Data Sheet

Millistak+® Pod
carbon depth filter media system

High adsorption capacity in the innovative Pod format

Millistak+® carbon (CR) depth filter media incorporates activated carbon for the removal of color and trace contaminants. Activated carbon is a complex adsorber with distinct adsorption characteristics. The adsorptive affinity for a particular impurity can vary depending on the nature of the impurity and the solution conditions (pH, ionic strength) of the process fluid.

Millistak+® CR depth filter media is formulated with carbon retained in a rigid structure by a cellulose matrix. These materials, combined with a state-of-the-art manufacturing process, create a tortuous flow path that ensures increased contact with the surface and pores of the activated carbon, for optimum impurity adsorption.

The superior performance of Millistak+® CR depth filter media is offered in the scalable and disposable Pod format. Accommodating applications from lab to pilot to process scale, the Pod format offers greater flexibility with its unique modular design.

Benefits

- Encapsulated format, eliminating dust and preventing inhalation for maximum operator safety
- No secondary filtration for removal of bulk carbon required
- Shorter process time
- Minimum disposal cost

Millistak+® CR depth filter media provides advantages over powdered activated carbon

Millistak+® CR depth filter media, comprising activated carbon, cellulose fibers and a charged resin binder, forms a rigid matrix, which quantitatively retains more contaminants than the equivalent weight of bulk powdered carbon. The rigid matrix of the Millistak+® media encourages an intimate contact between the liquid stream and the surface and within the pores of the activated carbon particles.

Activated carbon removes contaminants from a liquid by adsorption onto the surface of the activated carbon. The impurities are held by a weak electrostatic force known as the "Van der Waals Force." Filtering can remove the powdered carbon, but channeling often occurs where the liquid passes through openings in the bed of bulk carbon.

Millistak+® CR depth filter media offers single-pass operation and high flow rates for increased speed and convenience. Bulk powdered carbon requires a long contact time between the carbon and the liquid to reach adsorption equilibrium prior to filtration. Millistak+® CR depth filter media provides speed, convenience, and optimal performance, particularly when compared to the adsorptive capacity of competitive carbons.

Comparison of Bulk Powdered Carbon and Millistak+® CR Pod Filter

	Bulk Powdered Carbon	Millistak+® CR Pod Filter
Cleanliness	Very fine powder that is readily dispersed into air when unpacked and handled.	Compressed sheet form eliminates dust.
Health Hazards	Prolonged inhalation of loose carbon can result in lung disease.	Encapsulated to prevent inhalation.
Safety	In certain production environments, PAC dust can be a fire hazard.	No carbon in atmosphere for maximum safety.
Secondary Filtration	After bulk carbon treatment, slurry must be filtered for removal of the spent carbon.	No secondary filtration required.
Labor Intensity	Requires cleaning dosage tanks and piping for the removal of carbon fines before sterile filtration. Residual bulk carbon is difficult to remove and can result in batch-to-batch contamination.	Instant filter disposal after use. No cleaning required.
Process Time	Use of bulk carbon requires mixing slurry for 1 hour or more to reach adsorption equilibrium prior to processing the batch.	Quicker achievement of equilibrium for shorter process time.
Disposal Costs	After filtration of slurry, customer must deal with difficult disposal of the loose carbon retained on the filter septum.	Minimal disposal cost.

Pyrogenicity

Millistak+® CR depth filter media is tested for pyrogens prior to release. The filter extracts must contain less than 0.25 EU/mL via LAL clot test techniques. Additionally, the Millistak+® CR depth filter media meets the following criteria:

- USP Class VI compliance
- 21CFR compliance
- 100% free of animal derived components

Applications

Activated carbon is a versatile process aid and has a high adsorption capacity for odorous compounds and color bodies over a wide range of molecular weights.

Millistak+® CR depth filter media can also be used directly on Protein A elution pools as the first step in downstream purification. Activated carbon's (AC) size selective properties allow it to remove impurities smaller than monoclonal antibodies – even antibody fragments – effectively without suffering significant product losses.

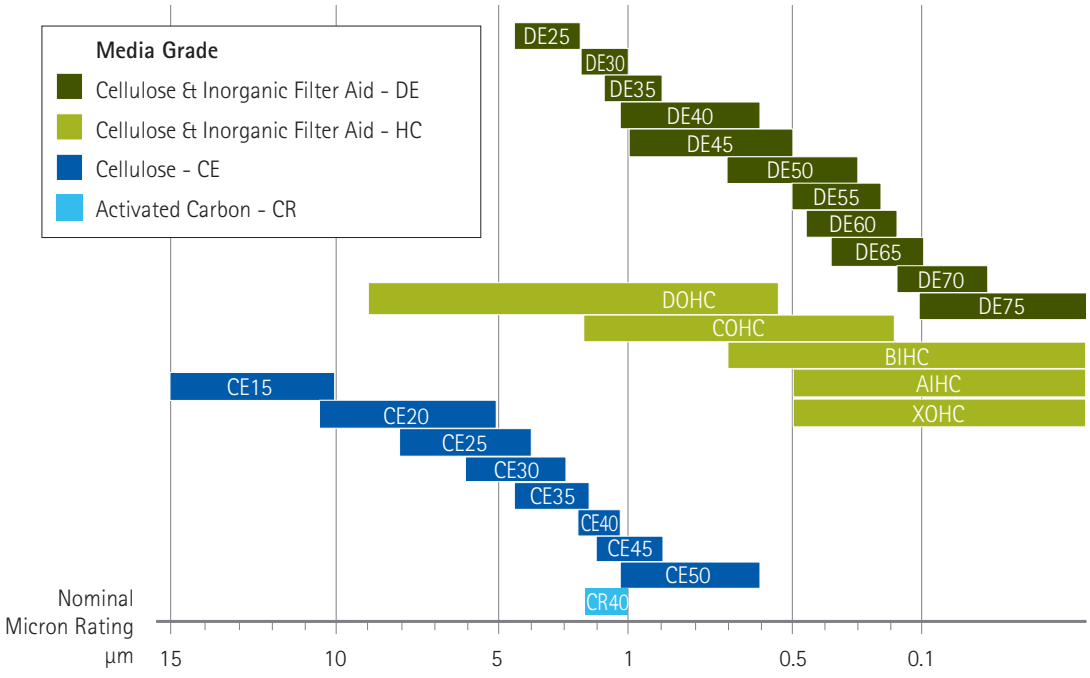
Application of Millistak+® Activated Carbon Depth Filters

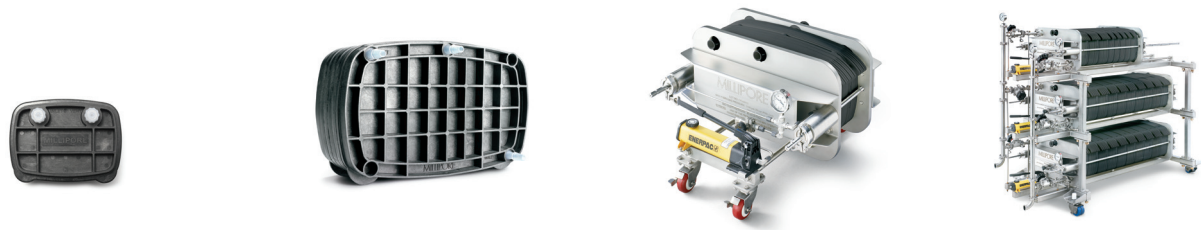
Application	Color Removal	Odor Removal	Haze Removal	Organic Impurities
SVP	X			
LVP	X			
Antibiotic	X			
Vitamin	X	X		
Enzymes	X	X		
Vaccine			X	
Plasma				X
Process Water		X		

Wide range of sizes

Whether you need to do process development, laboratory scale work, pilot studies for scaling, or full-scale manufacturing, Merck Millipore has a device size to suit your needs and process volumes.

The µPod® format offers 23 cm^2 of surface area for screening trials. The lab scale Pod (0.027 and 0.054 m^2) is available when the process volumes dictate a move to preliminary scaling studies. Finally, pilot and process scale devices (0.11, 0.55, and 1.1 m^2) are available for pilot and full scale manufacturing.

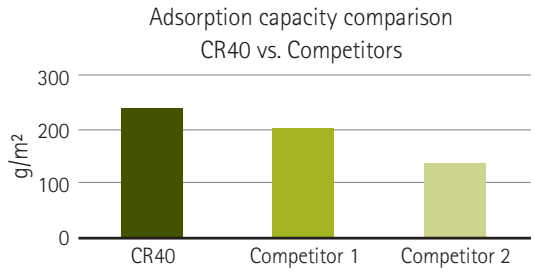




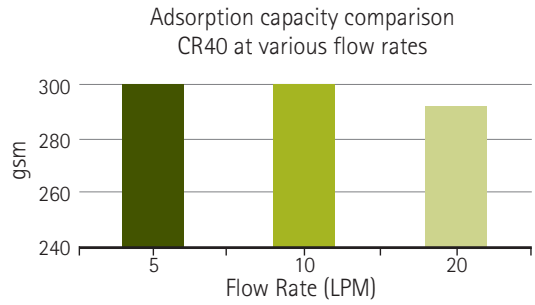
Small Scale: CR: 23 cm^2 → Lab Scale: CR: 0.027–0.054 m^2 → Pilot Scale: CR: 0.11–5.5 m^2 → Process Scale: CR: 5.5–33 m^2

Typical extractable metals

Element	mg/ft² media
Arsenic (As)	< 0.001
Aluminum (Al)	≤ 0.033
Calcium (Ca)	≤ 1.505
Chromium (Cr)	< 0.032
Cobalt (Co)	< 0.001
Copper (Cu)	≤ 0.035
Iron (Fe)	< 0.041
Lead (Pb)	< 0.001
Magnesium (Mg)	≤ 1.129
Manganese (Mn)	≤ 0.624
Mercury (Hg)	< 0.001
Nickel (Ni)	≤ 0.005
Potassium (K)	≤ 0.380
Sodium (Na)	≤ 17.513
Titanium (Ti)	≤ 0.012
Zinc (Zn)	≤ 0.046



Challenged with 50 ppm methylene blue solution
@46 liters per minute per sq. m of media



Millistak+® CR Depth Filter Specifications

Surface Area	1.2 ft² (0.11 m²)	5.9 ft² (0.55 m²)	11.8 ft² (1.1 m²)
Materials of Construction			
Filter Media:	Cellulose Fibers with activated carbon		
Pod Housings:	Glass Filled Polypropylene		
Adapters:	Glass Filled Polypropylene*		
Gaskets and Plugs:	Thermo Plastic Elastomer (TPE)*		
Pod Dimensions			
Length:	24.2 in. (62 cm)	24.2 in. (62 cm)	24.2 in. (62 cm)
Height:	12.5 in. (32 cm)	12.5 in. (32 cm)	12.5 in. (32 cm)
Thickness:	1.2 in. (3 cm)	2.8 in. (7.1 cm)	4.8 in. (12.2 cm)
Maximum Operating Pressure	50 psig (3.5 bar) at 25 °C; 15 psig (1.0 bar) at 80 °C		
Maximum Differential Pressure			
Forward:	30 psid (2.1 bar) at 25 °C; 15 psid (1.0 bar) at 80 °C		
Reverse:	30 psid (2.1 bar) at 25 °C		
Sterilization	May be autoclaved for 1 cycle of 60 minutes at 123 °C		
Indirect Food Additive	All components meet the FDA indirect food requirements cited in 21 CFR 177-182.		
Toxicity	All component materials meet the requirements of the current USP <88> biological reactivity test for class VI plastics.		
Bacterial Endotoxin	< 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test.		
CE Pressure Equipment Directive	This filter has been designed and manufactured according to the essential requirements of the Pressure Equipment Directive 97/23/EC. Only 1.1 m² filters carry the CE mark.		

* Pilot and process scale only.

Millistak+® CR Depth Filter Specifications (continued)

Surface Area	0.29 ft² (0.027 m²)	0.58 ft² (0.054 m²)	0.025 ft² (23 cm²)
Materials of Construction			
Filter Media:	Cellulose Fibers with activated carbon		
Pod Housings:	Glass Filled Polypropylene		
Pod Dimensions			
Length:	8.5 in. (22 cm)	8.5 in. (22 cm)	3.5 in. (8.9 cm)
Height:	5.3 in. (14 cm)	5.3 in. (14 cm)	2.6 in. (6.6 cm)
Thickness:	2.9 in. (7.4 cm)	3.7 in. (9.4 cm)	1.6 in (4.1 cm)
Maximum Operating Pressure	30 psig (2.1 bar) at 25 °C		50 psid (3.5 bar) at ≤ 40 °C
Maximum Differential Pressure			
Forward:	30 psid (2.1 bar) at 37 °C; 30 psid (2.1 bar) at 4 °C		30 psid (2.1 bar) at 40 °C
Reverse:	30 psid (2.1 bar) at 37 °C		15 psid (1.0 bar) at 40 °C
Sterilization	May be autoclaved for 2 cycles of 60 minutes at 123 °C		
Indirect Food Additive	All components meet the FDA indirect food requirements cited in 21 CFR 177-182.		
Toxicity	All component materials meet the requirements of the current USP <88> biological reactivity test for class VI plastics.		
Bacterial Endotoxin	< 0.25 EU/mL as determined by the Limulus Amebocyte Lysate (LAL) test.		

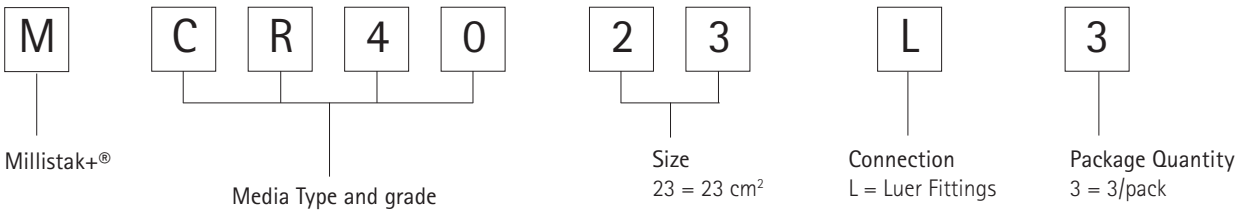
* Pilot and process scale only.

Millistak+® CR Depth Filters

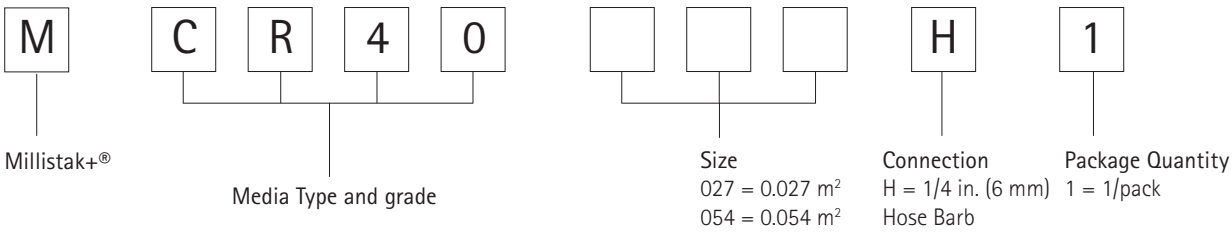
Media Type/Grade	Water Flow Rate L/min/m² at 10 psid, 23° C
CR40	73.3 - 597.0

Ordering information

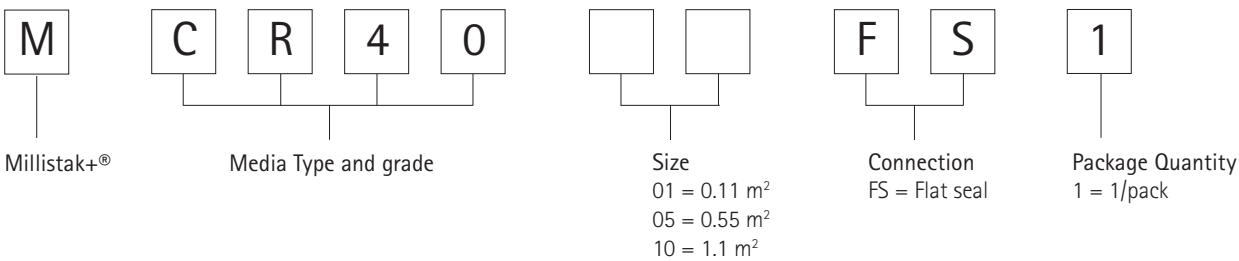
µPod® Filters



Lab Scale Pod Filters



Pilot and Process Scale Pod Filters



Pilot and process scale pods require a pod holder. Lab scale pods and µPod® filters do not require a holder. Please contact your local sales representative for more information.

To place an order or receive technical assistance

In Europe, please call Customer Service:

France: 0825 045 645
Germany: 069 86798021
Italy: 848 845 645
Spain: 901 516 645 Option 1
Switzerland: 0848 645 645
United Kingdom: 0870 900 4645

For other countries across Europe, please call: +44 (0) 115 943 0840

Or visit: **www.merckmillipore.com/offices**

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