

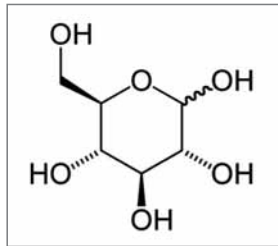


## Sterilizing Grade Filtration of high concentrated Sugar Solutions



Application  
Note

Process  
Optimization



Sugars in water-based solutions are used in many different industrial applications. However, microorgan-

isms must be removed from these solutions, because sugars are good carbon sources for product spoiling microorganisms. In complex compositions with amino acids it is not possible to sterilize sugar solutions by autoclavation because of the Maillard reaction. The Maillard reaction is a chemical reaction between amino acids and reducing sugars usually occurring when heat is applied. As a result of the reaction the sugars can caramelize. Fortunately, microorganisms can be easily removed by the use of membrane filtration.

### Temperature | Flow rate

The solubility of glucose in water at 25°C is about 91 g/100 ml [2]. Nevertheless, product concentrations higher than 40% (w | w) are usually handled at elevated temperatures, because the viscosity of the solution decreases as temperature rises. For example, 70% glucose (w | w) at 50°C has a dynamic viscosity of about 7 mPas. The measured flow rate for Glucose and Sartopore® 2 XLI 0.35 | 0.2 µm sterilizing grade filter is about 600 l/hm<sup>2</sup>.

### Filtration of Glucose Solutions

An effective pre-filtration step is critical to protect the final, much more expensive, membrane filters. Polypropylene depth filters, such as Sartopure PP2, are the optimal prefilter for glucose solutions. The filter is useful in removing various particles such as paper from the packaging and larger product impurities.

The required retention rating depends mainly on the product quality of the filtrate. For pharmaceutical grades of Glucose Sartopure PP2 0.65 µm usually is sufficient. For food grade qualities a two stage pre-filtration may be necessary.

The Sartopore® 2 XLI was shown to be the ideal sterilizing grade filter for glucose solutions. Glucose solutions have a small particle distribution that is very close to the 0.2 µm. It was shown that these particles were small enough to pass 0.8 µm and 0.45 µm prefilter layers of the Sartopore® 2 XLG and Sartopore® 2, respectively. The 0.35 µm prefilter layer of Sartopore® 2 XLI was able to protect the final 0.2 µm by retaining the most particles (please refer to the picture). Product spoiling microorganisms are reliably removed from the Glucose solution. For Glucose solutions up to 10,000 kg can be filtered with one single 10" Sartopore® 2 XLI filter element.



Fig. 1: 47 mm filter discs of Sartopore® 2 XLI, Sartopore® 2 and Sartopore® 2 XLG after filtration of Glucose solution

### Applications of Glucose

Glucose is utilized for enteral and parenteral nutrition because the human body metabolizes glucose (dextrose) directly. It is also used as an additive in beverages, especially sport drinks [1]. In biotechnology Glucose is a broadly used carbon source in fermentation processes.

Sartopore® 2 XLI double layer 0.35 | 0.2 µm filter elements offer highest degree safety and are individually integrity tested to ensure filters are integral. The integrity test is correlated to HIMA/ASTM F 838-05 Bacteria Challenge Test. Sartopore® 2 XLI filter cartridges comprise polyethersulfone membranes. The unique heterogeneous 0.35 | 0.2 µm double layer PES membrane combination is specifically developed to provide exceptional high total throughputs and outstanding flow rates even with highly viscous solutions. The exceptionally high effective filtration area of 0.8 m<sup>2</sup> per 10" cartridge provides outstanding total throughput and flow rate performance in the target applications. Thus ensuring highest process efficiency, minimized filtration costs and short filtration cycle times.

Optimization studies using Zero-T, Sartorius Stedim Biotech's proprietary system, for the prefilter and final filter can be performed depending on the Glucose quality. The small scale filterability trials should be performed before setting up a large scale process (see below).

### Compatibility

The Sartopure PP2 and Sartopore® 2 XLI cartridges offer broad chemical compatibility, for pH 1-14, and low extractable levels. The cartridges can withstand multiple in-line steam sterilization cycles, 20 to 25 cycles respectively, at up to 134°C (20 min.).

After some time the flow rate of the filters can decrease by blockage of particles from the sugar solution. For food applications Sartopure PP2 and Sartopore® 2 XLI can be cleaned using caustic (1 M NaOH). After flushing with water the filter elements can be used for the next product batch.

### Process Optimization

Zero-T, the process optimization system created by Sartorius Stedim Biotech, can be used to optimize the filtration of glucose on a small scale. The system is comprised of flexible hardware with a balance and up to 3 pressure transducers in combination with a sophisticated, priority data logging and analyzing software. The system is used to help identify the best filter material and sizing combinations quickly by using a small volume of product.

The Zero-T can be used with flat membranes, such as 47 mm discs, or with small pleated filters. The membranes in the small scale devices are the same as membranes in the larger filters used in the production scale. For sugar solutions, it is highly

recommended to use small pleated filters for initial testing or to verify any small scale testing with 47 mm discs. The small pleated filters provide a more accurate indication of effective filtration area requirements, because the construction is similar to the larger filters used in process scale. In Figure 2 a typical Zero-T setup comprising small pleated filter elements is shown.

### Technical References

Sartopure PP2:  
Validation Guide: SPK5717-e  
Extractables Guide: SPK5719-e  
Sartopore® 2 XLI:  
Validation Guide: SPK5768-e  
Extractables Guide: SPK5766-e

### Literature

- [1] Sportgetränke: H. Striegel, A.M. Niess, DEUTSCHE ZEITSCHRIFT FÜR SPORTMEDIZIN Jahrgang 57, Nr. 1 (2006)
- [2] <http://en.wikipedia.org/wiki/Glucose>

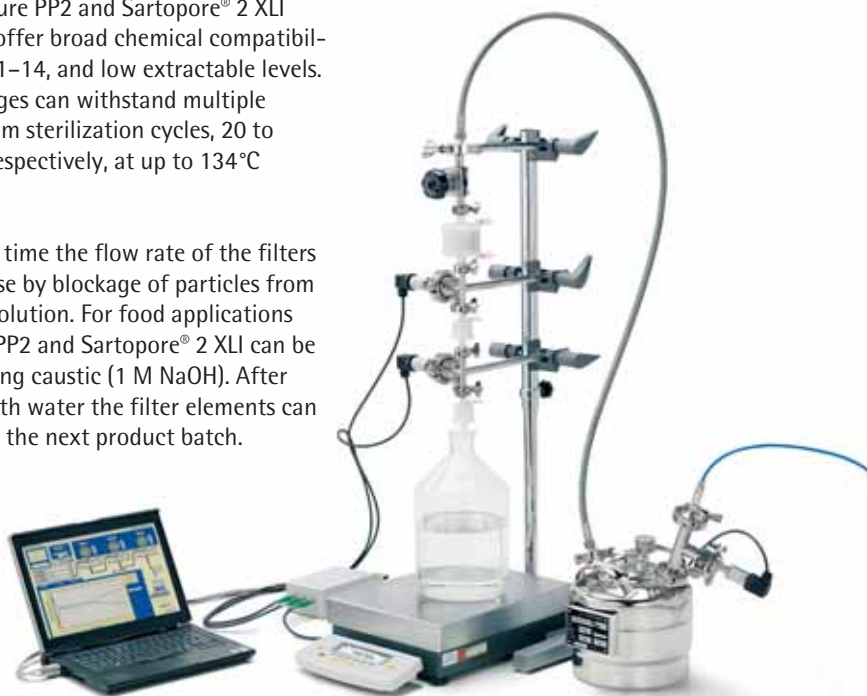


Fig. 2: Zero-T filter optimization system for up to three filter elements in line

# Sales and Service Contacts

For further contacts, visit [www.sartorius-stedim.com](http://www.sartorius-stedim.com)

## Europe

### Germany

Sartorius Stedim Biotech GmbH  
August-Spindler-Strasse 11  
37079 Goettingen

Phone +49.551.308.0  
Fax +49.551.308.3289

[www.sartorius-stedim.com](http://www.sartorius-stedim.com)

Sartorius Stedim Systems GmbH  
Schwarzenberger Weg 73-79  
34212 Melsungen

Phone +49.5661.71.3400  
Fax +49.5661.71.3702

[www.sartorius-stedim.com](http://www.sartorius-stedim.com)

### France

Sartorius Stedim Biotech S.A.  
ZI Les Paluds  
Avenue de Jouques – BP 1051  
13781 Aubagne Cedex

Phone +33.442.845600  
Fax +33.442.845619

Sartorius Stedim France SAS  
ZI Les Paluds  
Avenue de Jouques – CS 71058  
13781 Aubagne Cedex

Phone +33.442.845600  
Fax +33.442.846545

### Austria

Sartorius Stedim Austria GmbH  
Franzosengraben 12  
A-1030 Vienna

Phone +43.1.7965763.18  
Fax +43.1.796576344

### Belgium

Sartorius Stedim Belgium N.V.  
Leuvensesteenweg, 248/B  
1800 Vilvoorde

Phone +32.2.756.06.80  
Fax +32.2.756.06.81

### Denmark

Sartorius Stedim Nordic A/S  
Hoerskaetten 6D, 1.  
DK-2630 Taastrup

Phone +45.7023.4400  
Fax +45.4630.4030

### Italy

Sartorius Stedim Italy S.p.A.  
Via dell'Antella, 76/A  
50012 Antella-Bagno a Ripoli (FI)

Phone +39.055.63.40.41  
Fax +39.055.63.40.526

### Netherlands

Sartorius Stedim Netherlands B.V.  
Edisonbaan 24  
3439 MN Nieuwegein

Phone +31.30.6025080  
Fax +31.30.6025099

### Spain

Sartorius Stedim Spain SA  
C/Isabel Colbrand 10,  
Oficina 70  
Polígono Industrial de Fuencarral  
28050 Madrid

Phone +34.90.2110935  
Fax +34.91.3589623

### Switzerland

Sartorius Stedim Switzerland GmbH  
Lerzenstrasse 21  
8953 Dietikon

Phone +41.44.741.05.00  
Fax +41.44.741.05.09

### U.K.

Sartorius Stedim UK Limited  
Longmead Business Park  
Blenheim Road, Epsom  
Surrey KT19 9 QQ

Phone +44.1372.737159  
Fax +44.1372.726171

## America

### USA

Sartorius Stedim North America Inc.  
5 Orville Drive  
Bohemia, NY 11716

Toll-Free +1.800.368.7178  
Fax +1.631.254.4253

Sartorius Stedim SUS Inc.  
1910 Mark Court  
Concord, CA 94520

Phone +1.925.689.6650  
Toll Free +1.800.914.6644  
Fax +1.925.689.6988

Sartorius Stedim Systems Inc.  
201 South Ingram Mill Road  
Springfield, MO 65802

Phone +1.417.873.9636  
Fax +1.417.873.9275

### Argentina

Sartorius Argentina S.A.  
Int. A. Avalos 4251  
B1605ECS Munro  
Buenos Aires

Phone +54.11.4721.0505  
Fax +54.11.4762.2333

### Brazil

Sartorius do Brasil Ltda  
Av. Dom Pedro I, 241  
Bairro Vila Pires  
São Paulo  
Cep 09110-001

Phone +55.11.4451.6226  
Fax +55.11.4451.4369

### Mexico

Sartorius de México S.A. de C.V.  
Circuito Circunvalación Poniente No. 149  
Ciudad Satélite  
53100 Naucalpan, Estado de México

Phone +52.5555.62.1102  
Fax +52.5555.62.2942

## Asia | Pacific

### Australia

Sartorius Stedim Australia Pty. Ltd.  
Unit 5, 7-11 Rodeo Drive  
Dandenong South Vic 3175

Phone +61.3.8762.1800  
Fax +61.3.8762.1828

### China

Sartorius Stedim Beijing  
Representative Office  
No. 33, Yu'an Road,  
Airport Industrial Zone B, Shunyi District  
Beijing 101300

Phone +86.10.80426516  
Fax +86.10.80426580

Sartorius Stedim Shanghai  
Representative Office  
Room 618, Tower 1, German Centre,  
Shanghai, PRC., 201203

Phone +86.21.28986393  
Fax +86.21.28986392.11

Sartorius Stedim Guangzhou Office  
Room 704, Broadway Plaza,  
No. 233-234 Dong Feng West Road  
Guangzhou 510180

Phone +86.20.8351.7921  
Fax +86.20.8351.7931

### India

Sartorius Stedim India Pvt. Ltd.  
#69/2-69/3, Jakkasandra  
Kunigal Road, Nelamangala Tq  
Bangalore – 562 123

Phone +91.80.4350.5361  
Fax +91.80.4350.5253

### Japan

Sartorius Stedim Japan K.K.  
KY Building, 8-11  
Kita Shinagawa 1-chome  
Shinagawa-ku  
Tokyo 140-0001

Phone +81.3.3740.5407  
Fax +81.3.3740.5406

### Malaysia

Sartorius Stedim Malaysia Sdn. Bhd.  
Lot L3-E-3B, Enterprise 4  
Technology Park Malaysia  
Bukit Jalil  
57000 Kuala Lumpur

Phone +60.3.8996.0622  
Fax +60.3.8996.0755

### Singapore

Sartorius Stedim Singapore Pte. Ltd.  
10, Science Park Road, The Alpha  
#02-25, Singapore Science Park 2  
Singapore 117684

Phone +65.6872.3966  
Fax +65.6778.2494