

Zeta Plus™ Activated Carbon

Cartridges & Capsules

Zeta Plus Filter Medium: The efficient way to decolorize your process liquids

Zeta Plus filter medium incorporates the latest activated carbon technology to decolorize and remove contaminants from your process streams. Zeta Plus filter media can be used in any application where bulk activated carbon is used.

Zeta Plus Principle

The activated carbon is made into Zeta Plus filter media with the addition of cellulose fibers and a positively charged resin. This eliminates the use of bulk carbon that causes dust-related issues especially for operators. Figure 1 shows activated carbon and Zeta Plus filter medium.

CUNO incorporates five standard types of activated carbon to cover a broad range of applications. These have been specifically selected for their properties to meet industry requirements. Zeta Plus filter media are also available in different porosities so that solutions with different viscosities can be processed.

Flow Rate Influence

Adsorption of molecules by activated carbon relies on Vander Waals' forces. As those interactions are of short range, contact time between the solution and the filter media is critical. Graph 1 shows the influence of the flux on the adsorption capacity of the filter media. It shows that when the flux increases the adsorption capacity of Zeta Plus filter media decreases.

Features & Benefits

Immobilized carbon in a cellulose-resin binder matrix.

- Eliminates the handling of bulk powdered carbon, eliminates equipment and solvent contamination with carbon dust and improves worker safety.

Variety of carbon types available.

- Provides a customized solution that enables maximum process economy, fewer unit operations and less re-work of off spec material.

Totally enclosed, sanitary design filter cartridge housing.

- Significantly reduces time required for cleaning between batches and reduces operator exposure to harmful solvent fumes.

Easy to install filter cartridges.

- Easy to use, reduces labor costs, positive sealing mechanism.

Full range of cartridge and capsule configurations.

- Full range of scalable configurations from bench top to production.

FDA Drug Master File, Biological Safety, Regulatory Support File & Certificate of Quality.

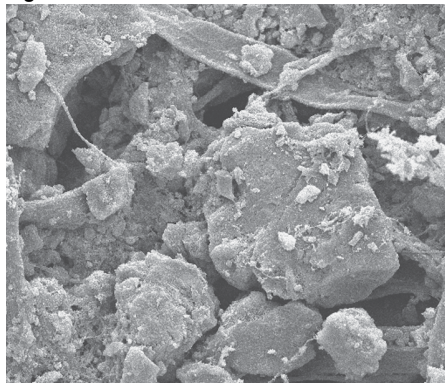
- Eases validation and regulatory submissions from bench top to production.



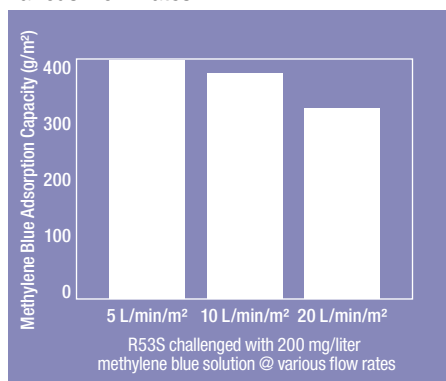
Applications

- | | |
|----------------------------|--|
| Pharmaceuticals | <ul style="list-style-type: none"> ▪ Decolorization in production of vitamins, antibodies, dextrose, & gelatin enzymes ▪ Parenterals ▪ Blood fractionation ▪ Catalyst removal from API |
| Chemicals | <ul style="list-style-type: none"> ▪ Catalyst removal ▪ Bulk pharmaceutical actives & intermediates ▪ Decolorization of solvents ▪ Decolorization of fine chemicals ▪ Removal of organic contaminants |
| Cosmetics | <ul style="list-style-type: none"> ▪ Alcohol deodorization ▪ Decolorization of perfumes |
| Food & Beverage | <ul style="list-style-type: none"> ▪ Removal of trace organic contaminants from gelatin, pectin, juices, oils ▪ Decolorization of wine & cider ▪ Decolorization of sugar ▪ Spirit purification ▪ Fatty haze removal |

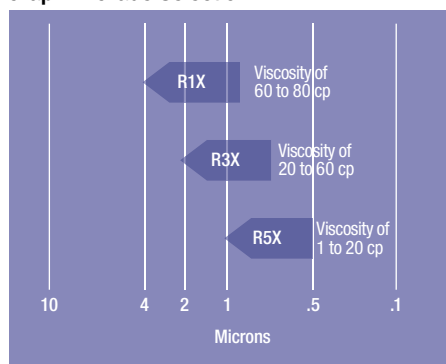
Figure 1: Zeta Plus Filter Medium



Graph 1: Adsorption Capacity at Various Flow Rates



Graph 2: Grade Selection



Evaluation and Scaling-up

CUNO offers a range of Zeta Plus™ products for laboratory-scale filtration, for process development scale-up work, and for small lot production runs all the way to full scale.

BC25, 1000 and 2000 disposable devices have surface areas of 25 cm² through to 1700 cm² enabling development to scale-up. In addition Zeta Plus discs (47 mm and 90 mm) are available.

Zeta Plus filtration is scaled up using a fixed value of filter flux (fluid flow rate per effective filtration area). Zeta Plus filter media should be evaluated initially at a recommended flux of 3 L/min/m² (0.07 gpm/ft²). However, there are some successful applications where flux is much higher than this recommended value, while maintaining high adsorption efficiency.

Grades of Zeta Plus Filter Media

Zeta Plus filter media are available in different porosity ratings in order to deal with products of different viscosity. Graph 2 can be used as a guide for optimum filter selection.

Cartridge Construction

Pre-tensioned cartridge construction, utilizing 316 stainless steel, ensures integrity in severe environments including *in-situ* steam sterilization and hot water sanitation. The unique edge seal design provides durable cell construction that maintains its integrity even under the most demanding process conditions.

Quality and Reliability

Zeta Plus filters are manufactured in accordance with an ISO 9001:2000 Quality Management System. All materials of construction are 21 CFR compliant and cartridge and capsule filter components have been tested in accordance with United States Pharmacopoeia (USP) Class VI Biological Reactivity tests. All Zeta Plus cartridge and capsule filters are shipped with a Certificate of Quality affirming compliance with rigid manufacturing quality specifications. Supporting Drug Master File (DMF) documentation is on file with the United States Food and Drug Administration (FDA). A complete Zeta Plus Regulatory Support File is available upon request (LITDRSFZC).

BC Capsules

Zeta Plus filter media is also available in BC Capsules, a range of completely encapsulated disposable depth filter assemblies for small volume biological, bioprocess, and pharmaceutical applications. BC units are available in three sizes (see ordering guide) to offer a high degree of application flexibility.

Extractables & Pyrogenicity

Inorganic and organic extractable testing was performed on Zeta Plus filter media with a variety of fluids. The following table lists typical level of metal extractables. More information on extractables and pyrogenicity is provided in the Regulatory Support File (LITDRSFZC).

Table 1: Recommended Operating Parameters

| | |
|--------------------------------------|---|
| Maximum Operating Temperature | BC25 Capsules: 40°C (104°F) BC1000/2000 Series Capsules: 60°C (140°F) Cartridge: 80°C (176°F) |
| Maximum Differential Pressure | BC25 Capsules: 2.4 bar (35 psid) BC1000/2000 Capsules: 2.4 bar (35 psid) Cartridge: 2.4 bar (35 psid) |
| Recommended Rinse Volume | 50 l/m ² of medium (1.25 gal/ft ²) |
| Recommended Flow Rate | 3 liters/minute/m ² of medium (0.07 gpm/ ft ²) |
| Steam Sterilization | Cartridge: 1 cycle at 121°C (250°F) for 30 min. BC: Autoclave only |

*Available on request, contact CUNO for additional information.

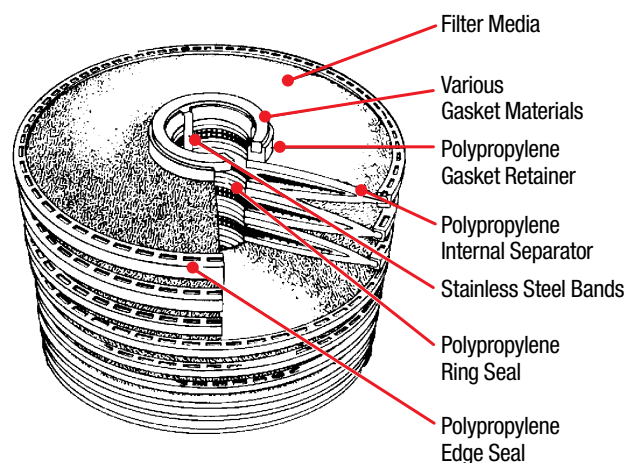


Table 2: Extractables of Metal (ppm)

| Zeta Plus Type | Al | Ca | Fe | Mg | K | Si | Na |
|----------------|--------|-------|-------|-------|-------|-------|-------|
| R51S | 0.005 | 0.355 | 0.016 | 0.023 | 0.048 | 0.033 | 0.069 |
| R52S | <0.005 | 0.470 | 0.005 | 0.070 | 0.083 | 0.160 | 0.510 |
| R53S | <0.005 | 0.240 | 0.010 | 0.015 | 0.033 | 0.023 | 0.062 |
| R54S | <0.005 | 0.190 | 0.009 | 0.035 | 0.053 | 0.029 | 1.218 |
| R55S | 0.026 | 0.190 | 0.022 | 0.022 | 0.056 | 0.034 | 0.415 |

Zeta Plus SP is tested for pyrogenicity by the LAL clot test. The acceptance criteria is < 0.50 EU/ml.

Table 3: Applications of Zeta Plus Activated Carbon

| Application | Recommended Grade |
|---|------------------------|
| Antibiotic Decolorization: Capromycin, Penicillin V, Cefazolin | R33S, R53S, R35S, R55S |
| Endotoxin removal | R53S |
| Removal of detergent | R32S, R52S |
| Removal of precipitation agent | R33S, R53S |
| Vaccine purification | R33S, R53S |
| Catalyst removal | R53S, R54S |
| Solvent decolorization (acetone) | R31S, R51S |
| Removal of trace organic contaminants from active compounds | R31S, R51S, R34S, R54S |
| Removal of trace organic contaminants from X-Ray contrast media | R33S, R53S |
| Blood fractionation: albumin decolorization, pKa reduction, biliverdine removal | R33S, R53S |
| Trace contaminant removal from Vodka, Whisky and Gin | R31S, R51S |
| Silicon oil decolorization | R11S, R14S |

Zeta Plus™ Activated Carbon Cartridge Ordering Guide

BC Series

| Capsule Designation | Nominal Filter Area | Packaging** | Grade | Quality Grade |
|---------------------|---|--|---|--------------------|
| BC | 0025 - 3.9 in ² (25 cm ²) | L - (Luer) S - (Sanitary) | R11S, R12S, R13S, R14S, R15S, R31S, R32S, R33S, R34S, R35S, R51S, R52S, R53S, R54S, R55S | P - Pharmaceutical |
| | 1000 - Capsule 0.7 in ² (650 cm ²) 2000 - Capsule 1.4 in ² (1300 cm ²) | A - Single Filter B - 3 Filter Pack | | |

Standard Zeta Plus Cartridges

| Base Cartridge Number | Gasket Material | Grade | Quality Grade |
|--|---|---|--------------------|
| 45109 - 8" x 7" cell DOE* - 2.5 ft ² (0.23 m ²) media surface area | 11 - Nitrile 13 - Fluorocarbon 14 - EPR 22 - Silicone 23 - PTFE | R11S, R12S, R13S, R14S, R15S, R31S, R32S, R33S, R34S, R35S, R51S, R52S, R53S, R54S, R55S | P - Pharmaceutical |
| 45167 - 8" x 6" cell Plug in - 2.1 ft ² (0.20 m ²) media surface area | 01 - Nitrile 02 - EPR 03 - Fluorocarbon 04 - Silicone 09 - PTFE Encapsulated Fluorocarbon | | |
| 45158 - 12" x 9" cell DOE* - 9.2 ft ² (0.9 m ²) media surface area 45159 - 12" x 13" cell DOE* w/Stainless Steel Bands - 13.3 ft ² (1.2 m ²) media surface area 45809 - 12" x 13" cell DOE* w/Hastelloy® Steel Bands - 13.3 ft ² (1.2 m ²) media surface area | 01 - Nitrile 03 - Fluorocarbon 04 - EPR 06 - Silicone 07 - PTFE | | |

| Base | Configuration | O-Ring Material | Packaging | Grade | Quality Grade |
|---|---------------|--|-----------|---|--------------------|
| Z8FA2 - 8" Plug-in with 2 cells - 0.7 ft ² (650 m ²) media surface area Z8FA4 - 8" Plug-in with 4 cells - 1.4 ft ² (1300 m ²) media surface area | NP | A - Silicone B - Fluorocarbon C - EPR D - Nitrile E - PTFE Encapsulated Fluorocarbon | 2 | R11S, R12S, R13S, R14S, R15S, R31S, R32S, R33S, R34S, R35S, R51S, R52S, R53S, R54S, R55S | P - Pharmaceutical |

| Base | Cartridge Design | Gasket Material | Grade | Quality Grade |
|------|---|--|---|--------------------|
| C16 | M - 16" x 13" cell DOE w/Stainless Steel Bands - 32.2 ft ² (3.0 m ²) media surface area | A - Silicone B - Fluorocarbon C - Ethylene Propylene (EPDM) D - Nitrile E - PTFE | R11S, R12S, R13S, R14S, R15S, R31S, R32S, R33S, R34S, R35S, R51S, R52S, R53S, R54S, R55S | P - Pharmaceutical |
| | R - 16" x 13" cell DOE w/Hastelloy® Steel Bands - 32.2 ft ² (3.0 m ²) media surface area | | | |

*Double Open End. **Other Gasket Materials are available. For sheets and discs contact your local CUNO distributor.

Important Notice CUNO MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Since a variety of factors can affect the use and performance of a CUNO product in a particular application, some of which are uniquely within the user's knowledge and control, user is responsible for determining whether or not the CUNO product is fit for a particular purpose and suitable for user's method of application.

Limitation of Remedies and Liability If the CUNO product is proved to be defective, THE EXCLUSIVE REMEDY, AT CUNO'S OPTION, SHALL BE TO REFUND THE PURCHASE PRICE OR TO REPAIR OR REPLACE THE DEFECTIVE PRODUCT. CUNO shall not otherwise be liable for loss or damages, whether direct, indirect, special, incidental or consequential, regardless of the legal theory asserted, including, but not limited to, contract, negligence, warranty or strict liability.

Warranty Seller warrants its equipment against defects in workmanship and material for a period of 12 months from date of shipment from the factory under normal use and service and otherwise when such equipment is used in accordance with instructions furnished by Seller and for purposes disclosed in writing at the time of purchase, if any. Any unauthorized alteration or modification of the equipment by Buyer will void this warranty. Seller's liability under this warranty shall be limited to the replacement or repair, F.O.B., point of manufacture, of any defective equipment or part which, having been returned to the factory, transportation charges prepaid, has been inspected and determined by Seller to be defective. THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTY, EITHER EXPRESSED OR IMPLIED, AS TO DESCRIPTION, QUALITY, MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE OR USE, OR ANY OTHER MATTER. Under no circumstances shall Seller be liable to Buyer or any third party for any loss of profits or other direct or indirect costs, expenses, losses or consequential damages arising out of or as a result of any defects in or failure of its products or any part or parts thereof or arising out of or as a result of parts or components incorporated in Seller's equipment but not supplied by the Seller.



a 3M company

Your Local CUNO Distributor:

CUNO Incorporated
400 Research Parkway
Meriden, CT 06450
U.S.A.
(800) 243-6894
(203) 237-5541
Fax (203) 630-4530
www.CUNO.com

Hastelloy is a trademark of Haynes International, Inc.
CUNO, and Zeta Plus are trademarks of 3M Company
used under license.

© 2008 3M Company. All rights reserved.
70-0201-8733-5
LITCZC1.0608