Activated carbon filters

WITH SEITZ AKS FILTERS

Powdered activated carbon (PAC) is widely used in the pharmaceutical industry for decolorization and removal of other trace impurities. However, its use has significant drawbacks relating to the handling of bulk carbon powder, cleaning of process equipment and time (costs) associated with carbon removal from the process. To alleviate these concerns, Seitz AKS immobilized carbon filters couples activated carbon within a matrix of cellulosic fibers with a downstream filter paper that eliminates carbon particle shedding downstream of the filter. The absorption efficiency of Seitz AKS filters is also greater than an equivalent amount of bulk PAC, further reducing overall process time and increasing product yield.

Streamlined Processing

Seitz AKS immobilized activated carbon filters provide a streamlined process only requiring a single step. The feed stream is simply passed once through the module at an appropriate flow rate to achieve the desired adsorption. This saves time, resources, and expense compared to using bulk activated carbon powder. It is nearly 100% free of carbon dust so operators and the workspace are much better protected. No additional mixing, filtration, or cleaning steps are needed.

Fig 1. Supracap™ 200 capsule cut away showing SUPRAdisc™ I module incorporating Seitz AKS immobilized carbon filters.

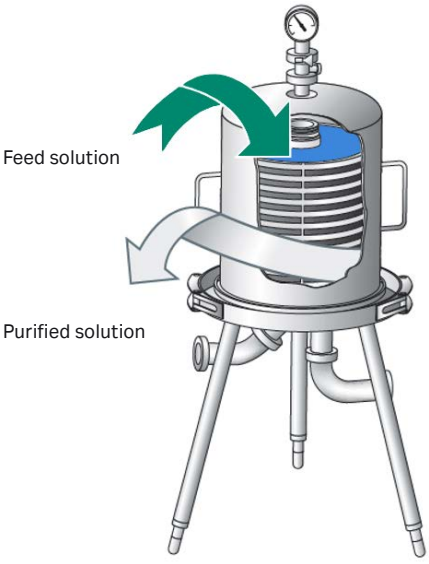
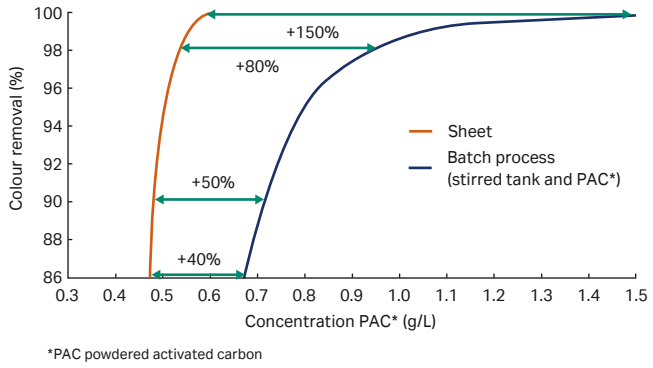


Fig 2. A typical decolorization process using a Seitz AKS immobilized activated carbon filter assembly.

Improved absorption

In addition to streamlining the process, Seitz AKS immobilized carbon filters are more efficient at removing colors and other impurities from a solution compared to a batch process with the equivalent PAC grade (Fig 3).



*PAC powdered activated carbon

Fig 3. Comparison of decolorization between bulk carbon and carbon-impregnated sheets with the same carbon grade using a customer active pharmaceutical ingredient (API).

Application guidelines

Since colors, impurities and processes can vary, we offer five optimized PAC grades incorporated into Seitz AKS filters. These grades are based upon different raw materials and different activation methods resulting in pore structures and adsorption characteristics appropriate for adsorbing different molecular impurities.

According to International Union of Pure and Applied Chemistry (IUPAC) definitions, three groups of pores are distinguished: macropores (above 50 nm diameter), mesopores (2 to 50 nm diameter) and micropores (< 2 nm diameter).

Macro- and mesopores can generally be regarded as the highways into the carbon particle and are crucial for adsorption kinetics. Macropores are used for the transport, and absorption occurs in the meso- and micropores.

Small molecules, such as methylene blue (0.32 kDa), are mainly captured in micropores.

For larger impurity molecules, other pore structures in the carbon must be available to ensure optimal adsorption. Carbon that can capture larger molecules, tends to adsorb smaller impurities as well, whereas dedicated carbons for small molecules do not remove larger contaminants.

Table 1 provides an overview of how different AKS grades may suit an application based on their general characteristics. However, due to the various factors that may affect the adsorption process, we recommend scaled-down testing of several Seitz AKS filter grades as the most reliable way of selecting a suitable grade.

Table 1. Typical applications and efficiency characteristics of AKS module grades

Filter grade	Typical application	Efficiency characteristic	Typical molecular weight of target contaminants
AKS1	API decolorization	Ultra-high efficiency	0.4 to 1.5 kDa
AKS2	API decolorization	Ultra-high efficiency	0.4 to 1.5 kDa
AKS5	Plasma fractionation	High efficiency	0.2 to 0.4 kDa
AKS6	Plasma fractionation	High efficiency	0.4 to 1.5 kDa
AKS7	API decolorization	Ultra-high efficiency	0.4 to 1.5 kDa

Ensuring highly efficient contaminant removal

We offer a complete range of filter capsules and cartridges for all AKS filter grades suitable for the development laboratory, through the pilot plant, to full production. Test discs are available as 47 mm, 60 mm and 90 mm diameter discs (other sizes upon request). Also available are fully disposable Supracap 50 capsules (22 cm^2) for grade selection and process development.

For pilot scale or small production, Supra AKS depth filter cartridges are available in 254 mm (10 in.), 508 mm (20 in.), and 762 mm (30 in.) sizes with all AKS grades. The internal elements of the Supra AKS cartridges follow the same design principle as the Supracap 100 capsules, consisting of activated carbon depth filter sheets supported by inside and outside separators. The entire element is held together by four support jackets, as well as an inner support anchor. Supra AKS cartridges feature a code 7 adapter for ease of use in standard stainless steel cartridge housings.

For full-scale production, SUPRAdisc AKS modules and Supracap 200 depth filter capsules are available. Supracap 200 capsules are fully encapsulated SUPRAadisc modules, designed for ease of use and applications with hazardous materials.
The encapsulation of the module significantly reduces operator exposure and simplifies handling during change-out.
The encapsulated modules provide a dramatically reduced proportion of normally wetted surfaces in the housing, resulting in faster hardware clean-up and easier cleaning validation compared to standard lenticular formats.

For selection and optimization studies, we recommend performing adsorption evaluation studies at a recommended range of flow rates either at your facility or in our Scientific and Laboratory Services (SLS) laboratories. Our specialists can provide valuable expertise and hands-on assistance if required, and will place our extensive technical resources at your disposal.

Product specifications

Supracap 50 capsules with AKS filters

Operating parameters	
Maximum operating pressure	3 barg (44 psig)
Maximum operating temperature	40°C
Maximum differential pressure	1.5 bar (22 psi)
Materials of construction	
Filter sheet	Cellulose base and PAC
Capsule	Polypropylene (PP)
Vent	PP
Sealing technology	Thermal bonding
Sterilization	
Autoclaving at 125°C 1 cycle × 30 minutes	
Typical filtration area	
22 cm^2 (0.024 ft^2)	

Supra AKS cartridges

Operating parameters	
Maximum operating temperature	80°C
Maximum differential pressure	2.4 bar (35 psi)
Materials of construction	
Filter sheet	Cellulose base and PAC
Plastic components	PP
O-rings	Platinum-cured silicone elastomer or fluorocarbon elastomer
Typical operating flux	
150 to 250 L/m^2/h	
Sterilization	
Not sterilizable by autoclaving or steaming *in-situ*	

Nominal dimensions

Element	Total length	Total diameter
254 mm (10 in.)	322 mm	70 mm
508 mm (20 in.)	572 mm	70 mm
762 mm (30 in.)	822 mm	70 mm

SUPRAdisc I modules with AKS filters

Operating parameters	
Maximum operating temperature	80°C in PP design 160°C in polyamide design
Maximum differential pressure	2.4 bar at 80°C
Typical operating flux	150 to 250 L/m^2/h
Materials of construction	
Filter sheet	Cellulose base and PAC
Plastic components	PP (standard version) Polyamide (high temperature version)
O-rings	Platinum-cured silicone elastomer, FEP-encapsulated silicone or EPDM elastomer
End cap gaskets	Platinum-cured silicone elastomer or fluorocarbon elastomer
Sterilization	
Maximum operating temperature	80°C in PP design 160°C in polyamide design
Maximum differential pressure	2.4 bar at 80°C
Typical operating flux	150 to 250 L/m^2/h

Nominal dimensions

Capsule style	Total length	Total diameter
Double O-ring end cap	332 mm	284 mm 410 mm
Flat gasket end cap	272 mm	284 mm 410 mm

Supracap 200 capsules with AKS filters

Operating parameters	
Maximum operating temperature	90°C
Maximum operating pressure	6 barg (87 psig) at 60°C 3 barg (44 psig) at 90°C
Maximum differential pressure	2.4 bar (35 psi) at 80°C
Materials of construction	
Filter sheet	Cellulose base and PAC
Plastic components	PP
O-rings	Platinum-cured silicone elastomer, FEP-encapsulated silicone or EPDM elastomer
Typical operating flux	
150 to 250 L/m^2/h	
Sterilization	
Steam in place	125°C for 30 minutes at 0.3 bar (4.3 psi) differential pressure maximum
Nominal module dimensions	
Total length	326 mm
Total diameter	298 mm

Technical information

Table 2. Supracap 200 capsule and SUPRAdisc I module configuration codes for different AKS filter grades and module diameters

Filter grade	Filter grade code	Configuration codes	SUPRAdisc I module diameter (mm)	Supracap 200 capsule diameter (mm)	Amount of PAC present per module (kg)	Filter area per module
AKS1	XAK1	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2
AKS2	XAK2	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2
AKS5	XAK5	214 416	284 410	298 -	1.05 2.40	1.60 m^2 3.70 m^2
AKS6	XAK6	214 416	284 410	298 -	1.35 3.00	1.60 m^2 3.70 m^2
AKS7	XAK7	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2

Technical information

Table 3. Supracap 200 capsule and SUPRAdisc I module configuration codes for different AKS filter grades and module diameters

Filter grade	Filter grade code	Config codes	SUPRAdisc I module diameter (mm)	Supracap 200 capsule diameter (mm)	Amount of PAC present per module (kg)	Filter area per module
AKS1	XAK1	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2
AKS2	XAK2	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2
AKS5	XAK5	214 416	284 410	298 -	1.05 2.40	1.60 m^2 3.70 m^2
AKS6	XAK6	214 416	284 410	298 -	1.35 3.00	1.60 m^2 3.70 m^2
AKS7	XAK7	212 415	284 410	298 -	1.40 3.65	1.35 m^2 3.50 m^2

Table 4. Supra AKS cartridge filter information for different AKS filter grades

Filter grade	Filter grade code	Amount of PAC present per 254 mm (10 in.) cartridge (g)	Filter area per 254 mm (10 in.) cartridge
AKS1	XAK1	72.5	700 cm^2
AKS2	XAK2	72.5	700 cm^2
AKS5	XAK5	52.5	800 cm^2
AKS6	XAK6	60.0	750 cm^2
AKS7	XAK7	72.5	700 cm^2

Table 5. Typical ash and endotoxin levels for different AKS grades

Filter grade	Typical ash content (%)	Typical endotoxin level (EU/mL)
AKS1	< 3	< 0.12
AKS2	< 4	< 0.12
AKS5	< 1	< 0.06
AKS6	< 3	< 0.06
AKS7	< 3	< 0.12

Ordering information

Supracap 50 capsules with AKS filters

Filter grade	Product code
AKS1	SC050XAK1
AKS2	SC050XAK2
AKS5	SC050XAK5
AKS6	SC050XAK6
AKS7	SC050XAK7

Supra AKS cartridges with Seitz AKS filters

Cartridge style	Nominal length	Filter grade	O-ring material	Product code
Code 7 double O-ring with bayonet lock and finned end	254 mm (10 in.)	AKS1	Platinum-cured silicone elastomer	AB1XAK17PH31
			Fluorocarbon elastomer	AB1XAK17PH
		AKS2	Platinum-cured silicone elastomer	AB1XAK27PH31
			Fluorocarbon elastomer	AB1XAK27PH
		AKS5	Platinum-cured silicone elastomer	AB1XAK57PH31
			Fluorocarbon elastomer	AB1XAK57PH
		AKS6	Platinum-cured silicone elastomer	AB1XAK67PH31
			Fluorocarbon elastomer	AB1XAK67PH
		AKS7	Platinum-cured silicone elastomer	AB1XAK77PH31
			Fluorocarbon elastomer	AB1XAK77PH
	508 mm (20 in.)	AKS1	Platinum-cured silicone elastomer	AB2XAK17PH31
			Fluorocarbon elastomer	AB2XAK17PH
		AKS2	Platinum-cured silicone elastomer	AB2XAK27PH31
			Fluorocarbon elastomer	AB2XAK27PH
		AKS5	Platinum-cured silicone elastomer	AB2XAK57PH31
			Fluorocarbon elastomer	AB2XAK57PH
		AKS6	Platinum-cured silicone elastomer	AB2XAK67PH31
			Fluorocarbon elastomer	AB2XAK67PH
		AKS7	Platinum-cured silicone elastomer	AB2XAK77PH31
			Fluorocarbon elastomer	AB2XAK77PH
	762 mm (30 in.)	AKS1	Platinum-cured silicone elastomer	AB3XAK17PH31
			Fluorocarbon elastomer	AB3XAK17PH
		AKS2	Platinum-cured silicone elastomer	AB3XAK27PH31
			Fluorocarbon elastomer	AB3XAK27PH
		AKS5	Platinum-cured silicone elastomer	AB3XAK57PH31
			Fluorocarbon elastomer	AB3XAK57PH
		AKS6	Platinum-cured silicone elastomer	AB3XAK67PH31
			Fluorocarbon elastomer	AB3XAK67PH
		AKS7	Platinum-cured silicone elastomer	AB3XAK77PH31
			Fluorocarbon elastomer	AB3XAK77PH

SUPRAdisc filter modules with Seitz AKS filters

Filter grade	End cap	Seal material	Product code: 284 mm module diameter	Product code: 410 mm module diameter
AKS1	Double O-ring	Silicone elastomer	300XAK1S212SP	300XAK1S415SP
		EDPM elastomer	300XAK1S212EP	300XAK1S415EP
	Flat gasket	Silicone elastomer	300XAK1C212SP	300XAK1C415SP
		EDPM elastomer	300XAK1C212EP	300XAK1C415EP
AKS2	Double O-ring	Silicone elastomer	300XAK2S212SP	300XAK2S415SP
		EDPM elastomer	300XAK2S212EP	300XAK2S415EP
	Flat gasket	Silicone elastomer	300XAK2C212SP	300XAK2C415SP
		EDPM elastomer	300XAK2C212EP	300XAK2C415EP
AKS5	Double O-ring	Silicone elastomer	300XAK3S214SP	300XAK3S416SP
		EDPM elastomer	300XAK3S214EP	300XAK3S416EP
	Flat gasket	Silicone elastomer	300XAK3C214SP	300XAK3C416SP
		EDPM elastomer	300XAK3C214EP	300XAK3C416EP
AKS6	Double O-ring	Silicone elastomer	300XAK6S214SP	300XAK6S416SP
		EDPM elastomer	300XAK6S214EP	300XAK6S416EP
	Flat gasket	Silicone elastomer	300XAK6C214SP	300XAK6C416SP
		EDPM elastomer	300XAK6C214EP	300XAK6C416EP
AKS7	Double O-ring	Silicone elastomer	300XAK7S212SP	300XAK7S415SP
		EDPM elastomer	300XAK7S212EP	300XAK7S415EP
	Flat gasket	Silicone elastomer	300XAK7C212SP	300XAK7C415SP
		EDPM elastomer	300XAK7C212EP	300XAK7C415EP

Supracap 200 capsules with Seitz AKS filters

Filter grade	Module type	Seal material	Seal material
AKS 1	Standard with double O-ring	EDPM elastomer	C300XAK1S212EP
		Silicone elastomer	C300XAK1S212SP
		FEP-encapsulated silicone elastomer	C300XAK1S212FP
	Without stainless steel ring in endcap adapter, double O-ring	EDPM elastomer	C306XAK1S212EP
		Silicone elastomer	C306XAK1S212SP
		FEP-encapsulated silicone elastomer	C306XAK1S212FP
AKS 2	Standard with double O-ring	EDPM elastomer	C300XAK2S212EP
		Silicone elastomer	C300XAK2S212SP
		FEP-encapsulated silicone elastomer	C300XAK2S212FP
	Without stainless steel ring in endcap adapter, double O-ring	EDPM elastomer	C306XAK2S212EP
		Silicone elastomer	C306XAK2S212SP
		FEP-encapsulated silicone elastomer	C306XAK2S212FP
AKS 3	Standard with double O-ring	EDPM elastomer	C300XAK3S214EP
		Silicone elastomer	C300XAK3S214SP
		FEP-encapsulated silicone elastomer	C300XAK3S214FP
	Without stainless steel ring in endcap adapter, double O-ring	EDPM elastomer	C306XAK3S214EP
		Silicone elastomer	C306XAK3S214SP
		FEP-encapsulated silicone elastomer	C306XAK3S214FP
AKS 6	Standard with double O-ring	EDPM elastomer	C300XAK6S214EP
		Silicone elastomer	C300XAK6S214SP
		FEP-encapsulated silicone elastomer	C300XAK6S214FP
	Without stainless steel ring in endcap adapter, double O-ring	EDPM elastomer	C306XAK6S214EP
		Silicone elastomer	C306XAK6S214SP
		FEP-encapsulated silicone elastomer	C306XAK6S214FP
AKS 7	Standard with double O-ring	EDPM elastomer	C300XAK7S212EP
		Silicone elastomer	C300XAK7S212SP
		FEP-encapsulated silicone elastomer	C300XAK7S212FP
	Without stainless steel ring in endcap adapter, double O-ring	EDPM elastomer	C306XAK7S212EP
		Silicone elastomer	C306XAK7S212SP
		FEP-encapsulated silicone elastomer	C306XAK7S212FP

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