criteria, the septum must be of the correct dimensions and elastic density to cause sealing of the injection port in order to allow high-pressure carrier gas to be channeled to the GC column without allowing leaks. It must also do this in such a way to allow a relatively fragile syringe needle to pierce the disk in order to inject a sample into the inlet liner. While the disk is pierced with the needle, it must maintain a seal around the needle until it is eventually removed from the septum, and then the septum must be pliable enough to seal itself off to prevent the vaporous sample from escaping out through the needle's hole. This self-occluding characteristic is absolutely vital in order to prevent the diffusion of air (containing oxygen) into the inlet. Allowing air into the carrier gas through insidious leaks is a primary cause of premature column failure.

Agilent Premium Septa

Agilent's premium septa are injection molded using the highest quality silicone polymers. Injection molding is not just a fancy term. It is what gives Agilent's premium septa two very important mechanical properties. First, it means that every septum will be of uniform dimensions. The most important dimension is the cross-sectional profile. Septa that are cut or punched out from large sheets of rubber can often give a septum an "hourglass" configuration. Injection molding ensures a true disk shape (Figure 1). This means that when compressed under the septum nut, the septum will seal the inlet without the need to over-tighten the septum nut. Over-tightening is the primary cause of premature septum failure. An associated cause is due to the excessive force applied with the septum nut that compresses the silicone disk to an abnormally high density. As the syringe needle forces its way through the disk, a sliver of the polymer is shaved off. On each injection, the needle continues to shave off slivers of the septum. These slivers are typically deposited inside the injection port liner, leading to an increased background signal. Because a portion of the bulk septum is shaved off by the syringe needle, the septum will quickly lose its ability to keep a leak-free seal, which means that more frequent septum replacement will be needed. The likelihood that the excess septum shavings will be deposited into the liner also means that more frequent liner changes may be necessary as well.

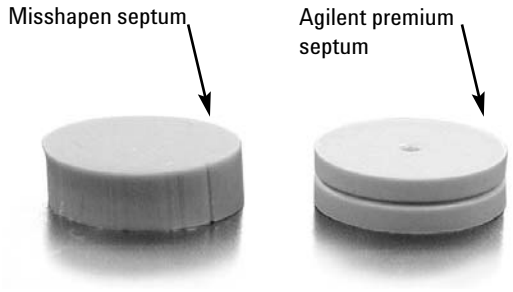

Figure 1. Misshapen septum and Agilent premium septum.

The second mechanical feature that injection molding gives to Agilent's premium septa is a conical dimple in the top of the disk. This important enhancement over standard solid septa is that, in conjunction with the septum nut, the dimple acts as a centering guide so that the syringe needle enters the same puncture hole on repeated injections. Unlike a solid disk septum or one with a predrilled hole, the injection-molded Agilent CenterGuide septum is an unadulterated solid disk. Because of this, the syringe needle creates a unique injection portal that will be more precisely entered, injection after injection. As illustrated in Figure 2, this septum is more easily resealed even after hundreds of injections. There will be less maintenance because there will be less septum material finding its way into the injection port liner, which will also reduce background noise.

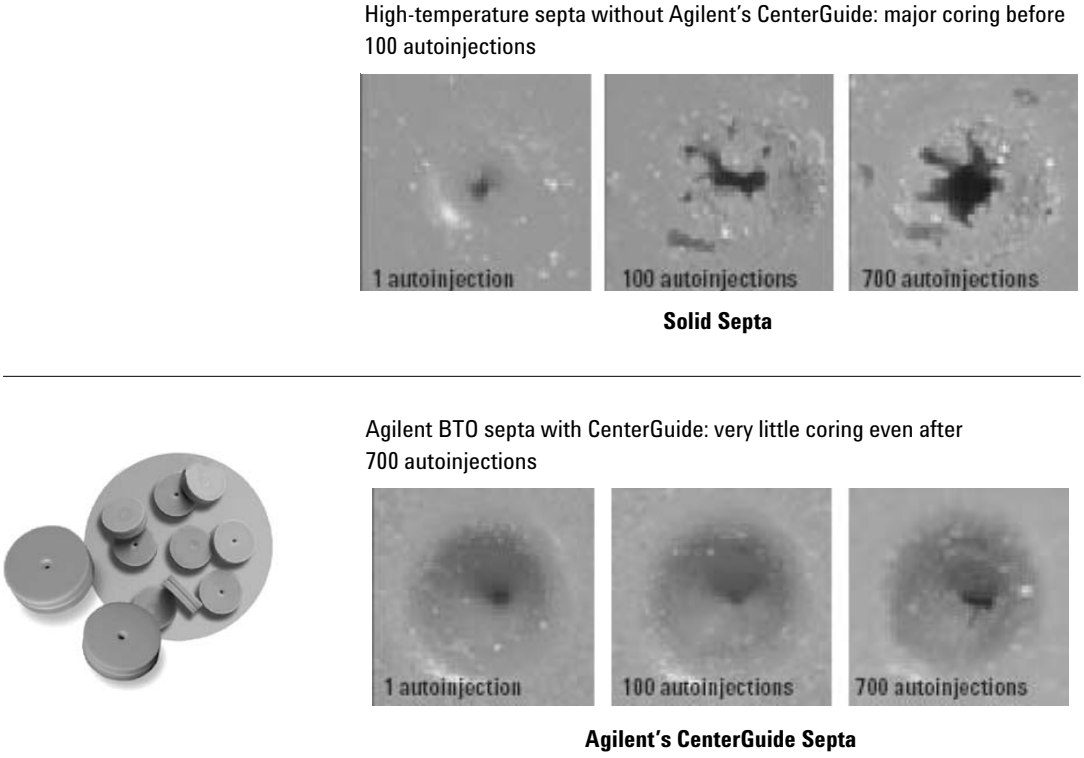

Figure 2. Standard and CenterGuide septa compared.

Agilent Technologies septa are the only GC injection port septa that are plasma treated prior to being packaged in an individually sealed blister pack in a clean room environment. The blister pack, while certainly being a convenient size for easy storage, most importantly ensures that the septa stay clean until they are ready to be installed (Figure 3).

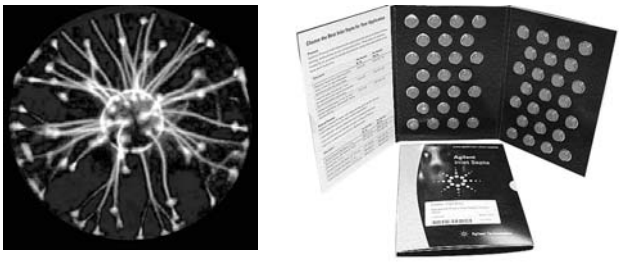

Figure 3. Plasma treatment and blister pack.

Plasma conditioning creates a septum that is not going to stick to the injection port sealing area. This proprietary nonstick treatment lowers background signal because over time, the residual septum material from standard septa will ultimately bleed into the injection port, creating ghost peaks and a surface that is even more prone to septa sticking (Figure 4).

The nonstick plasma treatment also effectively eliminates surface contaminants that can cause ghost peaks when a new septum is installed and helps to minimize the conditioning time for the new septum. This is a more effective means of septa conditioning than prebaking the septa in an oven. Oven baking can cause the polymeric material in the bulk of these septa to become less pliable and thus lose some resealing characteristics. In turn, this creates the need to replace the septum after fewer injections. Since the plasma only affects the surface of the premium septum, the disk retains its bulk resealing characteristics.

Figure 4. Residues from standard septa inside injection port.

Figure 5 illustrates the impact of the combination of blister pack packaging and the nonstick treatment on our premium Long Life septa.

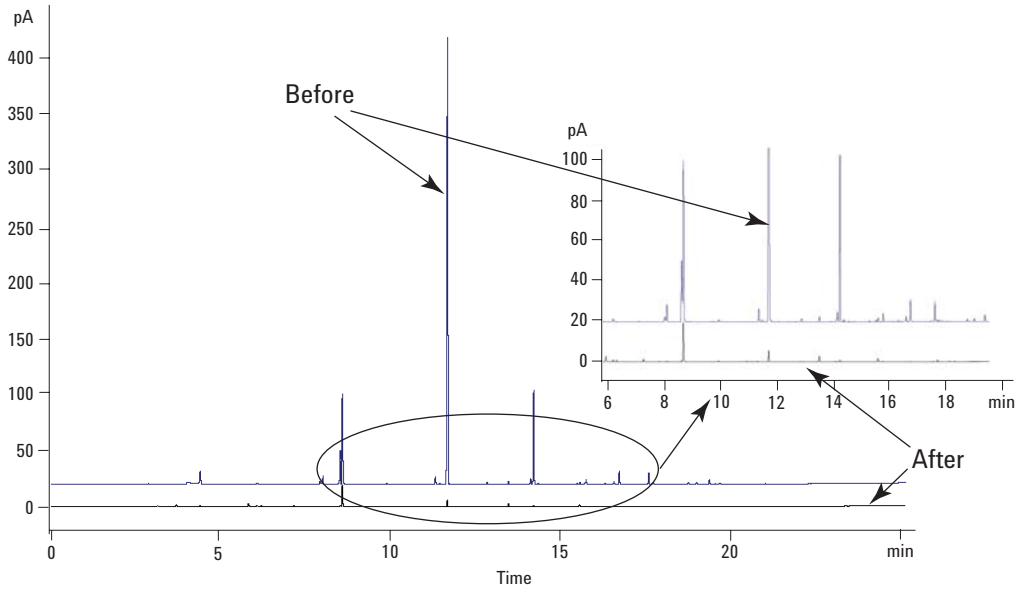

Figure 5. Chromatographic comparison of Agilent Long Life septa before and after plasma treatment.

Figure 6 compares the background between the Agilent Bleed and Temperature Optimized (BTO) septa and a competitor's "replacement" septa, which are packaged in a plastic bag. In each of these analyses, a single septum was sealed in a 10-mL static headspace vial. The sample was then analyzed in an Agilent G1888 Headspace Sampler. After heating the septa to 150 °C and equilibrating for 1 hour, a 1-mL sample was analyzed by GC-FID. In comparisons with our previous septa products and other competitive products, the results were all similar to these. The Agilent premium septa demonstrated a significant improvement, as seen by the reduction of outgassed contaminates that are traceable to residual manufacturing materials on the competitor's septa or to semivolatile contaminants picked up on the surface of the disks while in the plastic bags the competitors typically use to store their septa.

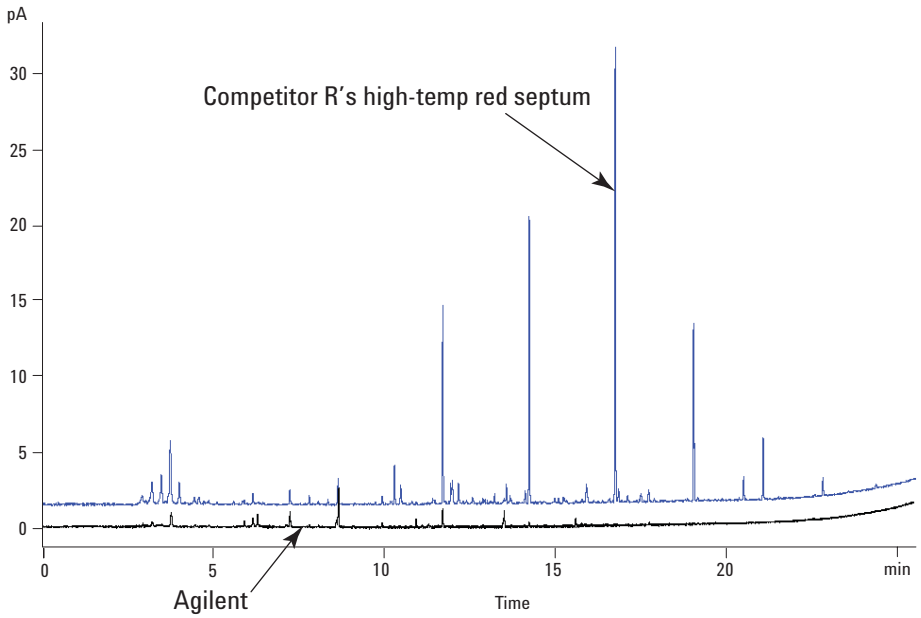

Figure 6. Chromatographic septa bleed comparison; Agilent BTO versus competitor's "Infrared" septum.

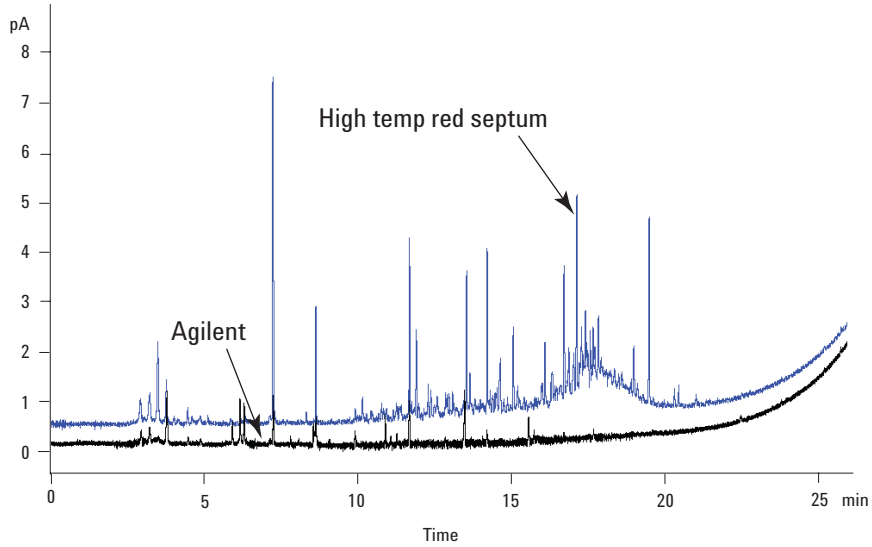

Figure 7. Chromatographic septa bleed comparison; Agilent BTO versus competitor's "HT" septum.

There are three types of Agilent premium septa from which to choose to suit all GC application types: the Bleed and Temperature Optimized (BTO), the Advanced Green, and the Long Life septa. Table 1 gives part numbers and recommended uses for each type.

Table 1. Agilent Septa Properties and Ordering Information

Septa	Properties	Ordering information
Bleed and Temperature Optimized (BTO)	Suitable for injection temperatures up to 400 °C. Strongly recommended in GC trace analysis.	p/n 5183-4757 (50 each, 11 mm) p/n 5183-4757-100 (100 each, 11 mm) p/n 5183-4758 (50 each, 5 mm)
Advanced Green	Recommended for injection port temperatures up to 350 °C. A good general-purpose septum.	p/n 5183-4759 (50 each, 11 mm) p/n 5183-4759-100 (100 each, 11 mm) p/n 5183-4760 (50 each, 5 mm)
Long Life	Recommended for auto-injector applications and where the injection port temperature is less than 350 °C. More injections before failure.	p/n 5183-4761 (50 each, 11 mm) p/n 5183-4757-100 (100 each, 11 mm) p/n 5183-4758 (50 each, 5 mm)

For More Information

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