

# Technical Brief

## Grade Selection with ZetaCarbon® 47 mm Discs

### Introduction

CUNO® ZetaCarbon® filters are a family of carbon impregnated filters designed to remove color, endotoxin, contaminating nucleic acids, and other organic impurities by adsorption. ZetaCarbon filters are available in 5 standard carbon grades, each in 3 different filtration ratings.

Bench-scale testing is sometimes required to determine which carbon grade of which filtration rating offers the best removal of the desired contaminant. Once the optimum grade and filtration rating are determined, experiments varying the flux (flow per unit area) can be performed to assist in scaling up ZetaCarbon filter to full size production cartridges. This Technical Brief provides a basic framework for conducting these grade selection experiments.

### ZetaCarbon Filter Part Numbering System

In the ZetaCarbon filter part number nomenclature, the filtration rating is denoted by the first digit in the part number suffix and the carbon grade is denoted by the second digit in the part number suffix. For instance, in ZetaCarbon filter part number 45159-01A-R53SP, this cartridge contains the "3" type of carbon in the "5" filtration rating.

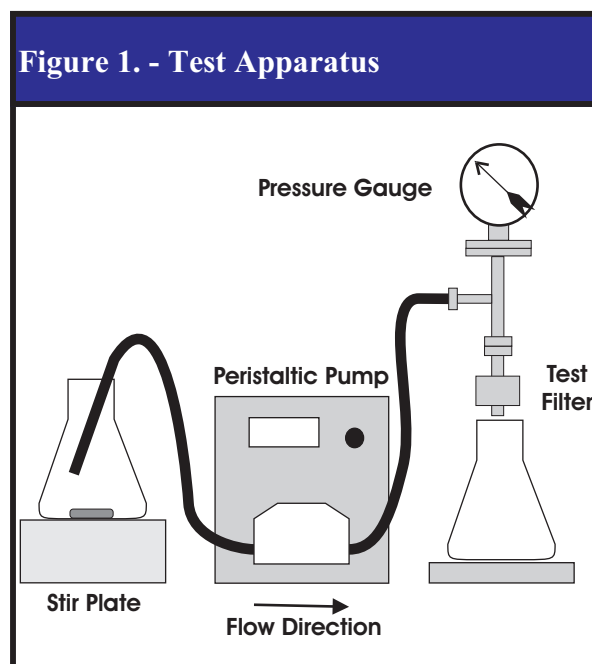
### Procedure

#### ZetaCarbon Filter Grade Selection

- 1) Determine how the decolorization or contaminant removal performance will be evaluated (e.g. visual assessment, fixed wavelength or scanning UV/VIS measurements, HPLC analytical methods, an analytical method developed specifically for the analysis of the contaminant of interest in the specific product solution).
- 2) Install a 47 mm (effective area 13.5 cm<sup>2</sup>) ZetaCarbon disc (grade R51SP) in the filter housing and attach the housing to a peristaltic pump. Place a pressure gauge on the upstream side of the filter housing capable of accurately measuring the pressure in the 0 – 40 psi range (See Figure 1)
- 3) Using the test set-up, rinse the filter and housing with filtered deionized solvent at a flow rate of 10 ml/min for 10 minutes to thoroughly wet the filter and flush out any carbon fines

**NOTE: During the wetting process, the housing should be vented to prevent air from being trapped in the housing.**

- 4) After wetting the 47 mm filter disc, the excess solvent can be removed by forcing air through the housing to blow-out the excess solvent or product solution can be used to flush out the excess solvent.
- 5) Decolorization performance can be evaluated by visual comparison of fractions or by measuring the absorbance of the product solution at a specific wavelength using a spectrophotometer. (For example: If the color is yellow, the color intensity can be evaluated at 430 nm using a UV/VIS spectrophotometer.)
- 6) Contaminant removal performance can be evaluated by an Analytical Method developed specifically for the analysis of the contaminant of interest in the specific product solution.



- 7) Measure and record the initial color of or the level of contaminant of interest in the product solution.
- 8) Pump the product to be decolorized through the 47 mm ZetaCarbon disc installed in the filter housing at an initial flow rate of 3 ml/min (flux of 0.25 ml/cm<sup>2</sup>/min). Collect filtrate fractions at various time intervals. Measure and record the color of each filtrate sample<sup>1</sup>. Measure and record the differential pressure across the media throughout the trial<sup>2</sup>.
- 9) Prepare a graph of throughput versus color value or throughput versus contaminant concentration.
- 10) Repeat Steps 2-9 with the remaining ZetaCarbon filter grades (R52SP, R53SP, R54SP, & R55SP).
- 11) Select the optimum ZetaCarbon filter carbon grade for the application.

## ZetaCarbon Filtration Rating Selection

The user can also evaluate the effect of each of the three available filtration ratings on decolorization or contaminant removal efficiency. This is typically studied after the optimum carbon grade has been selected by the process above.

All ZetaCarbon carbon grades are available in 3 different filtration ratings that provide different resistance to flow. These filtration ratings are usually matched with the fluid viscosity, with the “1” filtration rating recommended for fluids of higher viscosity (60 cp or greater), the “3” filtration rating for fluids of intermediate viscosity (20 – 60 cp), and the “5” filtration rating for fluids of low viscosity (0 – 20 cp).

Repeat Steps 1-9, this time using 47 mm disc samples of each of the three filtration grades in the optimum carbon grade determined in the first set of experiments. This work should be conducted at the same flow rate of 3 ml/min.

## ZetaCarbon Flux Selection

Once the optimum ZetaCarbon carbon grade and filtration rating have been determined, it is often beneficial to evaluate the effect of flux on decolorization or contaminant removal efficiency. Experience has shown that decolorization and contaminant removal increases with decreasing flux. A lower flux increases the residence time of the product in contact with carbon. However, it is important to determine the fastest flux at which acceptable performance is achieved in order to minimize the number of ZetaCarbon cartridges required for the given application.

Repeat Steps 1 to 9 with a new ZetaCarbon media disc of choice and evaluate the decolorization or contaminant removal at a flow rate of 6 ml/min (flux 0.5 ml/cm<sup>2</sup>/min), twice the flow rate of the original experiments.

Repeat the tests as necessary using increasing flow rate until the fastest process flow rate is found that still produces the desired decolorization or contamination removal result.

<sup>1</sup>**NOTE: The end point of the test can be defined in one of two ways: When the required product color or other contaminant reduction has been achieved for a pooled sample of fractions or when the equivalent process batch throughput is reached.**

<sup>2</sup>**NOTE: Differential pressure should not be a critical parameter, as a high differential pressure (i.e. meets or exceeds 30 psid) would mean the ZetaCarbon media is blocking due to mechanical sieving and the adsorption capacity will be impaired. If this is the case, consider the use of a particle filter to remove solids from the fluid prior to the use of ZetaCarbon.**



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