ГЕЙЗЕР®
фильтры для воды

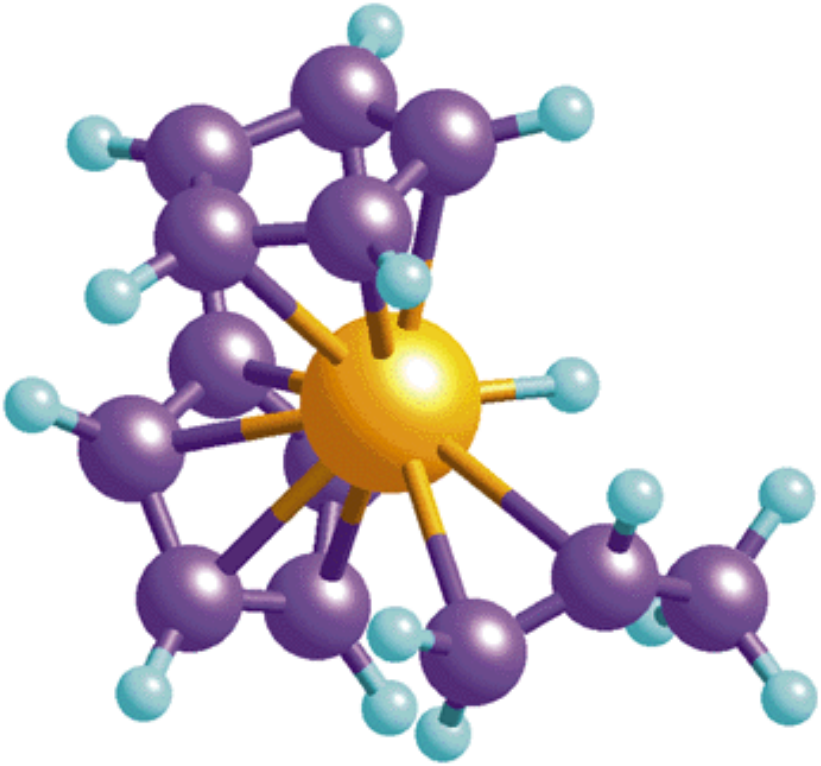
Mechanism of Harmful Impurities, Viruses and Bacteria Removal from Water By Aragon BIO Material.

Recent Test Results From Europe and Russia.

Saint Petersburg, 2014


ГЕЙЗЕР
фильтры для воды
ARAGON
UNIQUE FILTERING MATERIAL

SGS-Polymers



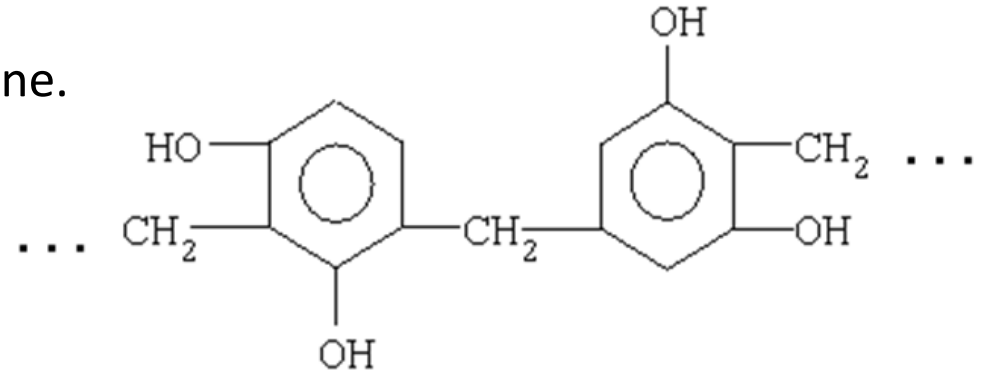
In 1988, the high molecular compounds, **SGS-polymers** were first prepared. They have both **cation-** and **anion-**exchange properties.

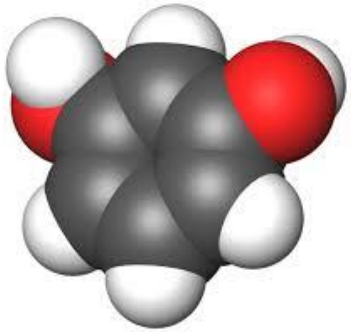
ARAGON is a Resorcinol–Based Polymer

Best Water Decontamination Performance (2001)

Resorcinol— meta-dihydroxybenzene.

Formula: C6H6O2
Molecular weight: 110.1 g/mol
Melting point: 110 °C
Density: 1.28 g/cm³
Boiling point: 277 °C





ARAGON is a compound polymeric material presented as a single block, with a bacteriostatic silver addition.

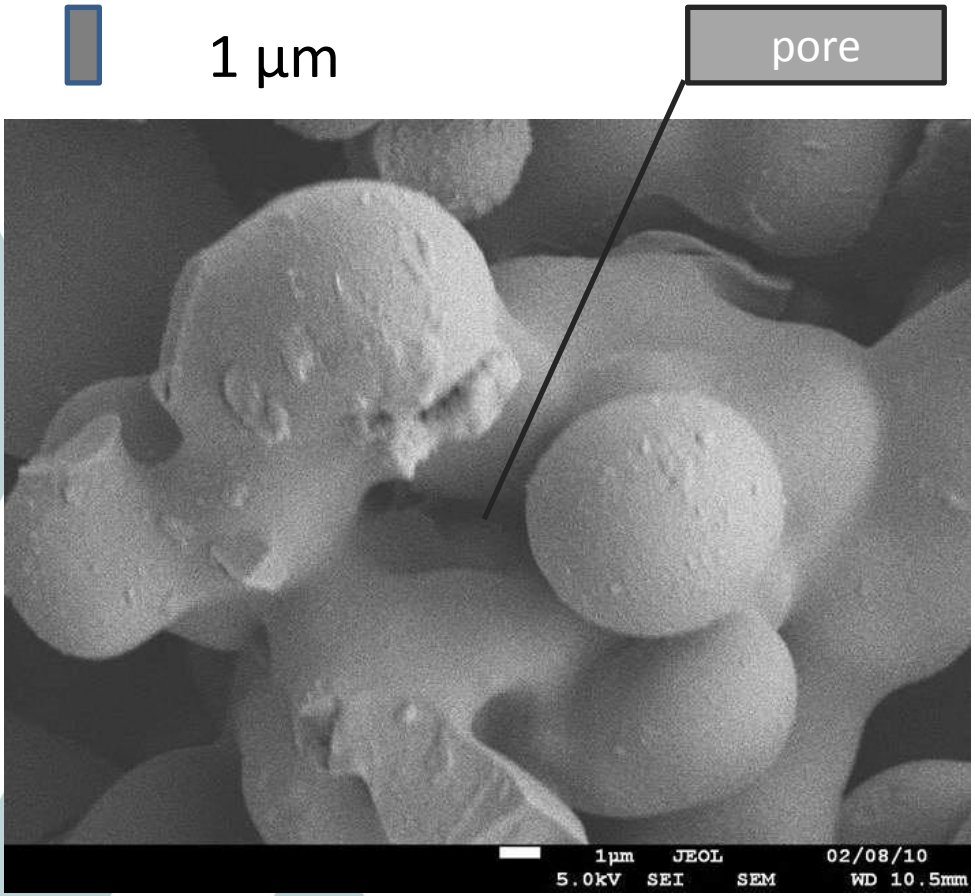
SGS-Polymer Filtering Cartridge

The SGS-polymer's structure is formed by **spherocolloids** with the size of **1 to 3-7 µm** (which is **2 orders of magnitude less** than standard granulation ion-exchanging materials (0.5-0.7 mm)), therefore volumetric flow rates of solutions through the SGS-polymer are significantly higher.

The spherocolloids form a regular highly-permeable porous structure.

Pores' sizes distribution is ±10%.

Spherocolloids



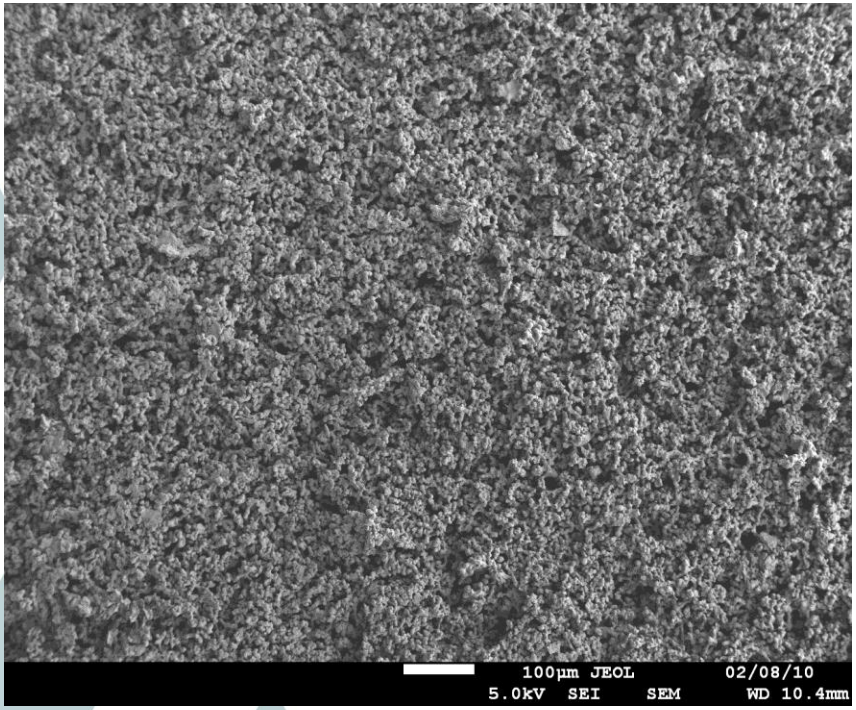
The spherocolloids are long polymeric chains, which combined form a mechanically strong structure with the internal surface size up to 500 m^2/g.

There are active ion-exchange groups on the globules' surface.

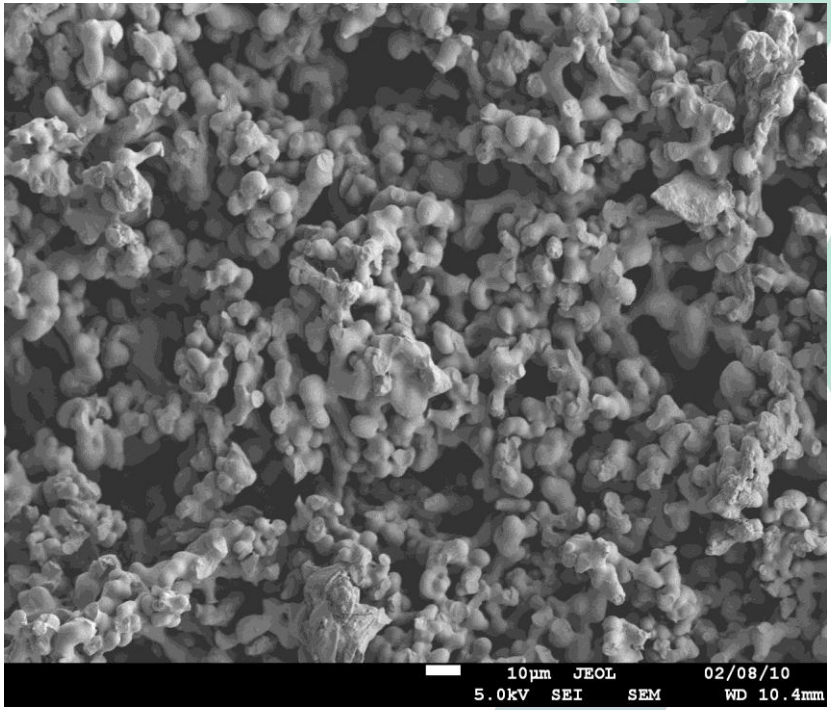
Photos of ARAGON made by an electronic microscope

ARAGON Material Photos

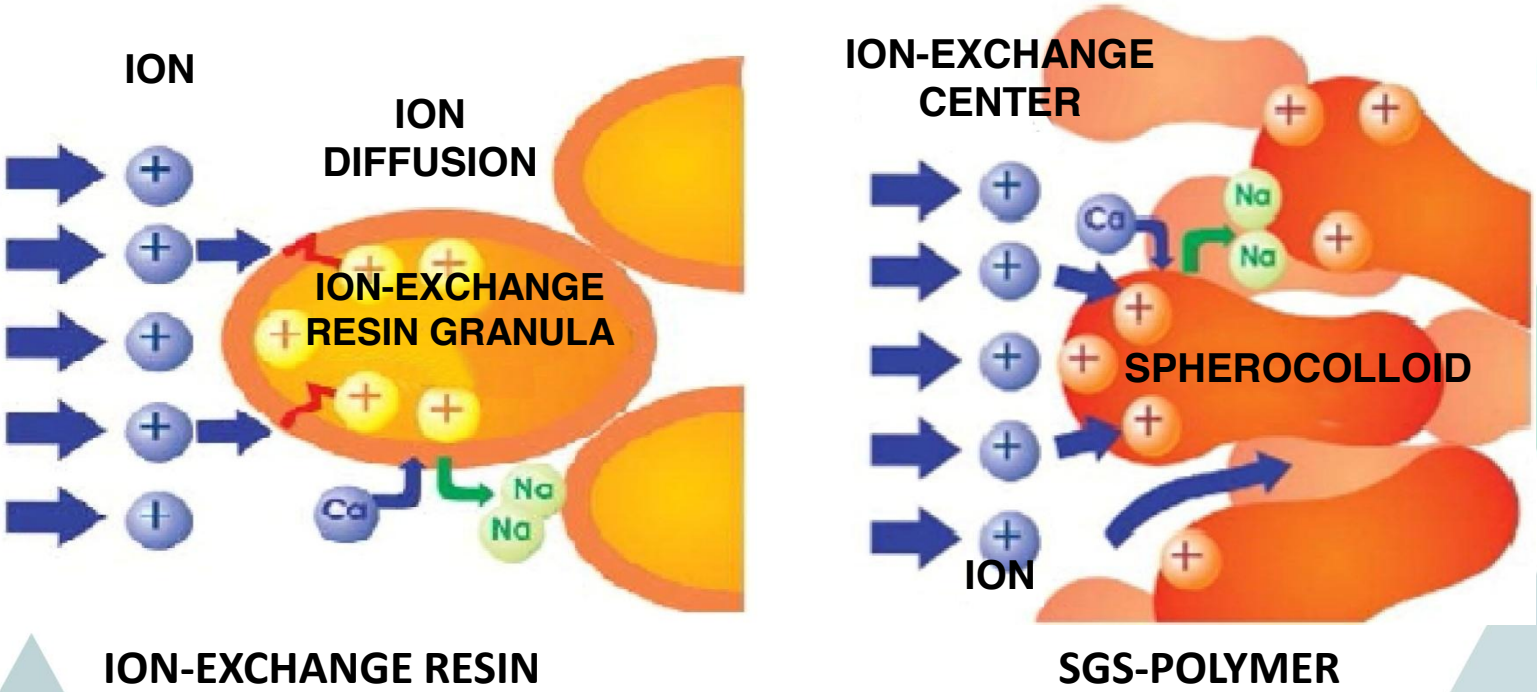
100 µm



10 µm



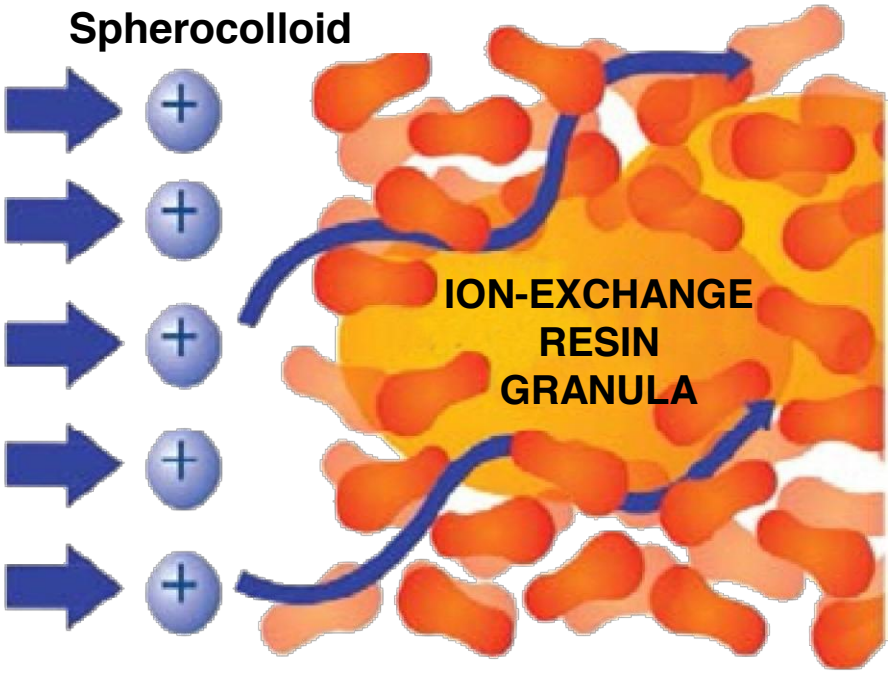
How SGS-Polymers work



The mass transfer is achieved by solutions passing through the polymer spherocolloids, rather than by diffusion process as there is in ordinary ion exchangers.

The transfer rate is subject to film kinetics laws. Therefore the efficiency of SGS ion exchange depends on the rate of solution replenishment in spherocolloids, i.e. the exchange rate will grow as solution throughput rate increases.

ARAGON-2



The inclusion of ion-exchange resin granulae in the polymer structure enables to increase the material's ion-exchanging capacity **twelve-fifteenfold**.

The resin particles are confined due to mechanical and electrokinetic bonds.

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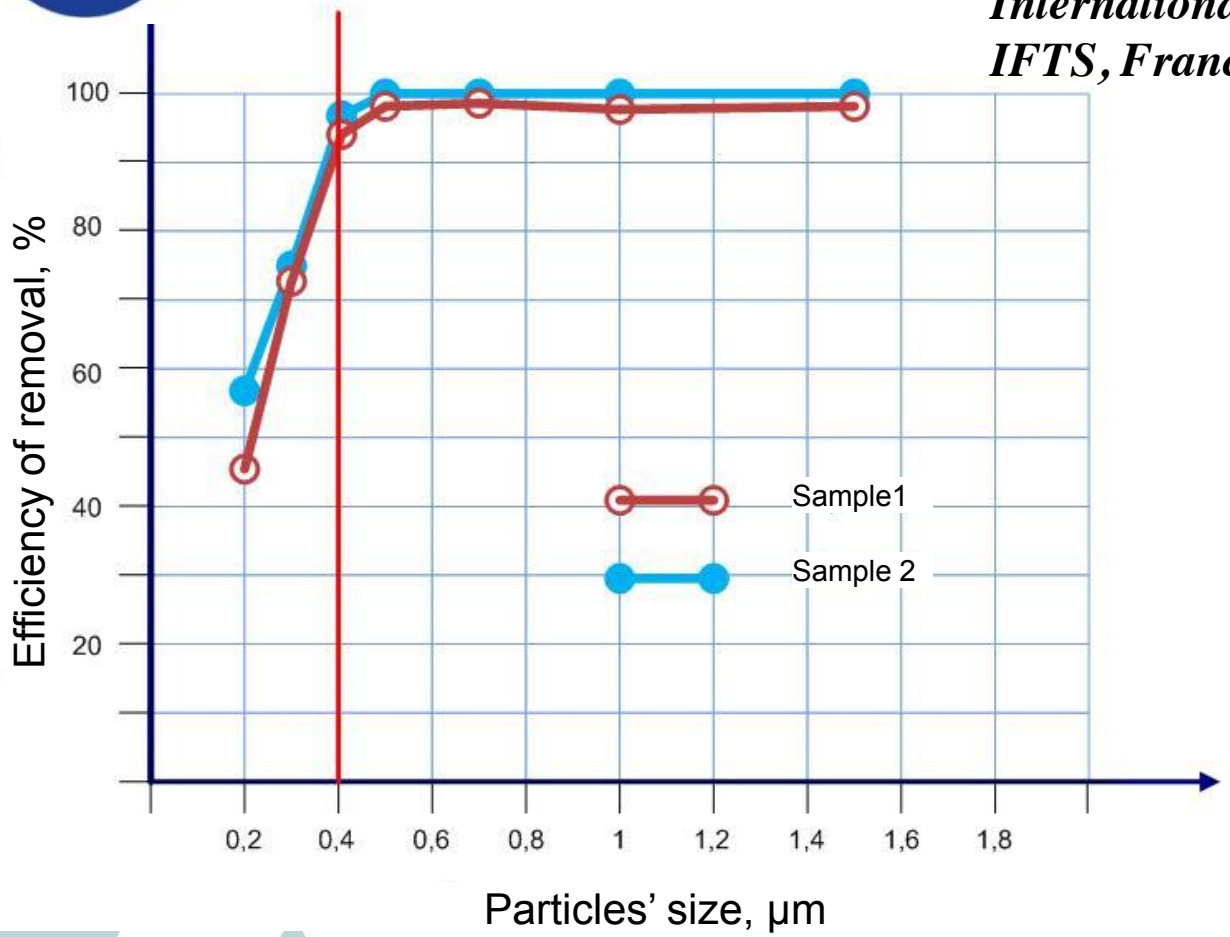
Removal of Insoluble Particles by Aragon BIO Cartridge

Saint Petersburg, 2014

Efficiency of Insoluble Particles' Removal

International Filter Testing Services
IFTS, France



Efficient removal of suspended particles of a preset sieving threshold, including bacteria and viruses.

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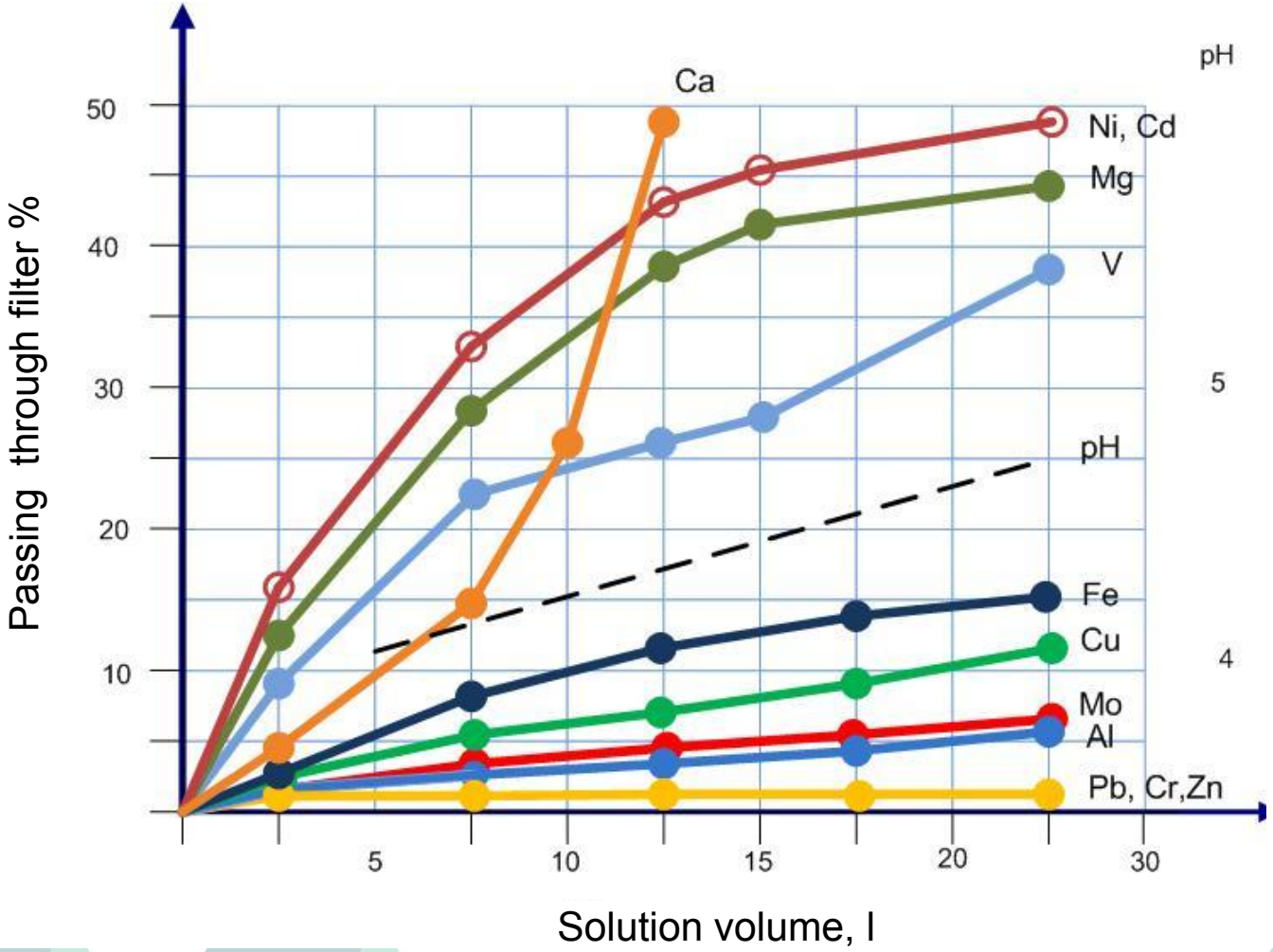
фильтры для воды

Removal of Contaminants. **ARAGON Ion-Exchange** Properties.

The V.G. Khlopin Radium Institute

Saint Petersburg, 2014

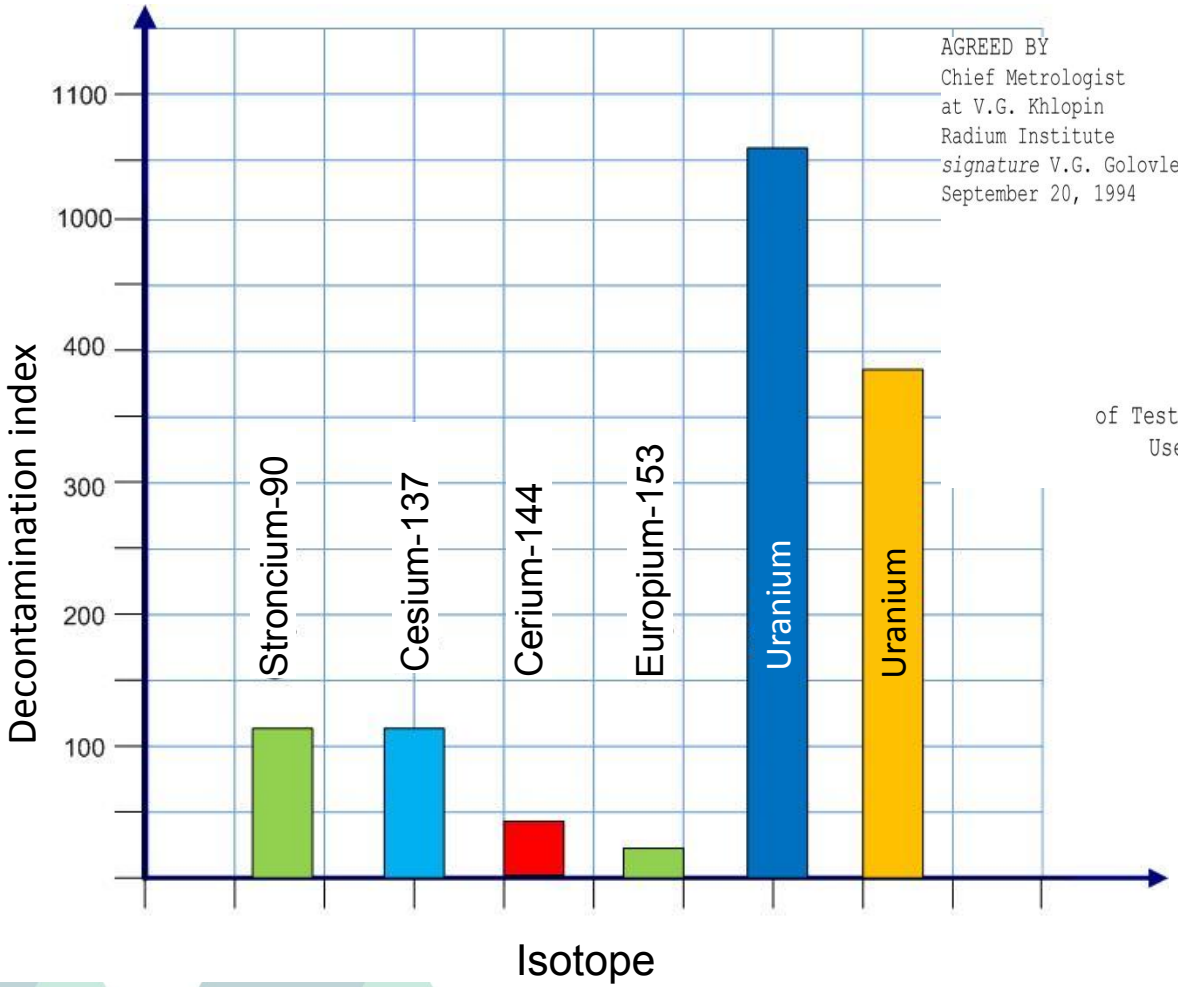
Metals removal efficiency, including radioactive ones



Elements' concentrations in the test solution, mg/l

Ca	4.7	-
Mg	3.3	-
Fe	2.7	10 MAC
Al	1.4	3 MAC
Mo	2.8	10 MAC
Pb	0.9	30 MAC
V	0.5	10 MAC
Ni	0.6	6 MAC
Zn	0.3	MAC
Cd	0.2	200 MAC
Cu	0.2	MAC
Cr	0.1	MAC

Treatment Efficiency of Water Contaminated by Radioactive Elements



AGREED BY
Chief Metrologist
at V.G. Khlopin
Radium Institute
signature V.G. Golovlev
September 20, 1994

Seal:
Research & Production
Association * V.G. Khlopin
Radium Institute

APPROVED BY
Deputy Director General
of the Research & Production Association
"V.G. Khlopin Radium Institute"
signature Ye. B. Anderson
September 20, 1994

CERTIFICATE

of Testing of Space-Globular Structure (SGS) Sorbents
Used in the Treatment of Waters Contaminated
with Radioactive Substances

ГЕЙЗЕР®
фильтры для воды

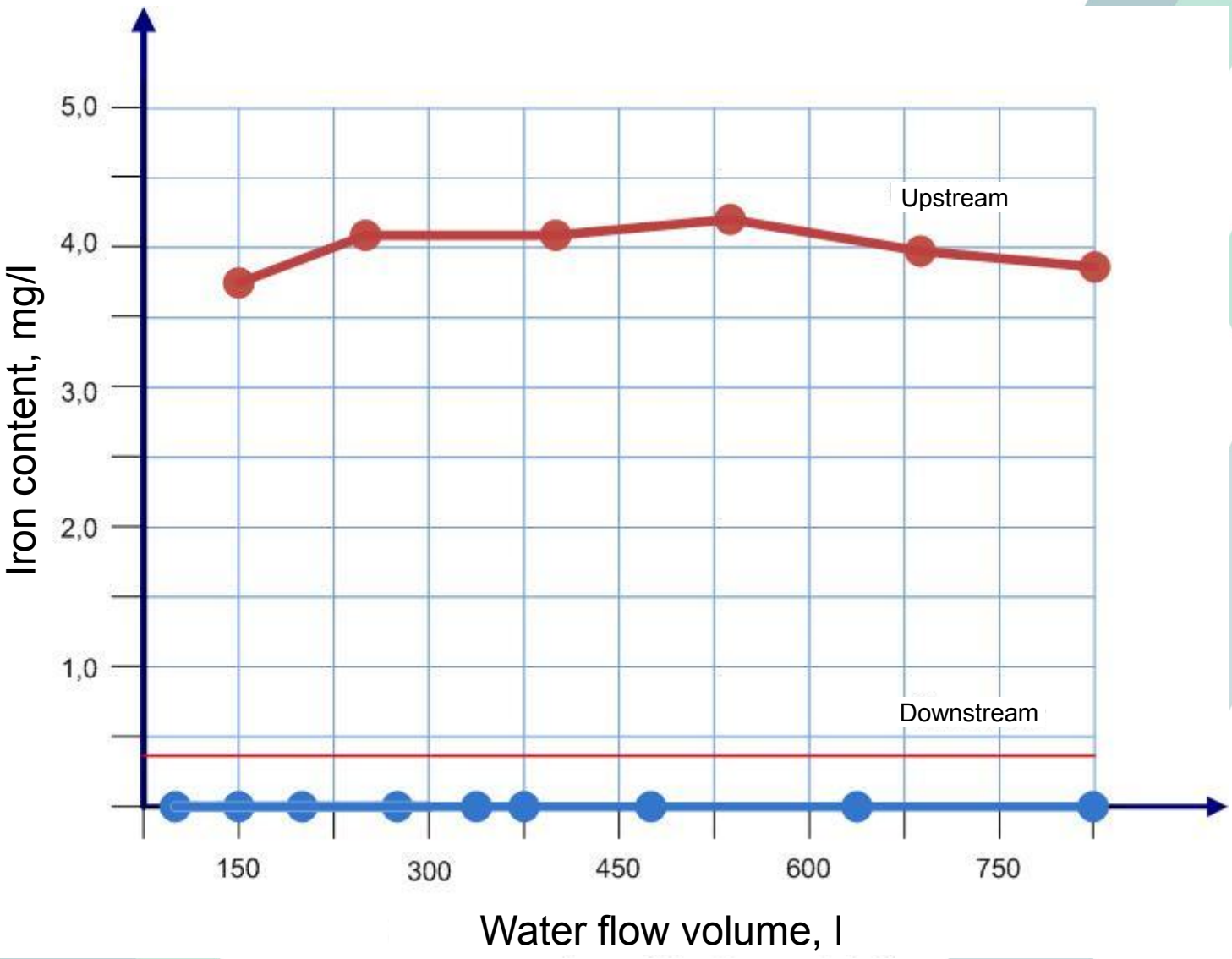
Cartridges' ARAGON Test Data

Institute of Filtration and Separation Techniques

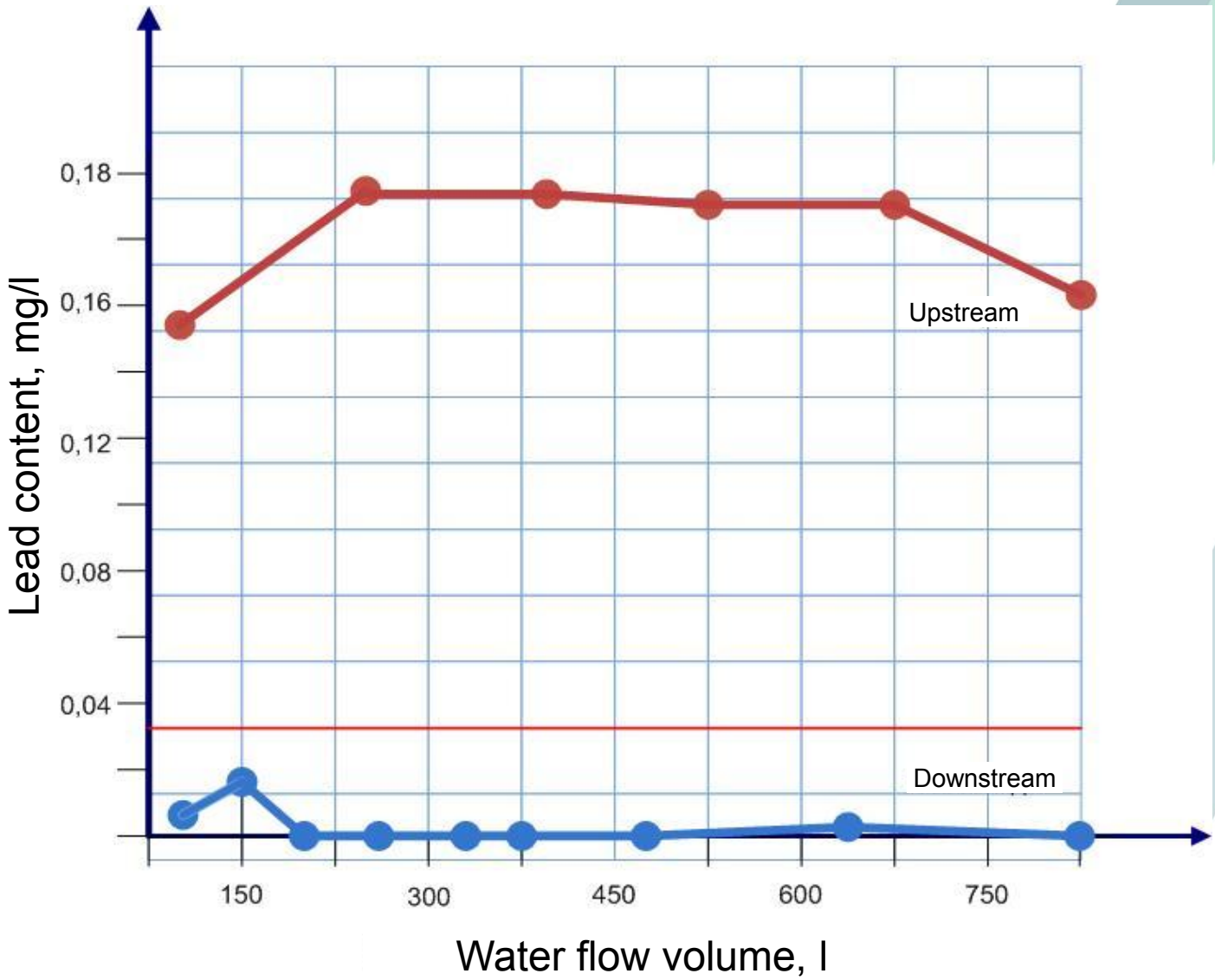
IFTS, France

Saint Petersburg, 2014

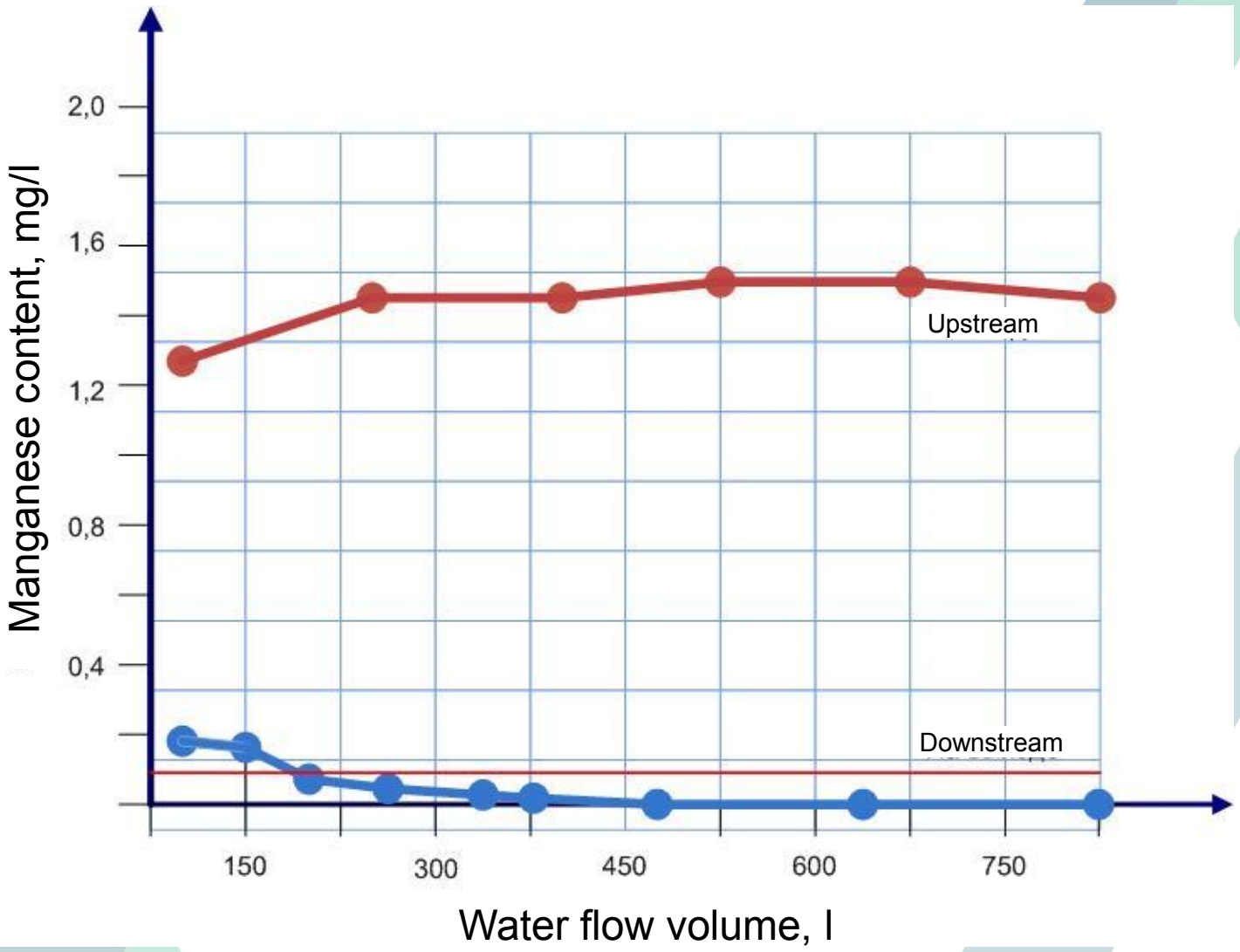
Iron Removal Efficiency



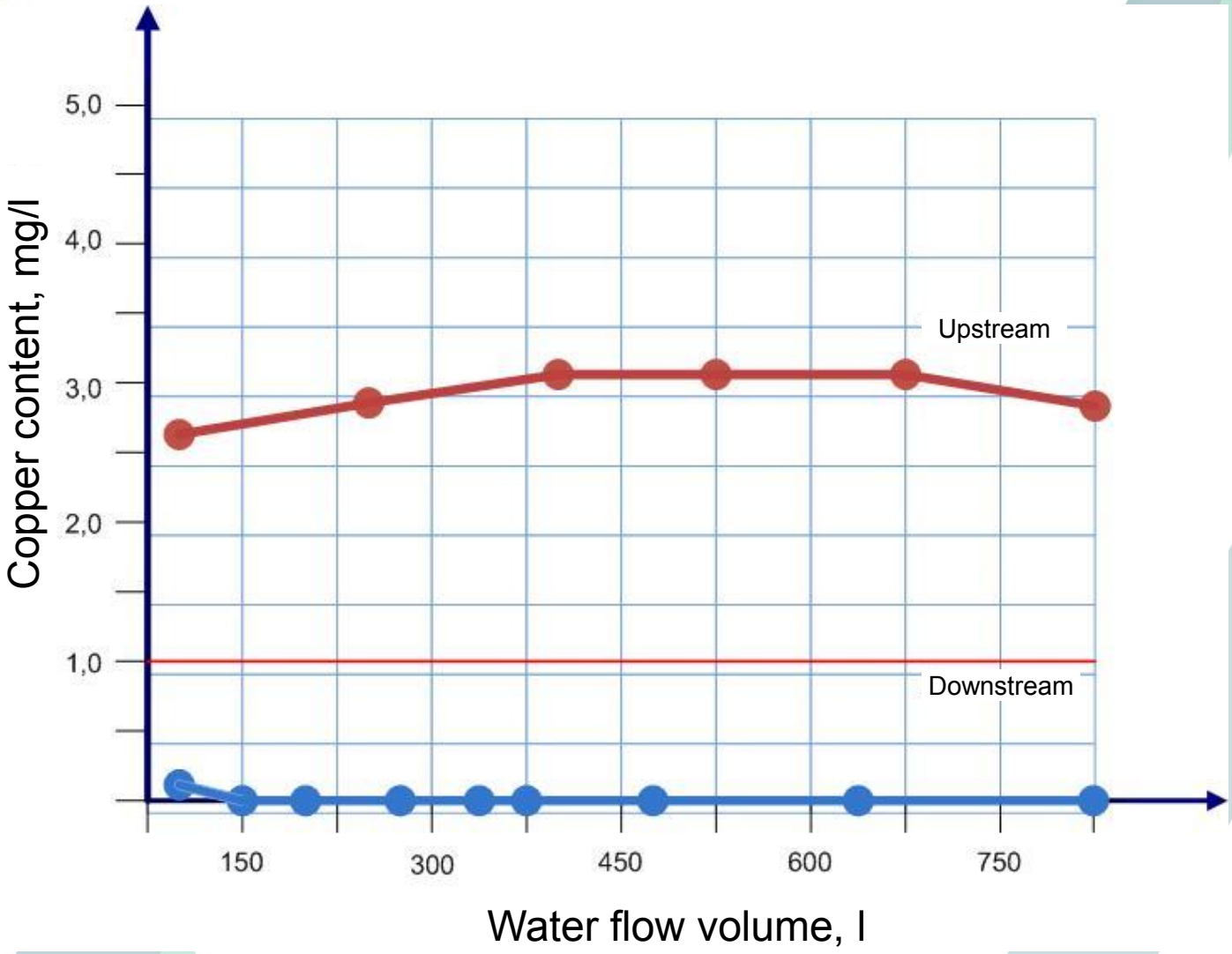
Lead Removal Efficiency



Manganese Removal Efficiency



Copper Removal Efficiency



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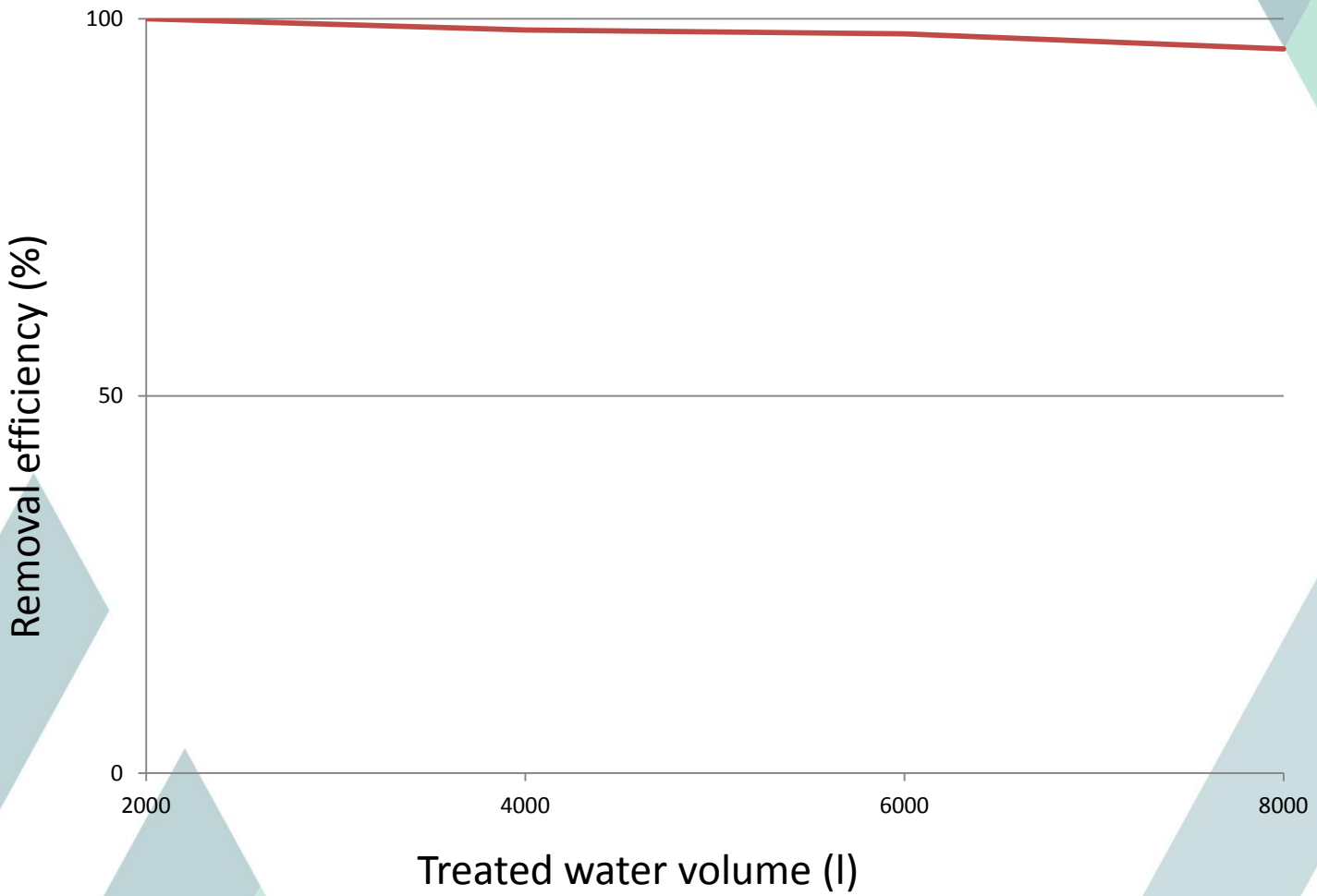
Removal of Contaminants. **ARAGON Sorption** Properties.

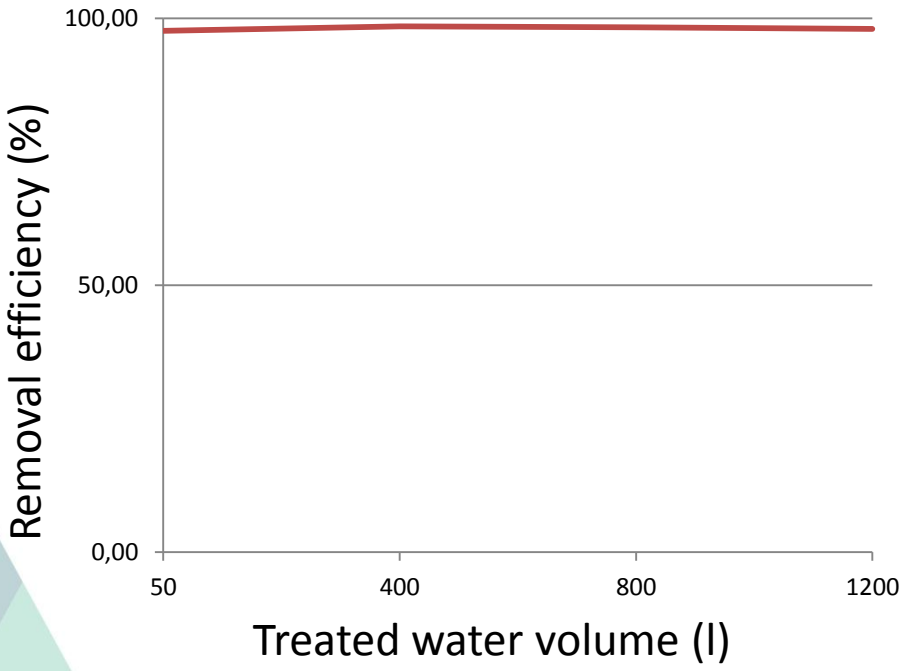
Saint Petersburg, 2014

Free Chlorine Removal



Pesticides Removal Efficiency (through the example of simazin)

Treated water volume (l)	Inlet concentration, mg/l	Outlet concentration, mg/l	Removal efficiency (%)
50	1,1	0,01	97,62
400	1,0	0,015	98,50
800	1,2	0,02	98,33
1200	1,0	0,02	98,00



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Quasi-Softening

Saint Petersburg, 2014

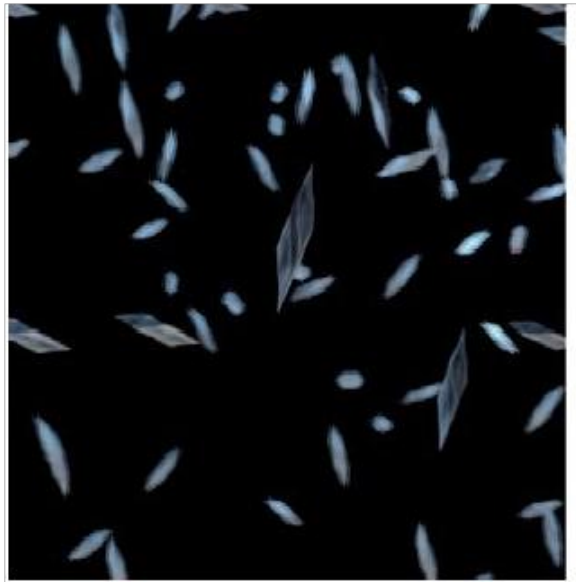
Discovery of Quasi-Softening

Without filter

With filter

The practice of continuous exploitation of filters with ARAGON in different Russian regions with hard water showed the unexpected effect. Even when a filter ion-exchange capacity expires, the treated water does not scale and even destroys the appeared scum.

Quasi-Softening
The invention patent No. 2261843

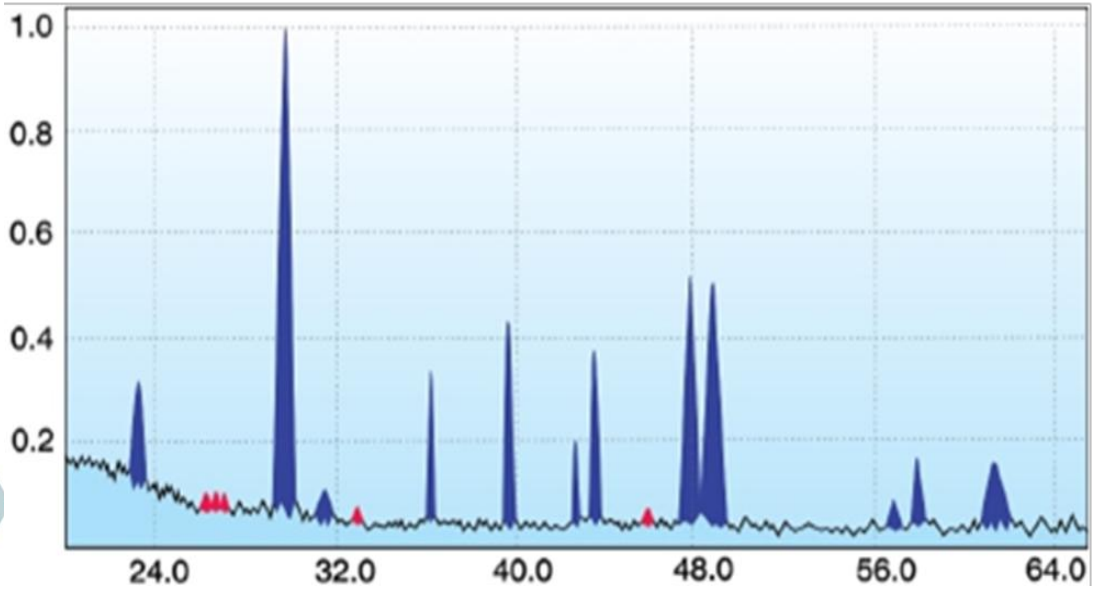


Aragonite

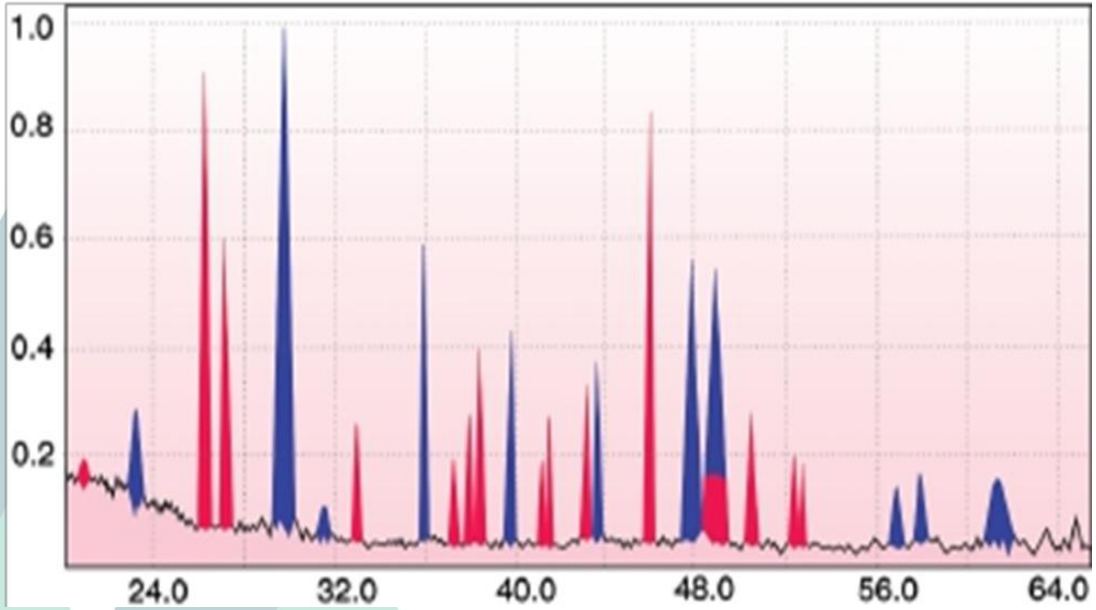
Calcspar

The hardness salts exist in water as metastable structures (clusters). As clusters move in channels between the spherocolloids the pressure increases and causes a shift of chemical balance. That is why, the chemical balance shifts towards dissolution of carbon dioxide contained in the water. Conditions for clusters recrystallization from Calcspar to aragonite are created. Downstream pressure grows and then drops rapidly. Carbon dioxide releases and pH increases; chemical balance shifts towards carbonates formation. The solution is oversaturated with the carbonates and enlarged aragonite seeds are formed. As more heated as less the aragonite solubility.

Water Spectral Structure Change



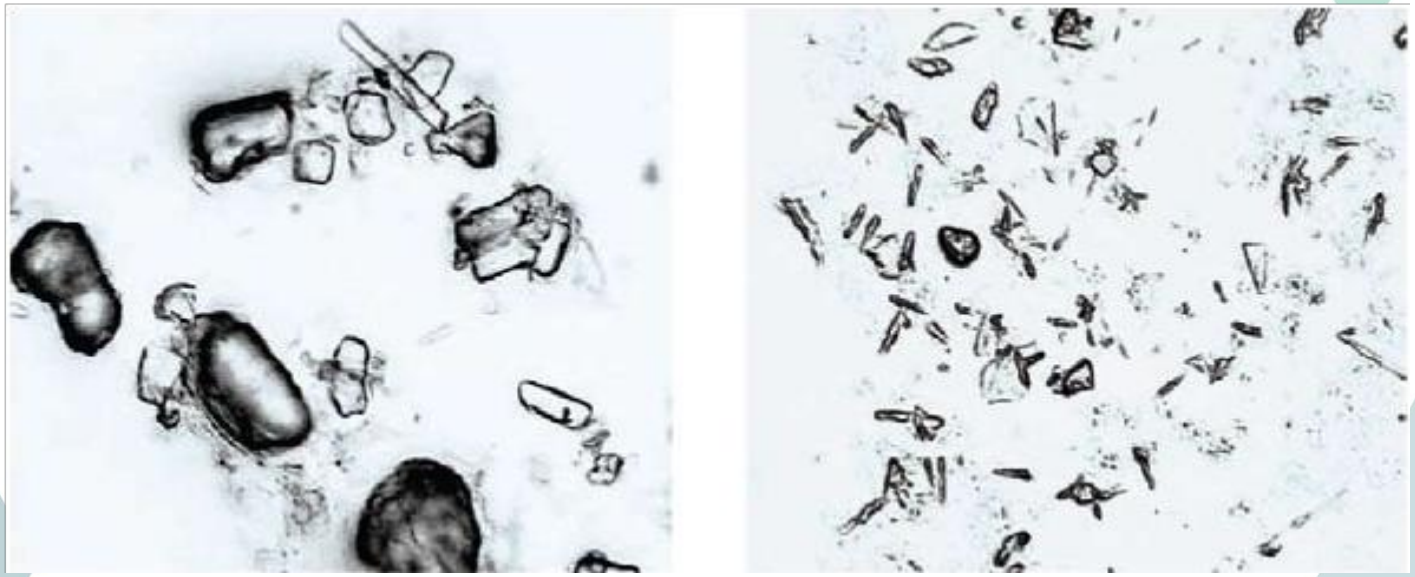
Ordinary hard water:
5% aragonite
95% calcspar



Treated water:
40% aragonite
60% Calcspar

The S.M. Kirov Military Medical Academy

ARAGON is as a mechanism of kidney stone disease prevention



Researches conducted at St. Petersburg Military Medical Academy have shown that when people drink hard water passing-through ARAGON there are less crystals causing lithiasis in people's organisms. The photos of white rats' urine sediment show the sizes difference. The aragonite form of hardness salts contributes to better calcium availability thus lowering the load on kidneys.

ГЕЙЗЕР®
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Viruses and Bacteria Removal By Aragon BIO

Saint Petersburg, 2014

GEYSER®
water filters

AHLSTROM

Nowadays in the world there are only two Companies that can produce cartridges which are able to delete all viruses and bacteria from water – GEYSER (Russia) and AHLSTROM (USA).

Geyser Group of Companies produces the cartridges based on SGS-polymers, and the American company uses nanoaluminium sorbing agent.

Method of Viruses Removal from Water. Invention Patent

РОССИЙСКАЯ ФЕДЕРАЦИЯ

ПАТЕНТ

НА ИЗОБРЕТЕНИЕ

№ 2506232

СПОСОБ ИНАКТИВАЦИИ ВИРУСОВ В ВОДНЫХ СРЕДАХ

Патентообладатель(ли): *ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ "АКВАТОРИЯ" (RU)*

Автор(ы): *Фридкин Александр Михайлович (RU), Гребенщиков Николай Романович (RU), Сафин Валерий Мансурович (RU)*

Заявка № **2012117611**

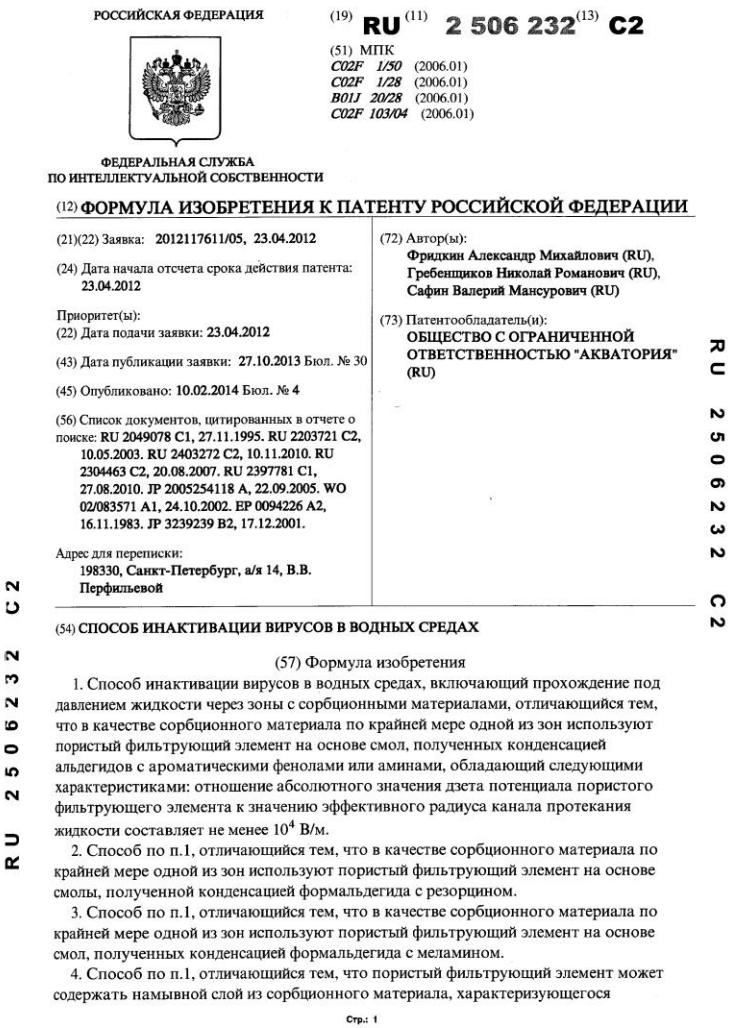
Приоритет изобретения **23 апреля 2012 г.**

Зарегистрировано в Государственном реестре изобретений Российской Федерации ***10 февраля 2014 г.***

Срок действия патента истекает **23 апреля 2032 г.**

Руководитель Федеральной службы по интеллектуальной собственности

Б.П. Симонов



РОССИЙСКАЯ ФЕДЕРАЦИЯ

(19) **RU** (11) **2 506 232** (13) **C2**

(51) МПК
C02F 1/50 (2006.01)
C02F 1/28 (2006.01)
B01J 20/28 (2006.01)
C02F 103/04 (2006.01)

ФЕДЕРАЛЬНАЯ СЛУЖБА ПО ИНТЕЛЛЕКТУАЛЬНОЙ СОБСТВЕННОСТИ

(12) **ФОРМУЛА ИЗОБРЕТЕНИЯ К ПАТЕНТУ РОССИЙСКОЙ ФЕДЕРАЦИИ**

(21)(22) Заявка: **2012117611/05, 23.04.2012**

(24) Дата начала отсчета срока действия патента:
23.04.2012

Приоритет(ы):
(22) Дата подачи заявки: **23.04.2012**

(43) Дата публикации заявки: **27.10.2013** Бюл. № 30

(45) Опубликовано: **10.02.2014** Бюл. № 4

(56) Список документов, цитированных в отчете о поиске: **RU 2049078 C1, 27.11.1995. RU 2203721 C2, 10.05.2003. RU 2403272 C2, 10.11.2010. RU 2304463 C2, 20.08.2007. RU 2397781 C1, 27.08.2010. JP 2005254118 A, 22.09.2005. WO 02/083571 A1, 24.10.2002. EP 0094226 A2, 16.11.1983. JP 3239239 B2, 17.12.2001.**

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(72) Автор(ы):
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Сафин Валерий Мансурович (RU)

(73) Патентообладатель(и):
ОБЩЕСТВО С ОГРАНИЧЕННОЙ ОТВЕТСТВЕННОСТЬЮ "АКВАТОРИЯ" (RU)

RU 2506232 C2

RU 2506232 C2

(54) **СПОСОБ ИНАКТИВАЦИИ ВИРУСОВ В ВОДНЫХ СРЕДАХ**

(57) Формула изобретения

1. Способ инактивации вирусов в водных средах, включающий прохождение под давлением жидкости через зоны с сорбционными материалами, отличающийся тем, что в качестве сорбционного материала по крайней мере одной из зон используют пористый фильтрующий элемент на основе смол, полученных конденсацией альдегидов с ароматическими фенолами или аминами, обладающий следующими характеристиками: отношение абсолютного значения дзета потенциала пористого фильтрующего элемента к значению эффективного радиуса канала протекания жидкости составляет не менее 10^4 В/м.

2. Способ по п.1, отличающийся тем, что в качестве сорбционного материала по крайней мере одной из зон используют пористый фильтрующий элемент на основе смолы, полученной конденсацией формальдегида с резорцином.

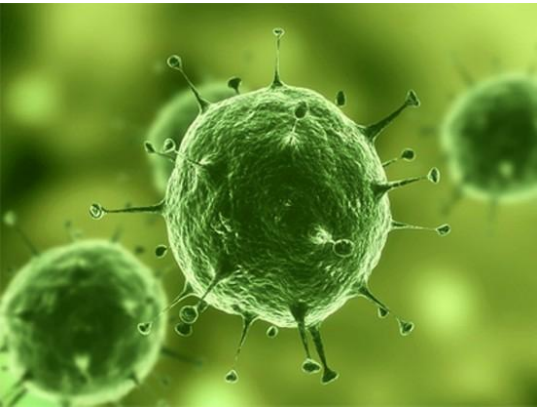
3. Способ по п.1, отличающийся тем, что в качестве сорбционного материала по крайней мере одной из зон используют пористый фильтрующий элемент на основе смол, полученных конденсацией формальдегида с меламином.

4. Способ по п.1, отличающийся тем, что пористый фильтрующий элемент может содержать намывной слой из сорбционного материала, характеризующегося

Стр.: 1

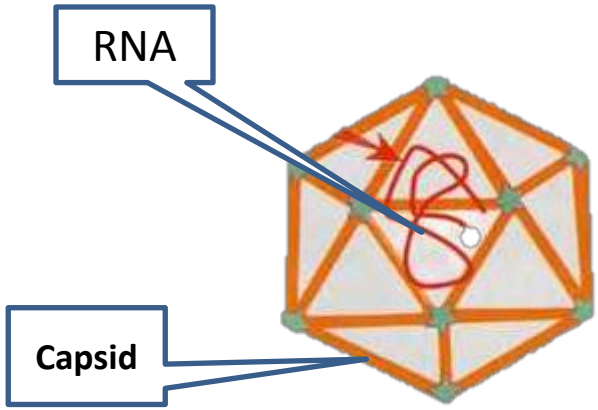
Classification of Viruses

Class of Viruses	Size (µm)	Share (%)	Diseases
Hepatitis A	27 – 32	3	Hepatitis
Norovirus	27 - 40	82	Intestinal influenza and acute enteric infection
Rotavirus	60 - 70	5	Rotaviral enteritis
Entero- and astroviruses	27 - 30	5	Poliomyelitis, etc.
Adenoviruses	70 - 90	5	Catarrhs of the upper respiratory tract , conjunctivitis, atypical pneumonia, etc.



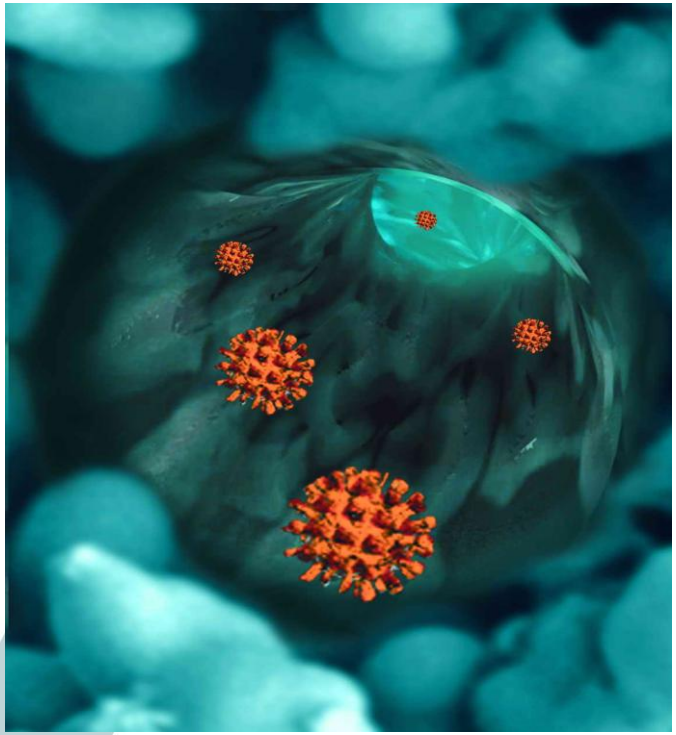
The enemy without taste and smell

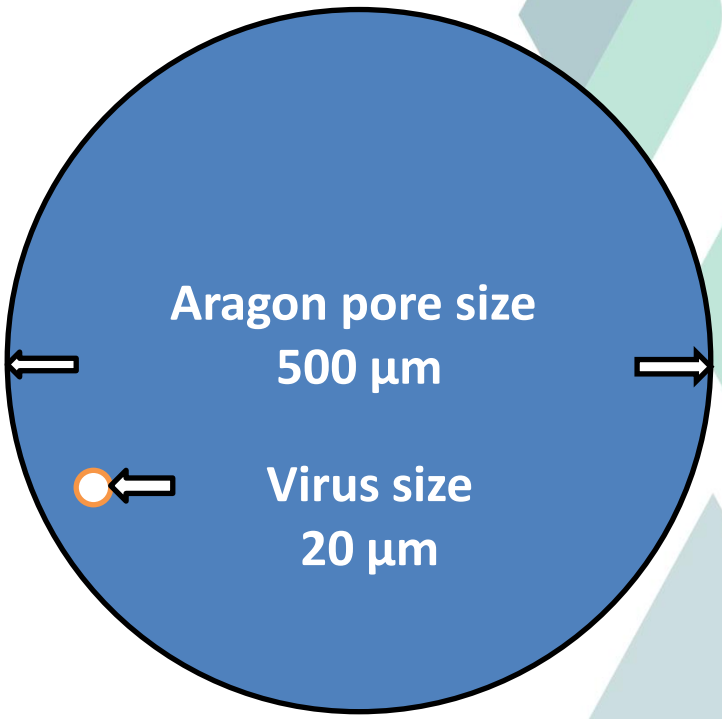
The virus cannot reproduce itself independently. In fact, it is some biological organization the main purpose of which is to find an object to reproduce into.



Most of the viruses have an envelope (capsid) protecting RNA in which the division process is preprogrammed.
To neutralize a virus it is enough to destroy the capsid or damage RNA.

Viruses Removal Mechanism



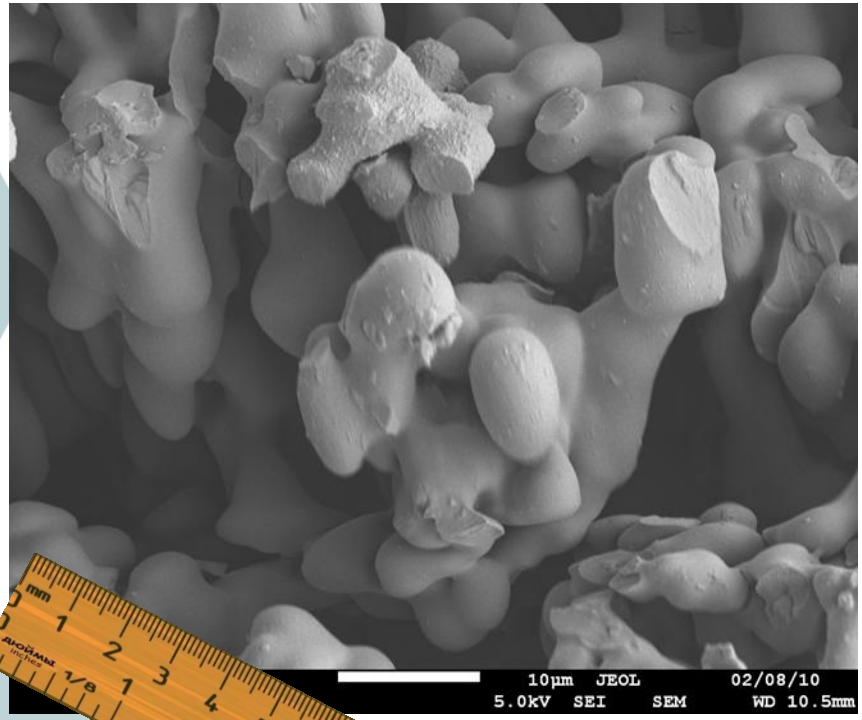


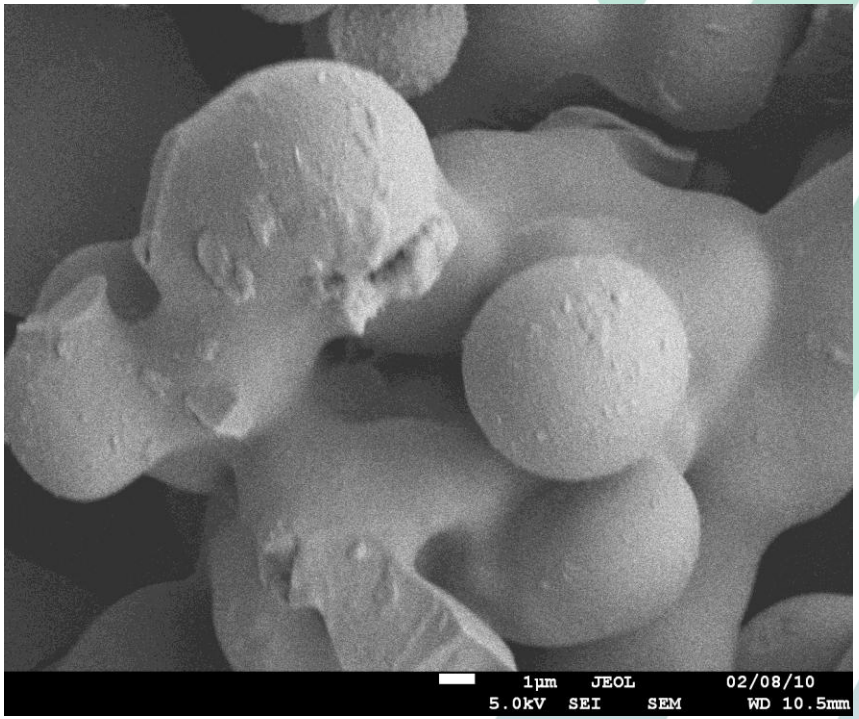
It has been established that Aragon pores are determined to have intensive surface potential that is opposite to the viruses' charges. That is why, when water with viruses passes through the Aragon pores the electric interaction between the material and viruses appears. This electric interaction is the same as one between opposite charges.

ARAGON Photos Made By an Electronic Microscope

10 µm

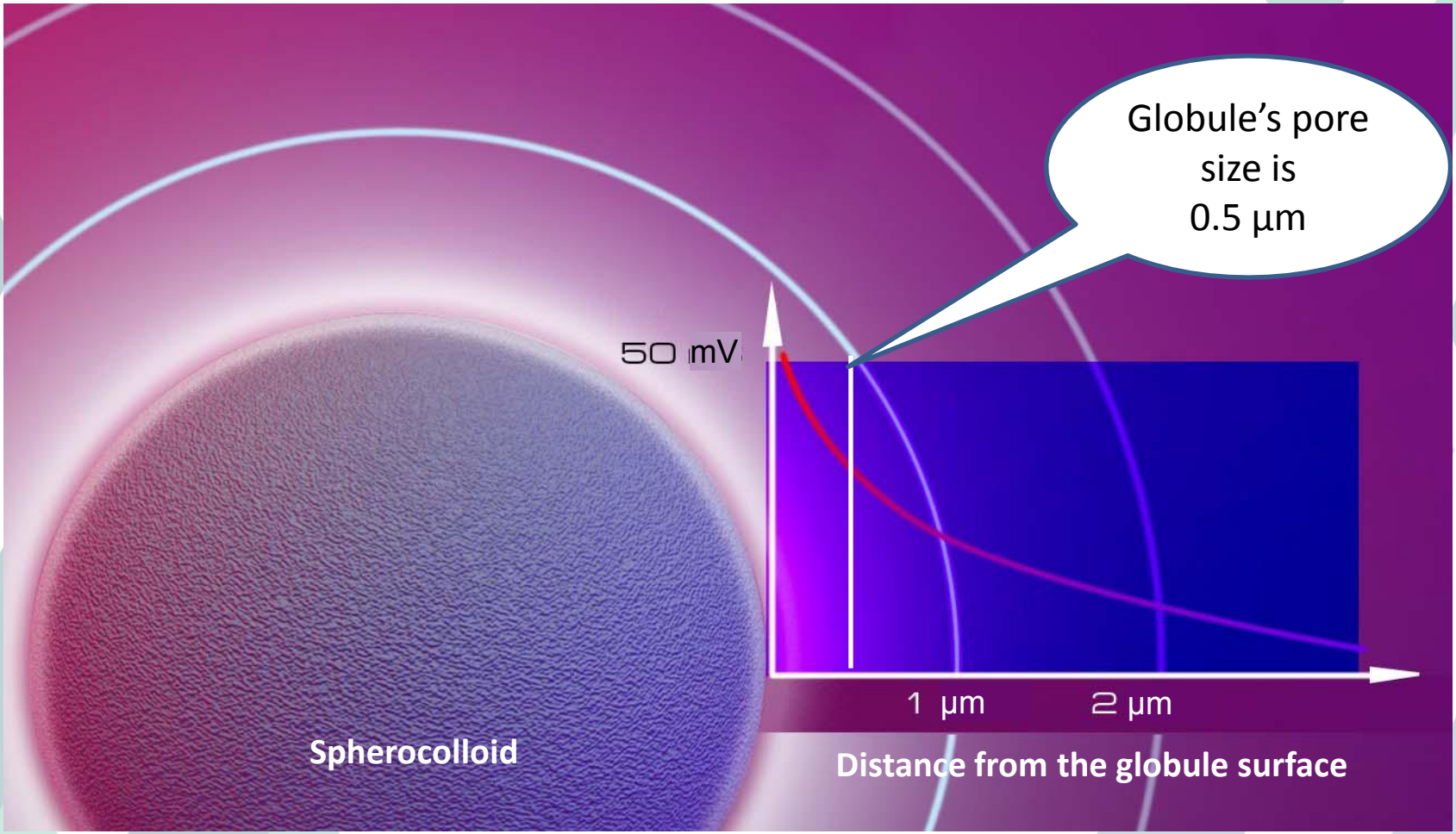
1 µm





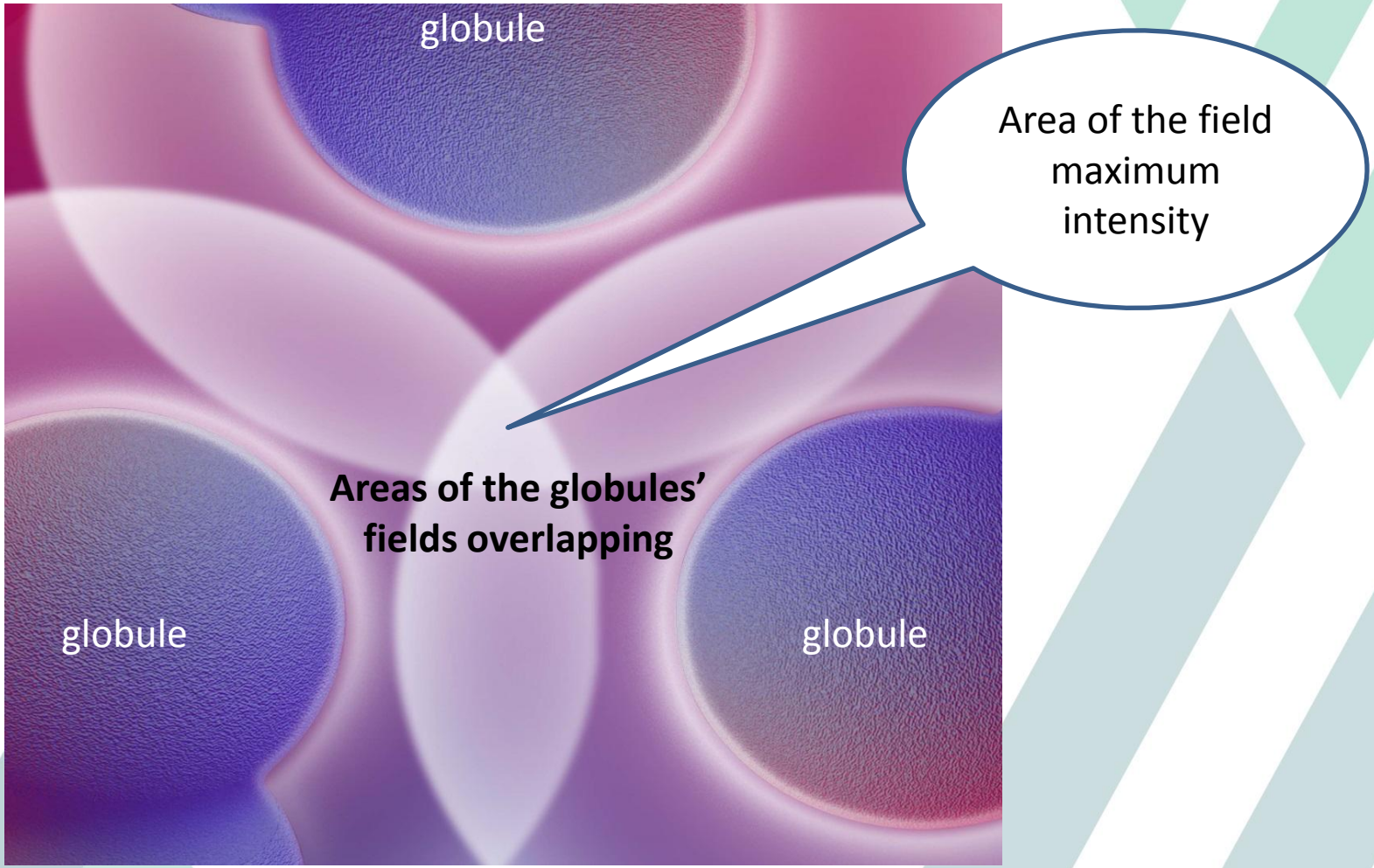
The Electric Field of a Globule

The surface of a globule has negative charge and forms strong magnetic field developed around it. That covers the entire pore fully.

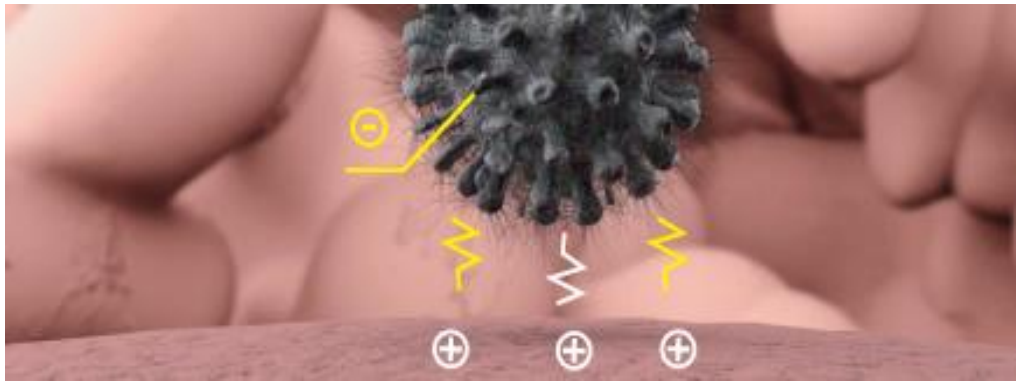


The Electric Field Inside the Pore

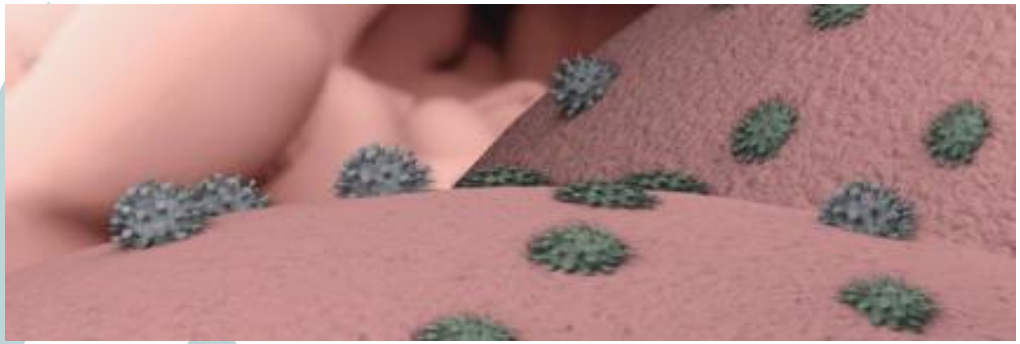
As a result of overlapping of individual globules' fields, high gradient electric field of high intensity is formed inside the pore.



Electrokinetic mechanism of impact on viruses

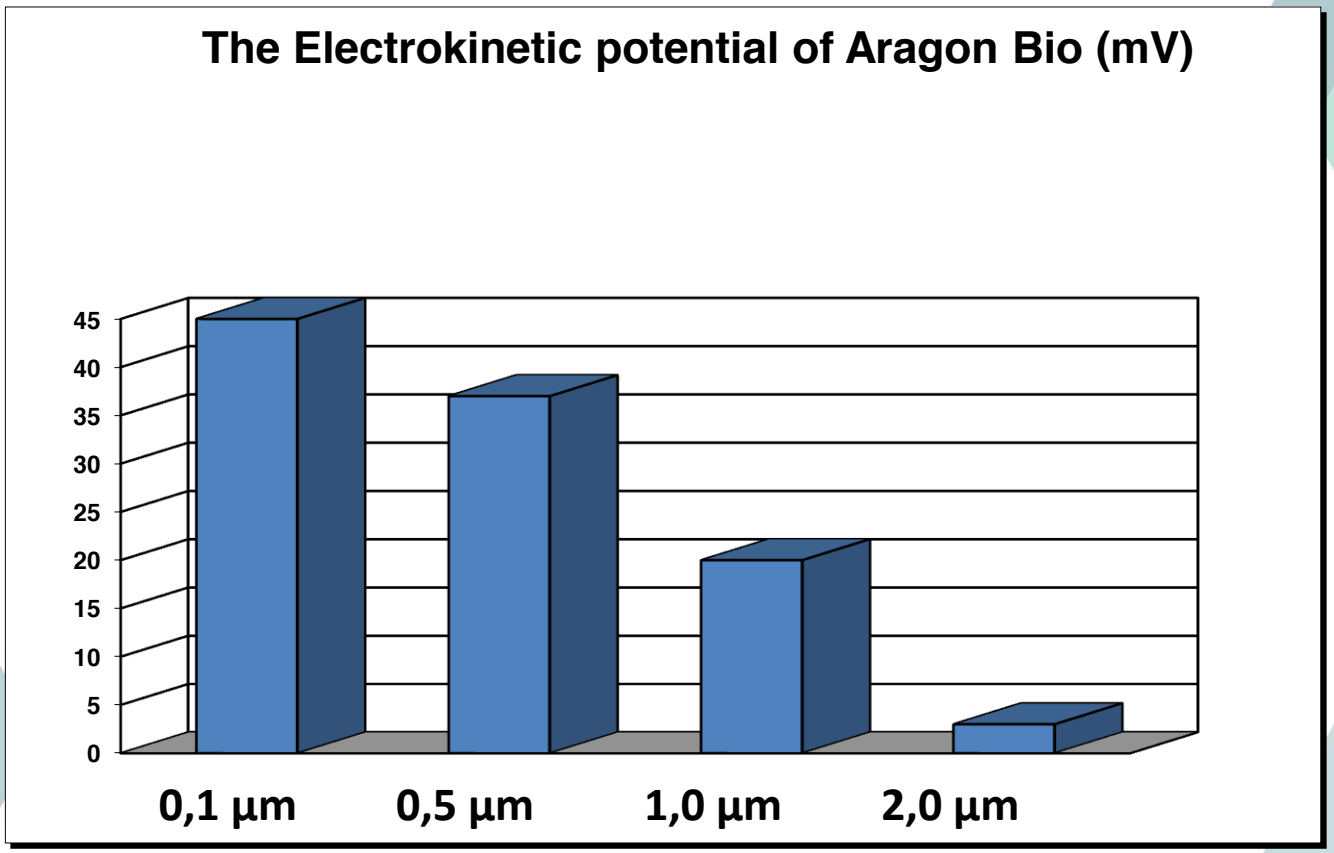


The electric field destroys the external protective cover of a virus.



Without the envelope a virus dies fast

The Results of Filtering Materials ζ-Potential Dimensions



The ζ-potential decreases as more as a pore size increases (from 0.5 to 2 µm). Thus, we can vary globules relative position and size and endue the polymer with the power to remove bacteria and viruses effectively.

The Aragon BIO Ability to Retain Viruses and Bacteria Tested & Confirmed

The V.G. Khlopin Radium Institute

The S.M. Kirov Military Medical Academy
2008

The Research Institute of Epidemiology and Microbiology named after L. Pasteur
2007 – 2010

The Research Institute of Human Ecology and Enviroµmental Health named after A.N. Sysin
2011

The Research Institute of Influenza
2011

Università di Ferrara
2012 г.

Institut Pasteur de Lille
2014 г.

The Opinion of the Research Institute of Human Ecology and Enviroμmental Health Named After A.N. Sysin (Russia)

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ
И СОЦИАЛЬНОГО РАЗВИТИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

ФЕДЕРАЛЬНОЕ ГОСУДАРСТВЕННОЕ БЮДЖЕТНОЕ УЧРЕЖДЕНИЕ
«НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ИНСТИТУТ ЭКОЛОГИИ ЧЕЛОВЕКА
И ГИГИЕНЫ ОКРУЖАЮЩЕЙ СРЕДЫ ИМ. А.Н.СЫСИНА»

Исх. №_____ от_____
на №_____

Российская Федерация, 119992, Москва, Погодинская ул. 10/15, стр.1
Телефон: 8 (499) 246 5824, Факс: 8 (499) 245 0374, E-mail: sysin@comcor.ru

УТВЕРЖДАЮ
Директор ФГБУ «НИИ ЭЧ и ГОС им. А.Н.Сысина»
Минздравсоцразвития России
_____ Ю.А. Рахманин
«___» _____ 2011 г.

ЗАКЛЮЧЕНИЕ

по результатам гигиенической оценки эффективности очистки воды от химических и микробных загрязнений воды ионообменными картриджами АРАГОН-БИО производства ООО «Акватория»

Гигиеническая оценка эффективности работы ионообменных фильтров АРАГОН-БИО выполнена в комплексных исследованиях, проведенных на базе ФГБУ НИИ Экологии человека и гигиены окружающей среды им. А.Н.Сысина Минздравсоцразвития России и ФГУН «Санкт-Петербургский НИИ Эпидемиологии и микробиологии им. Пастера» Роспотребнадзора в соответствии с требованиями ГОСТА Р 51871 «Устройства водоочистные. Общие требования к эффективности и методы ее определения».

На основании проведенных исследований были сделаны следующие выводы:

1. Испытанные ионообменные картриджи АРАГОН-БИО показали 100% эффективность очистки воды от вирусного загрязнения, проведенного на модельных водах с исходной концентрацией норовирусов и гепатита А до $1x10^9$ ТЦД/мл и ротавирусов - до $1x10^{10}$ ТЦД/мл.
2. В ресурсных испытаниях картриджей АРАГОН-БИО получен 100% вирулицидный эффект в отношении ротавирусов при их концентрации $1x10^6$ ТЦД/мл на протяжении всего ресурса (50 л, 200 л, 1000 л, 2000 л и 5000 л).
3. Оценка эффективности очистки воды в аварийных ситуациях от бактериального загрязнения, проведенное на водопроводной воде, контаминированной канализационными стоками с исходной концентрацией E.coli $2,2x10^5$ КОЕ/мл показало, что картриджи АРАГОН-БИО обеспечивают 100% эффективность задержки E.coli и соответствие очищенной воды требованиям, предъявляемым к питьевой воде.
4. Оценка эффективности очистки воды от различных химических загрязнений, в частности, металлов при их начальной концентрации 2ПДК показало, что ионообменные картриджи АРАГОН-БИО обеспечивают эффективную очистку от свинца (75%) , алюминия (96%), железа (98%), меди (92%).
5. На основании данных физико-химических и микробиологических исследований фильтры с ионообменными картриджами АРАГОН-БИО рекомендованы для дообеззараживания (E.Coli, гепатит А, ротавирусы, норовирусы) и доочистки водопроводной воды от химических загрязнений (свинец, алюминий, железо, медь) и улучшения органолептических показателей. Фильтры с картриджем АРАГОН-БИО могут быть рекомендованы для использования в дошкольных и школьных учреждениях, учреждениях социального профиля, лечебных и других учреждениях.

Зав лабораторией гигиены питьевого
водоснабжения и санитарной охраны водоемов,
д.м.н., профессор Михайлова Р.И.

"The tested Aragon cartridges have shown 100% water decontamination efficiency from viral pollution The tests were conducted on model with initial concentration of Norovirus and Hepatitis A ($1x10^9$ TCD/m/ml) and Rotavirus (до $1x10^{10}$ TCD/m/ml)".

Федеральное государственное бюджетное учреждение
Научно-исследовательский институт ГРИППА
Министерства здравоохранения и социального развития
Российской Федерации

Заключение

По результатам проведенных исследований по оценке барьерной функции картриджей «АРАГОН-БИО» в отношении ротавирусов и норовирусов при очистке водопроводной воды

На базе Федерального государственного бюджетного учреждения «Научно-исследовательский институт гриппа» Министерства здравоохранения и социального развития Российской Федерации (ФГБУ «НИИ гриппа» Минздравсоцразвития России) было проведено исследование барьерной функции материала «АРАГОН-БИО» в отношении ротавирусов и норовирусов, являющихся наиболее распространенными возбудителями острых кишечных инфекций, передающихся через воду.

На основании проведенных испытаний были сделаны следующие выводы:

1. Фильтр «Гейзер БИО» с картриджем «АРАГОН-БИО» удаляет из воды 99,99% опасных для человека патогенов - ротавирусов и норовирусов.
2. Максимальная концентрация вирусов в воде, полностью задерживаемая картриджем «АРАГОН-БИО», составила $1{,}0x10^8$ частиц/л для ротавирусов и $0{,}5x10^7$ частиц/л для норовирусов, что более чем в 1000 раз превышает максимально возможную концентрацию патогенных вирусов в водопроводной воде.

Таким образом, на основании результатов проведенных вирусологических исследований фильтр «Гейзер БИО» для воды с картриджем «АРАГОН-БИО» можно рекомендовать как простое и эффективное средство дообеззараживания водопроводной воды. Фильтры «Гейзер БИО» могут быть рекомендованы для постоянного использования в дошкольных и школьных учреждениях, учреждениях социального профиля, лечебных и других учреждениях.

Директор ФГБУ «НИИ гриппа»
Минздравсоцразвития России
Академик РАМН

О.И.Киселев

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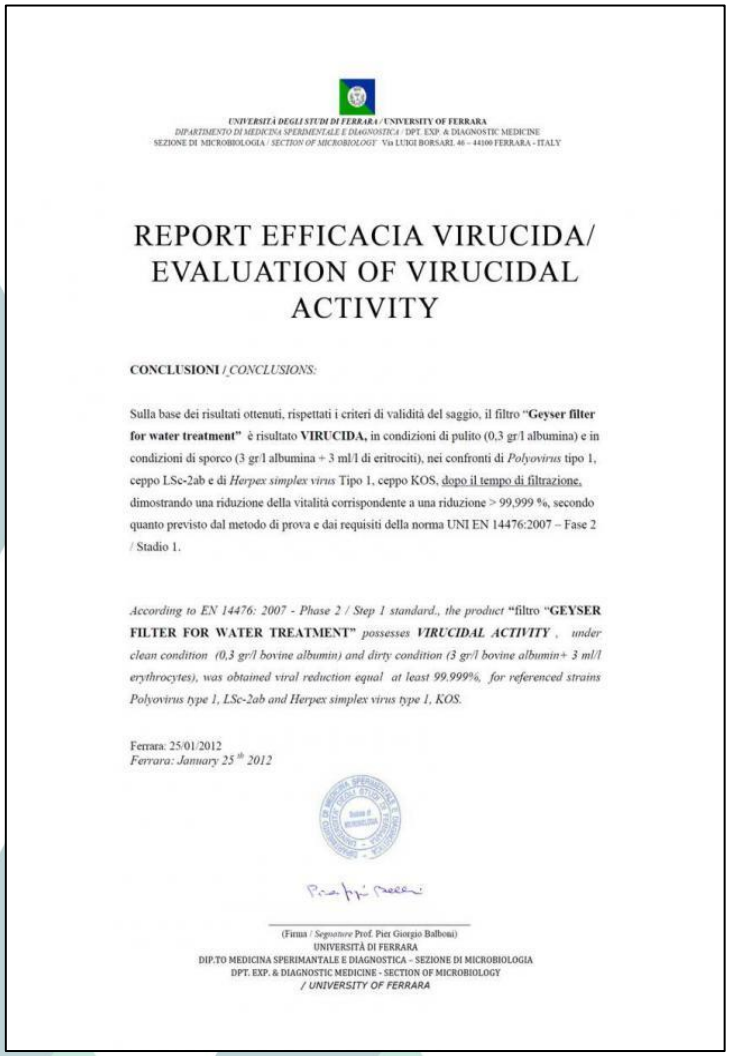
Тел./факс: +7 (812) 234–5973

"The ARAGON BIO filter removes 99.9% of human pathogens, i.e. rotaviruses and noroviruses, from water.

The maximum concentration of viruses in water, completely retained by the filter, is amounted to $1.0x\ 10^8$ U/L for rotaviruses and $0.5x\ 10^7$ for noroviruses.
That is approximately 1000 times higher than maximum possible concentration of pathogenic viruses in the tap water."

Opinion of Università di Ferrara, Italy



UNIVERSITÀ DEGLI STUDI DI FERRARA / UNIVERSITY OF FERRARA
DIPARTIMENTO DI MEDICINA SPERIMENTALE E DIAGNOSTICA / DPT. EXP. & DIAGNOSTIC MEDICINE
SEZIONE DI MICROBIOLOGIA / SECTION OF MICROBIOLOGY Via LUIGI BORSARI, 46 – 44100 FERRARA - ITALY

REPORT EFFICACIA VIRUCIDA/
EVALUATION OF VIRUCIDAL
ACTIVITY

CONCLUSIONI / *CONCLUSIONS:*

Sulla base dei risultati ottenuti, rispettati i criteri di validità del saggio, il filtro "**Geyser filter for water treatment**" è risultato **VIRUCIDA,** in condizioni di pulito (0,3 gr/l albumina) e in condizioni di sporco (3 gr/l albumina + 3 ml/l di eritrociti), nei confronti di *Polyovirus* tipo 1, ceppo LSc-2ab e di *Herpex simplex virus* Tipo 1, ceppo KOS, dopo il tempo di filtrazione, dimostrando una riduzione della vitalità corrispondente a una riduzione > 99,999 %, secondo quanto previsto dal metodo di prova e dai requisiti della norma UNI EN 14476:2007 – Fase 2 / Stadio 1.

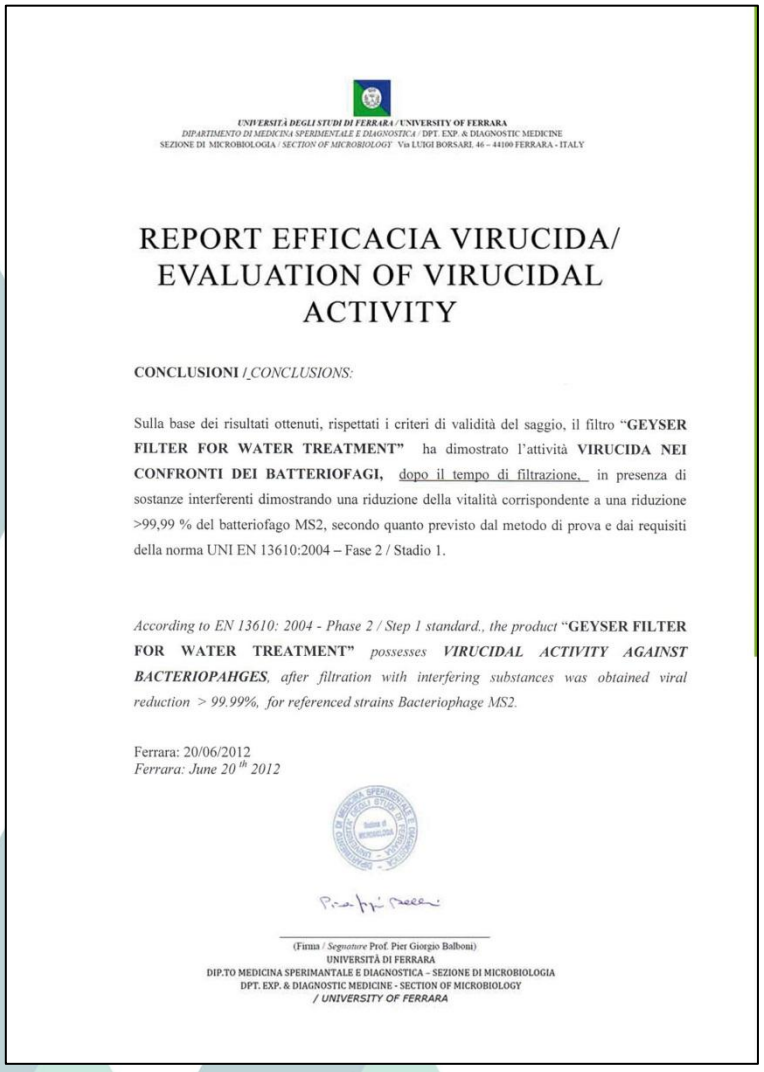
According to EN 14476: 2007 - Phase 2 / Step 1 standard., the product "filtro "**GEYSER FILTER FOR WATER TREATMENT**" *possesses* ***VIRUCIDAL ACTIVITY*** *, under clean condition (0,3 gr/l bovine albumin) and dirty condition (3 gr/l bovine albumin+ 3 ml/l erythrocytes), was obtained viral reduction equal at least 99.999%, for referenced strains Polyovirus type 1, LSc-2ab and Herpex simplex virus type 1, KOS.*

Ferrara: 25/01/2012
Ferrara: January 25th 2012

(Firma / *Signature* Prof. Pier Giorgio Balboni)
UNIVERSITÀ DI FERRARA
DIP.TO MEDICINA SPERIMANTALE E DIAGNOSTICA - SEZIONE DI MICROBIOLOGIA
DPT. EXP. & DIAGNOSTIC MEDICINE - SECTION OF MICROBIOLOGY
/ UNIVERSITY OF FERRARA

"According to the results of laboratory tests due to UNI EN 14476:2007 - phase 2, first step, the filter "Geyser" has antiviral activity and removes herpes virus LSc-2a of the first type and also circulating poliovirus from water. The laboratory tests have proven the reduction of viral load by 99,999%, which is in compliance with the declared standards and the requirements of UNI EN 14476:2007 – phase 2, first step.
The filter's efficiency has been determined as a result of laboratory tests of albumin (0.3 g/l) and also albumin (3 g/l) + erythrocytes (3 ml/l)."

Opinion of Università di Ferrara (Italy)



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DIPARTIMENTO DI MEDICINA SPERIMENTALE E DIAGNOSTICA / DPT. EXP. & DIAGNOSTIC MEDICINE
SEZIONE DI MICROBIOLOGIA / SECTION OF MICROBIOLOGY Via LUIGI BORSARI, 46 – 44100 FERRARA - ITALY

REPORT EFFICACIA VIRUCIDA/
EVALUATION OF VIRUCIDAL
ACTIVITY

CONCLUSIONI / *CONCLUSIONS:*

Sulla base dei risultati ottenuti, rispettati i criteri di validità del saggio, il filtro "**GEYSER FILTER FOR WATER TREATMENT"** ha dimostrato l'attività **VIRUCIDA NEI CONFRONTI DEI BATTERIOFAGI,** dopo il tempo di filtrazione, in presenza di sostanze interferenti dimostrando una riduzione della vitalità corrispondente a una riduzione >99,99 % del batteriofago MS2, secondo quanto previsto dal metodo di prova e dai requisiti della norma UNI EN 13610:2004 – Fase 2 / Stadio 1.

According to EN 13610: 2004 - Phase 2 / Step 1 standard., the product "**GEYSER FILTER FOR WATER TREATMENT"** *possesses* ***VIRUCIDAL ACTIVITY AGAINST BACTERIOPAHGES****, after filtration with interfering substances was obtained viral reduction > 99.99%, for referenced strains Bacteriophage MS2.*

Ferrara: 20/06/2012
Ferrara: June 20th 2012

(Firma / *Segnature* Prof. Pier Giorgio Balboni)
UNIVERSITÀ DI FERRARA
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DPT. EXP. & DIAGNOSTIC MEDICINE - SECTION OF MICROBIOLOGY
/ UNIVERSITY OF FERRARA

"According to the results of laboratory tests, the Geyser filter has antiviral activity and removes bacteriophages from water. The laboratory tests have confirmed the reduction of MS 2 bacteriophage by 99.99%, which is in compliance with the declared standards and the requirements of EN 13610:2004".

Institut Pasteur de Lille (France)

The institute took its name from the famous French microbiologist Louis Pasteur, the founder and the first director. Louis Pasteur was buried in Notre-Dame de Paris cathedral for his prominent services to France, but later reburied in the territory of the Institute (Lille).

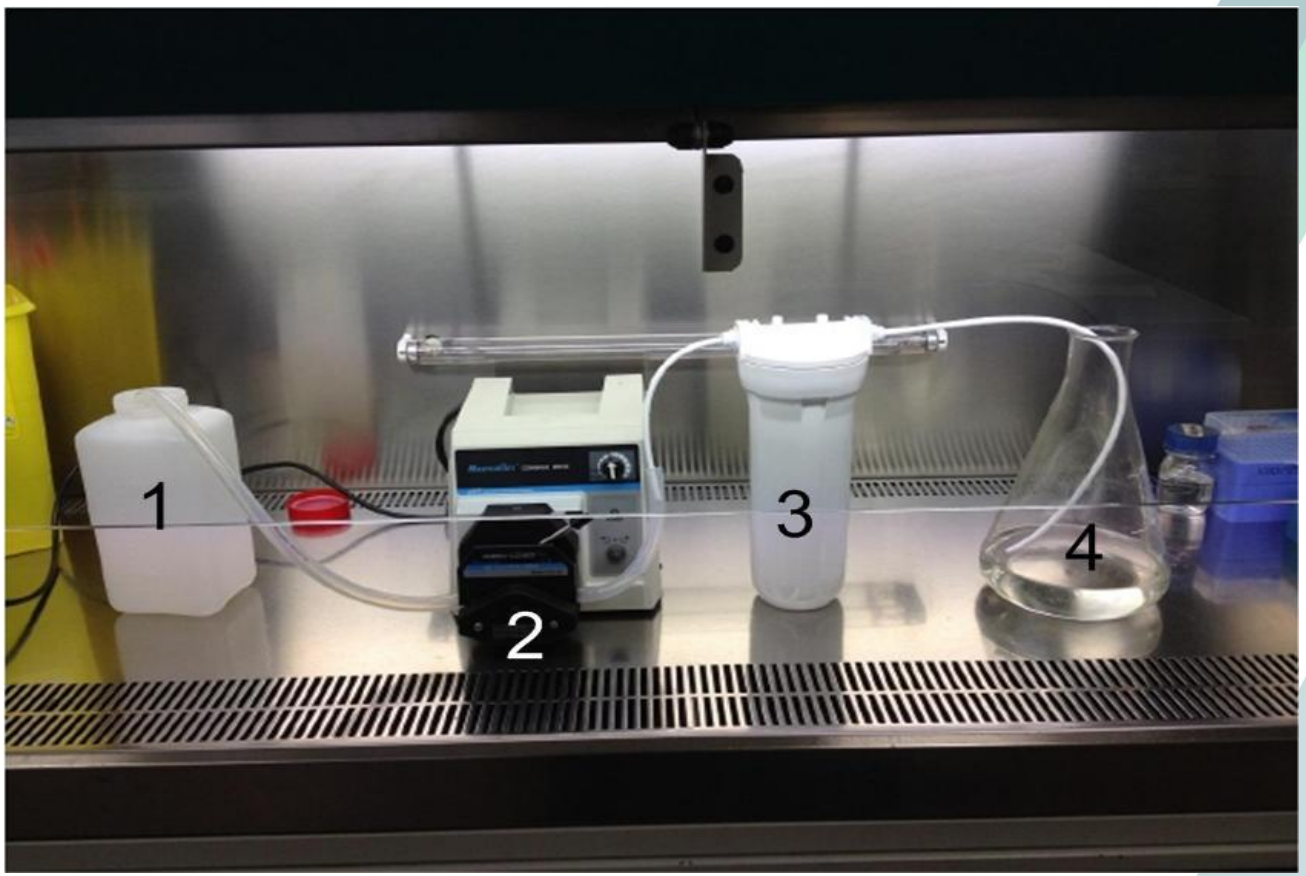
Important discoveries have been made In Pasteur Institute. That contributed to successful control of such virulent diseases as diphtheria, tetanus, tuberculosis, poliomyelitis, influenza, yellow fever and plague. In 1983 the human immunodeficiency virus was discovered in the institute. Since 1908 ten scientists of the institute have received Noble Prizes for Medical Science and Physiology.

How the Tests Were Conducted?

The filtering modules made of ARAGON were taken randomly from the batch. They were placed into a standard series-produced plastic housing. A peristaltic pump was used to circulate water through the modules. Each module was tested once. The tests were conducted with the use of artificially contaminated ultrapure water. Pollution-free water passed through the module prior to the experiment then contaminants were added and the treated water was collected after being filtered.

Photo: the modules and the housing presented to the Institut Pasteur de Lille

Laboratory Setup



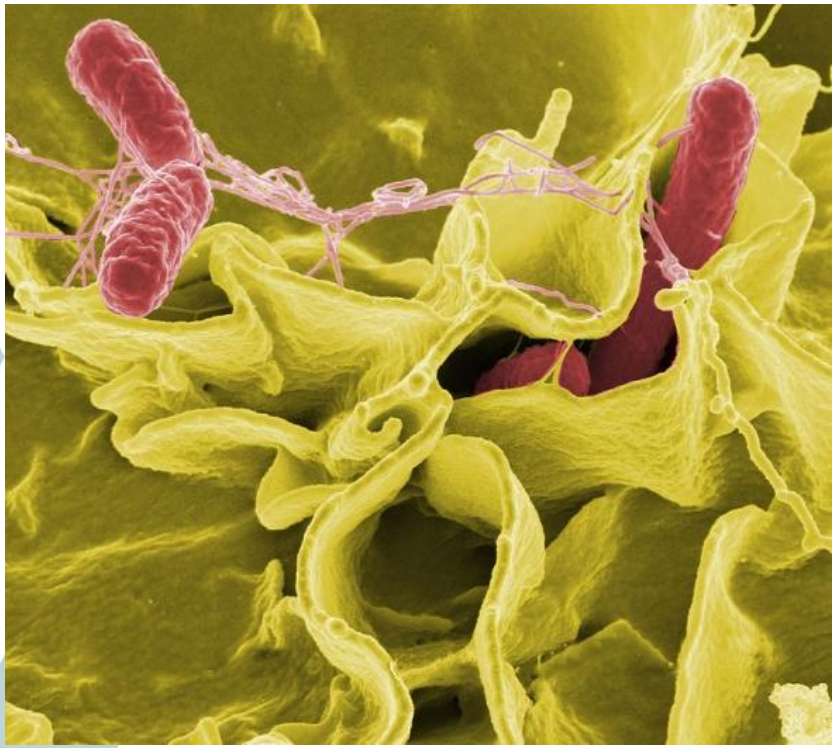
1 – The capacity with artificially polluted water
2 – The peristaltic pump
3 – The filter with the module made of Aragon material
4 – The capacity with water collected downstream of the filter

The photo was presented by Institut Pasteur de Lille

Removal of Bacteria and Viruses

Test strains of bacteria and viruses typical for water supply networks have been selected for the testing.

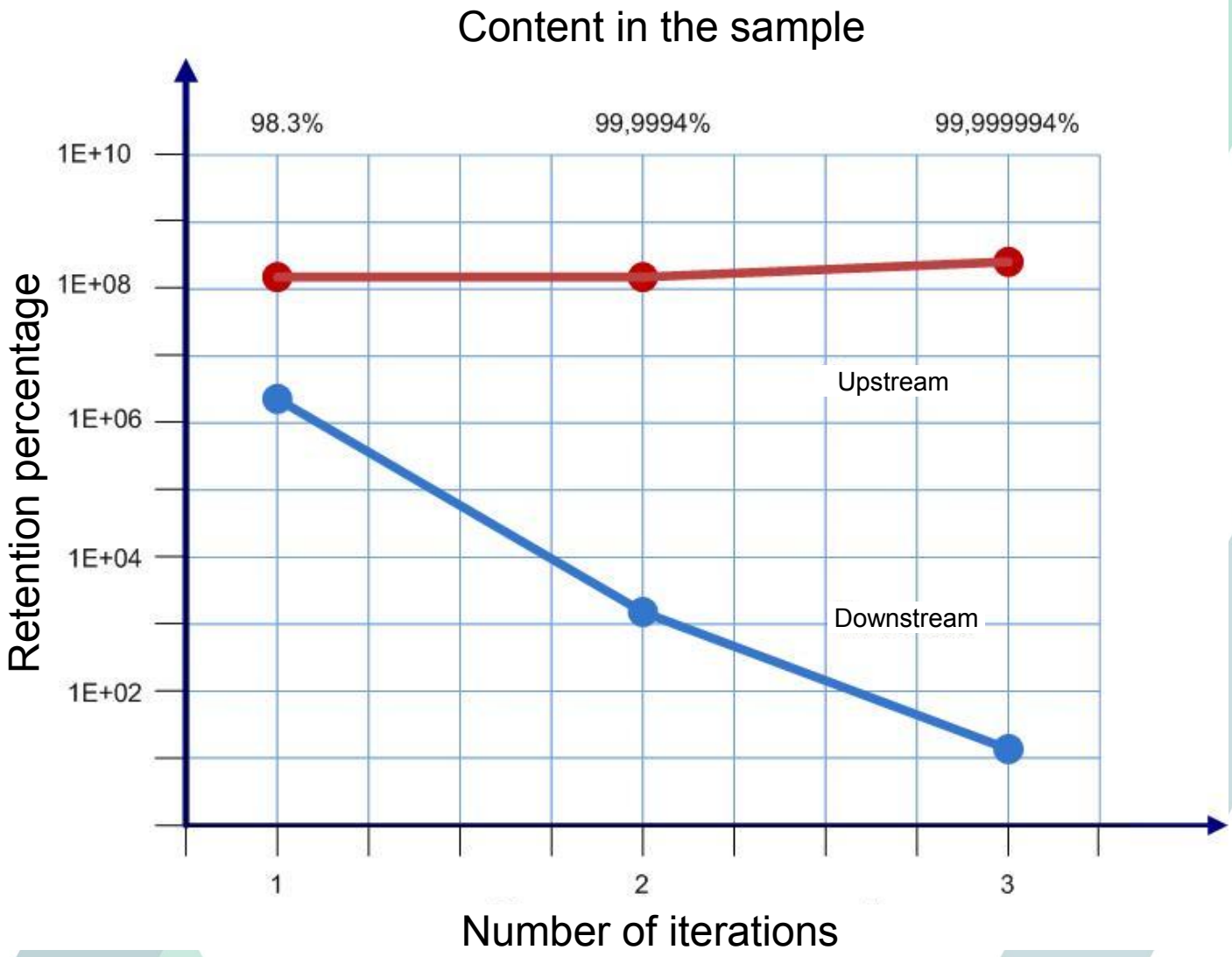
Strains and Media. Bacteria.



Salmonella is a mouse typhus agent. Nonspore-forming rod-shaped bacteria. Length: 1-7 µm; width: around 0.3-0.7 µm. The salmonellas are gram-negative mobile facultative-anaerobic bacilli.

Growth and counting medium: Trypticase soy agar.

Removal of Salmonella

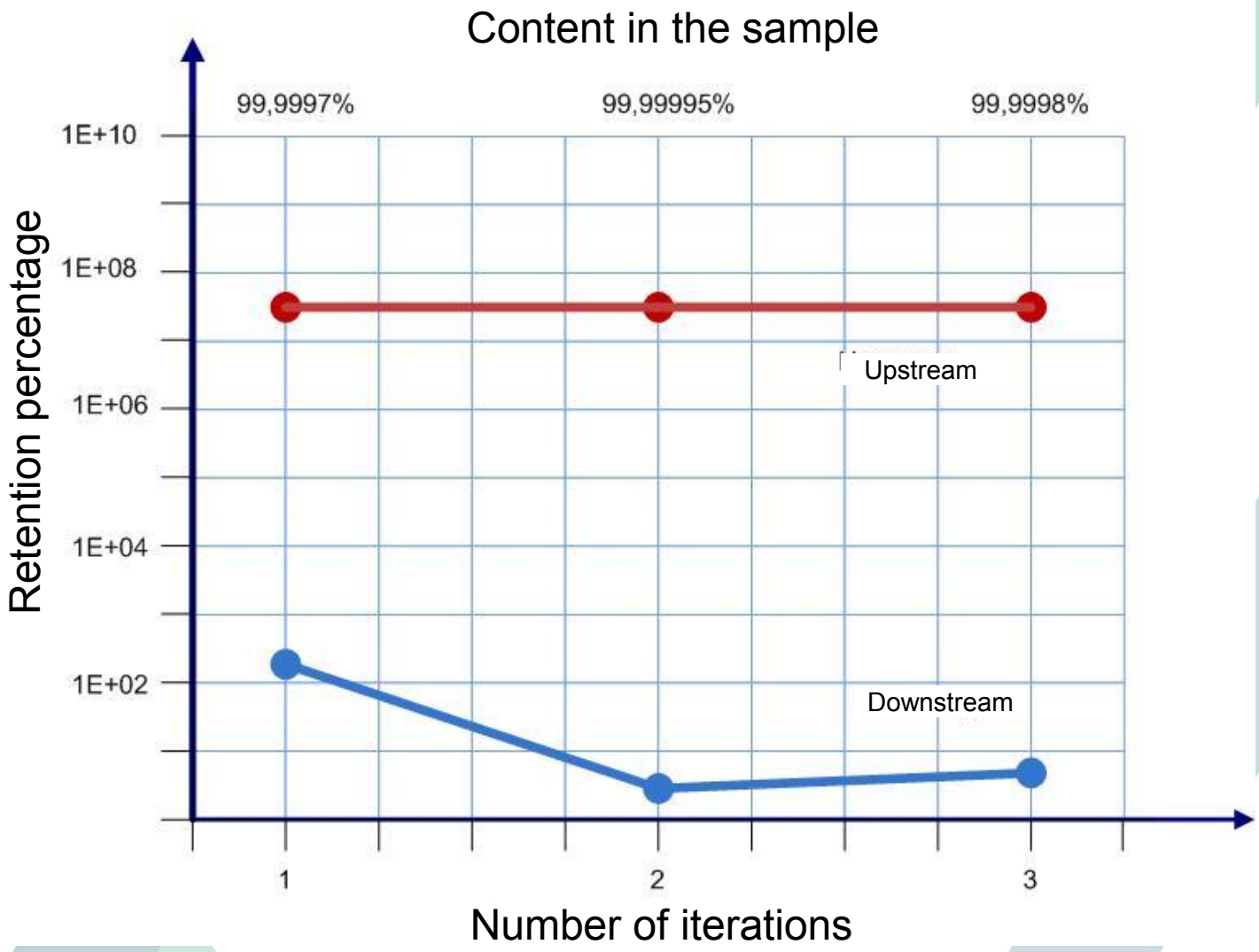


Strains and Media. Bacteria.

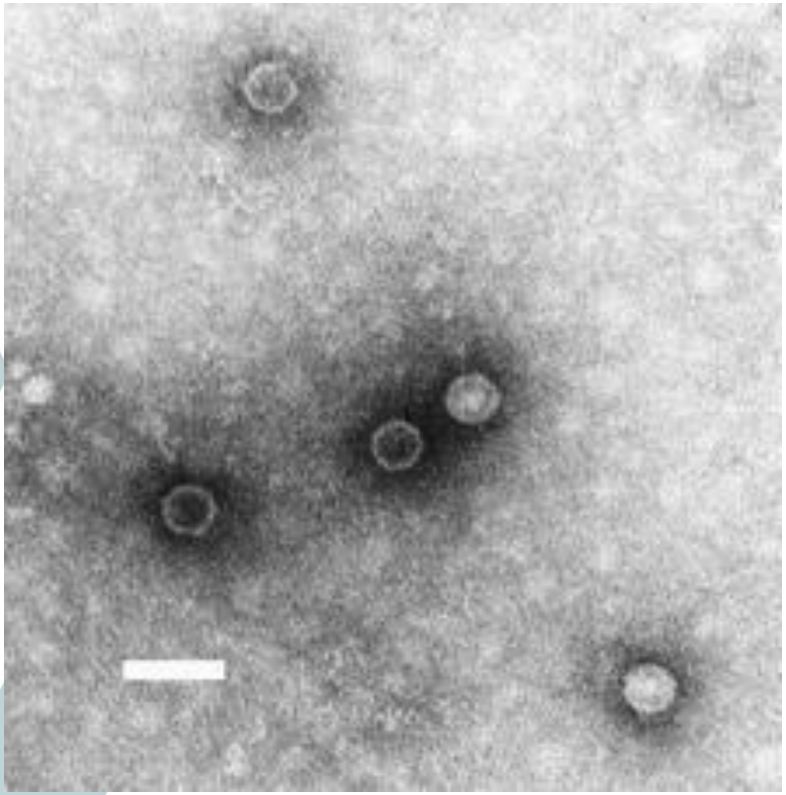
Legionella pneumophila
are pathogenic gram-negative bacteria.
Diameter: 0.2 to 0.7 µm,
length: 2 to 20 µm.

Legionella pneumonia (legionaries' disease). The disease has been known since 1976 when it appeared as ARVI outbreak. This outbreak was characterized by severe pneumonia and high lethality among the participants of “American Legion”, veterans organization’s congress in Philadelphia. 182 of 4400 persons taking part in the congress fell ill, 29 of them died. Meanwhile the term “legionaries’ disease” first appeared. The most common agent is Legionella pneumophilla. The inhabitation places of legionella are fresh water bodies and soil and also water supply and air conditioning systems in buildings, heating water converter plants and shower facilities, fountains, etc.

Removal of Legionella



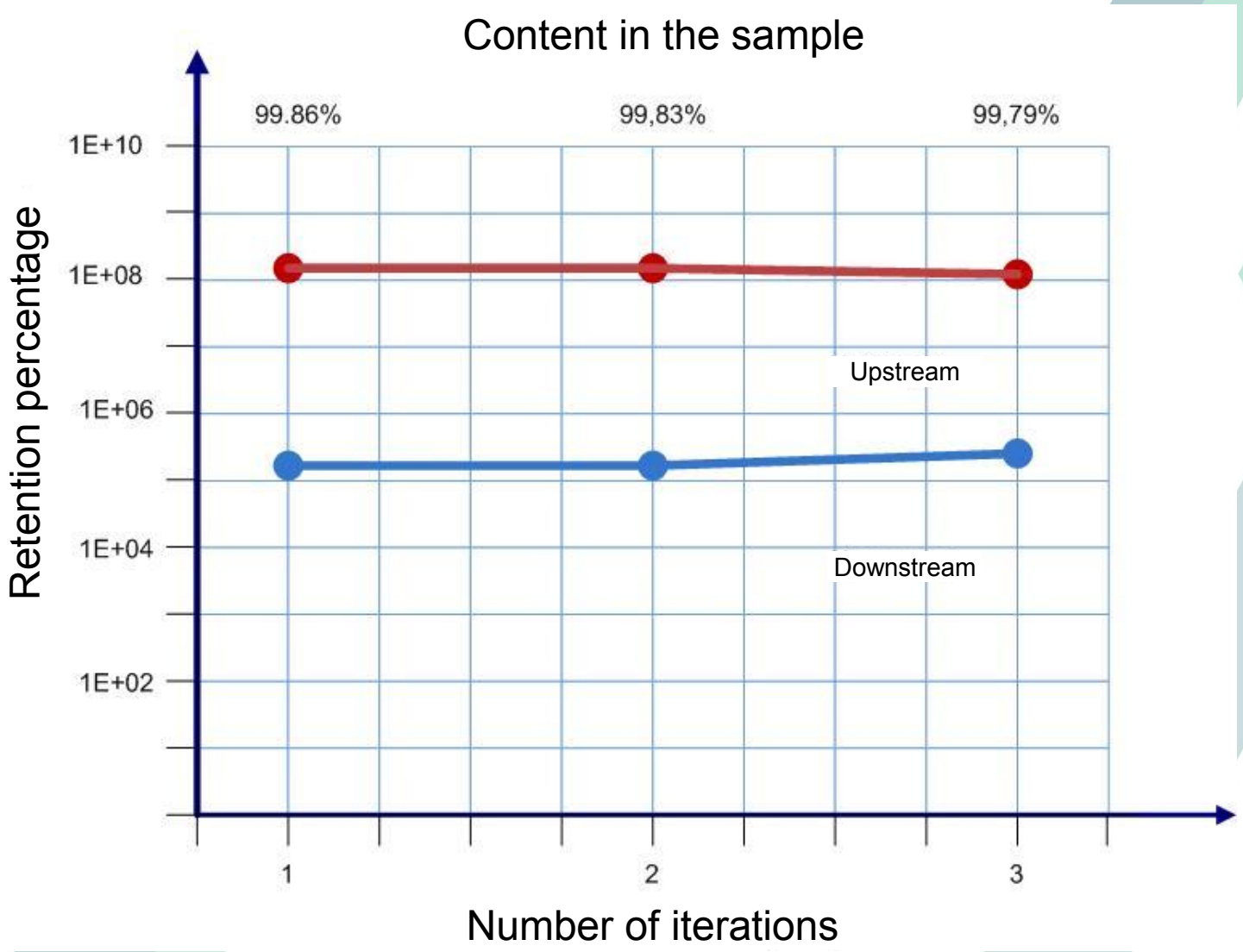
Strains and Media. Viruses.



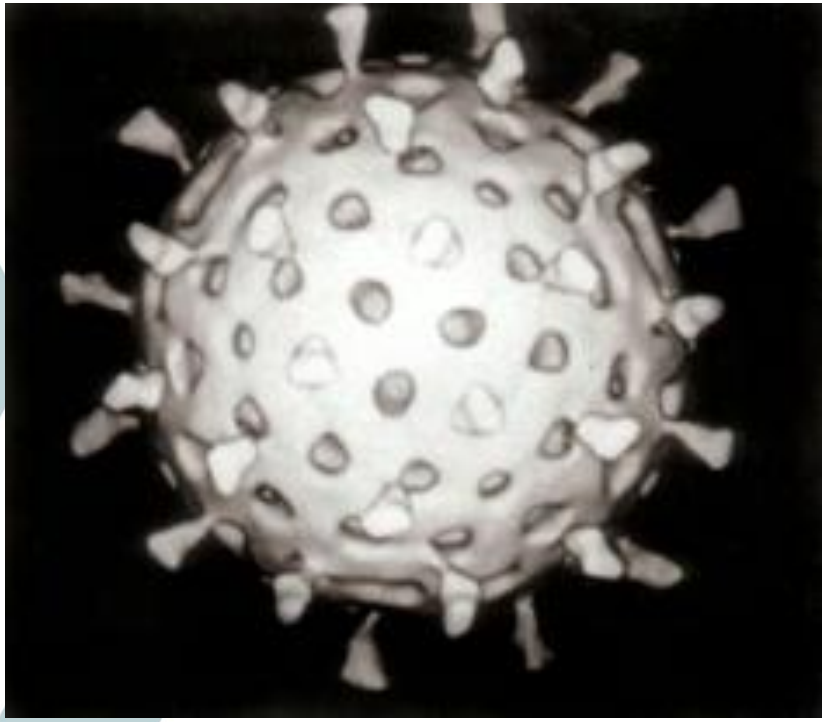
Poliovirus
(Poliovirus strain Sabin type I) belongs to the family Picornaviridae, enterovirus (enteric virus) group.
Virus size: 27-30 µm.

Production and titration were on the BGMK cells (African green monkey's kidney).

Removal of Poliovirus



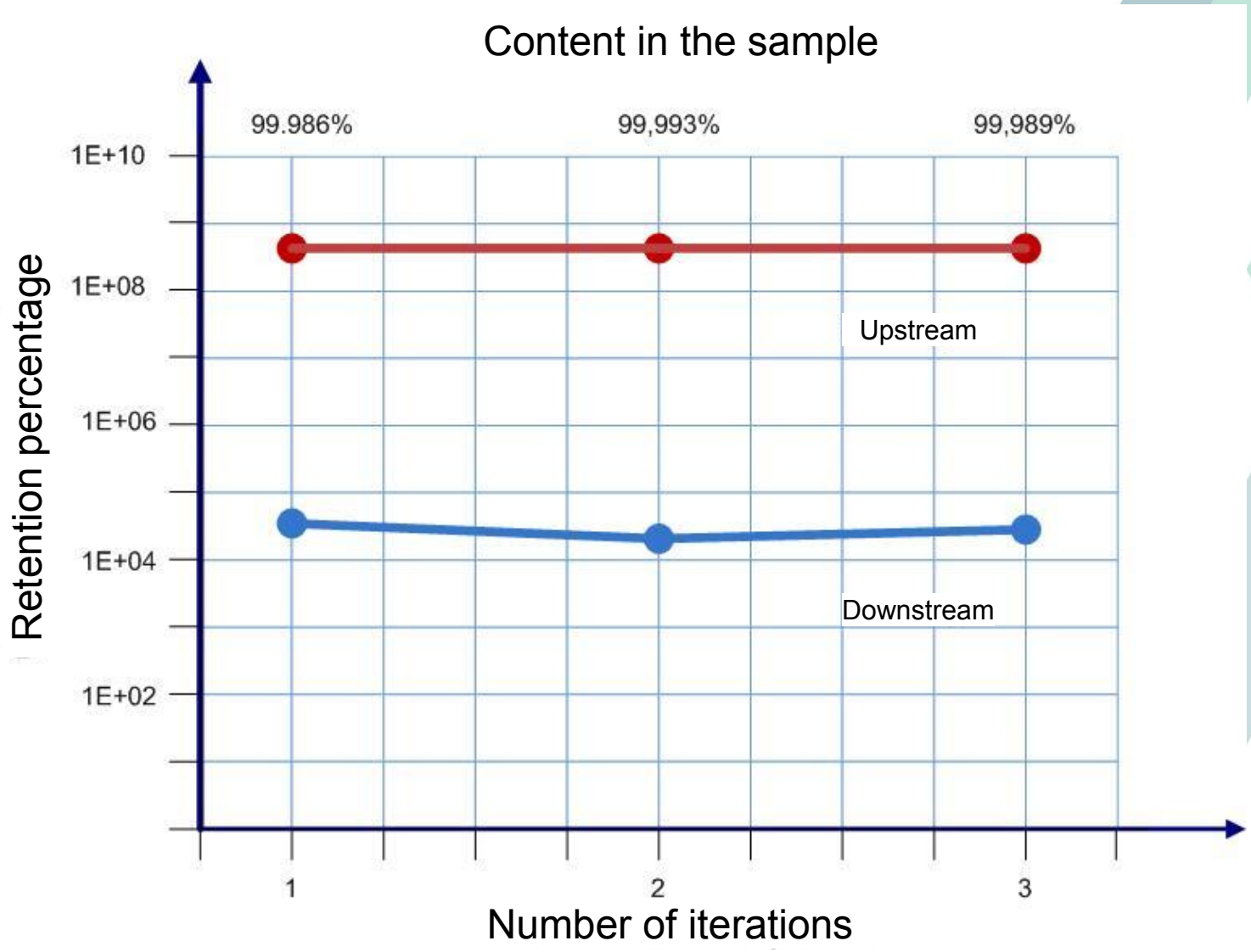
Strains and Media. Viruses.



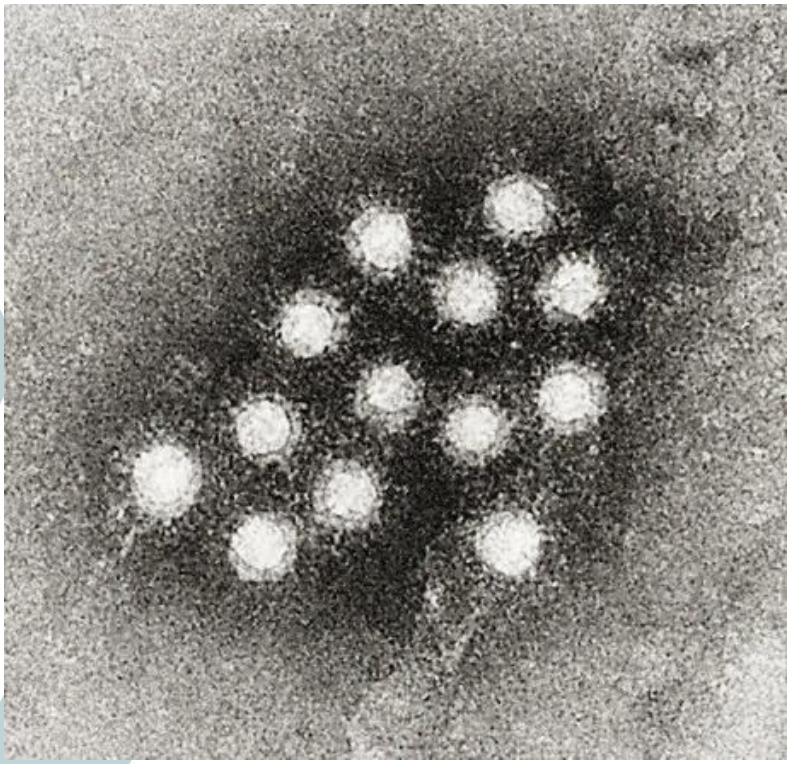
Rotavirus is an enveloped virus with two-strand fragmented RNA belonging to the family Reoviridae, rotavirus infection agent.
Virus size: 76.5 µm in diameter.

Production and titration were on the primates MA104 cells.

Removal of Rotavirus



Strains and Media. Viruses.

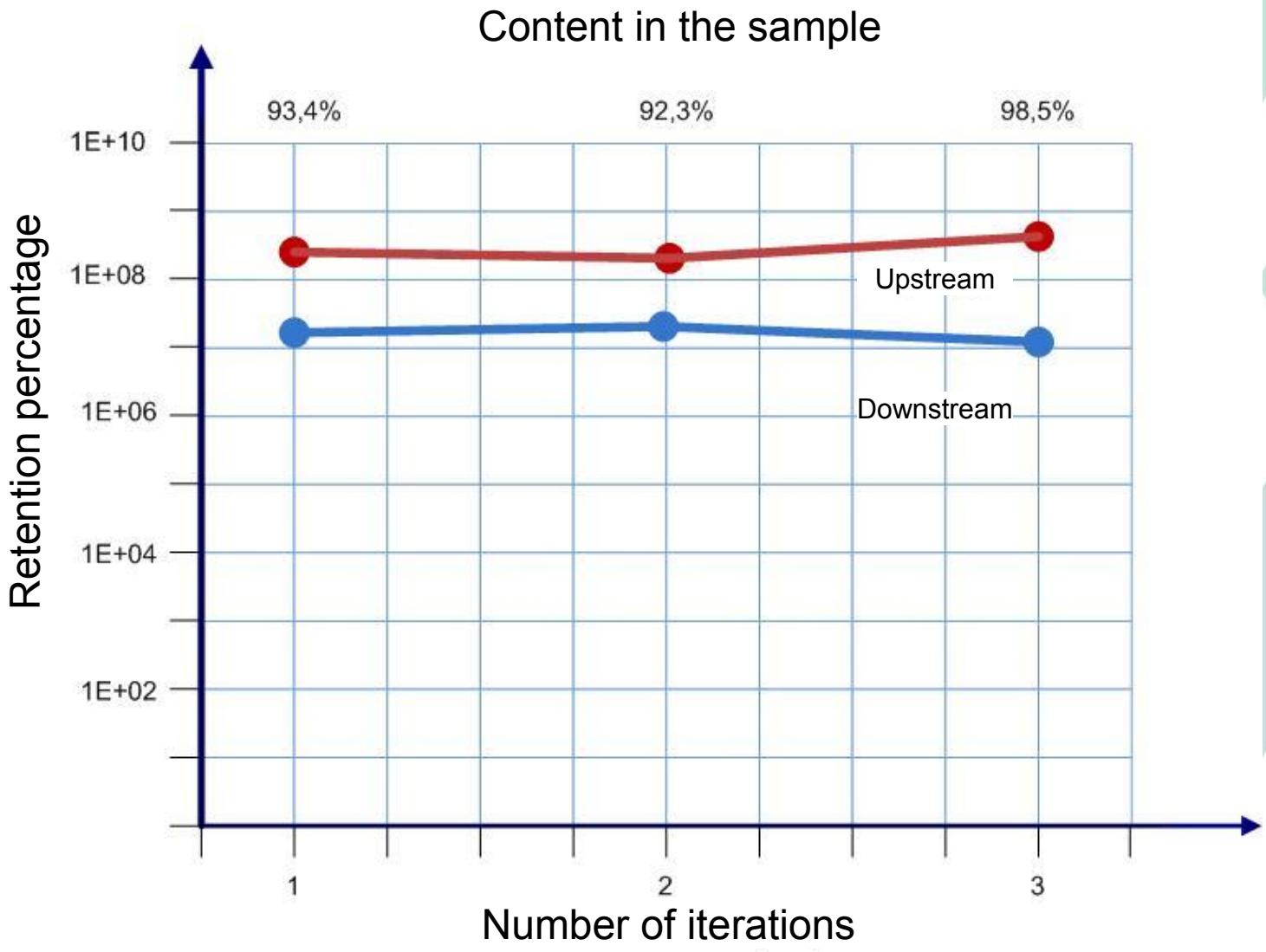


Hepatitis A (formerly known as infectious hepatitis) belongs to Picornaviridae family of viruses. It has no envelope and contains (+) single-stranded RNA packaged into protein capsid.

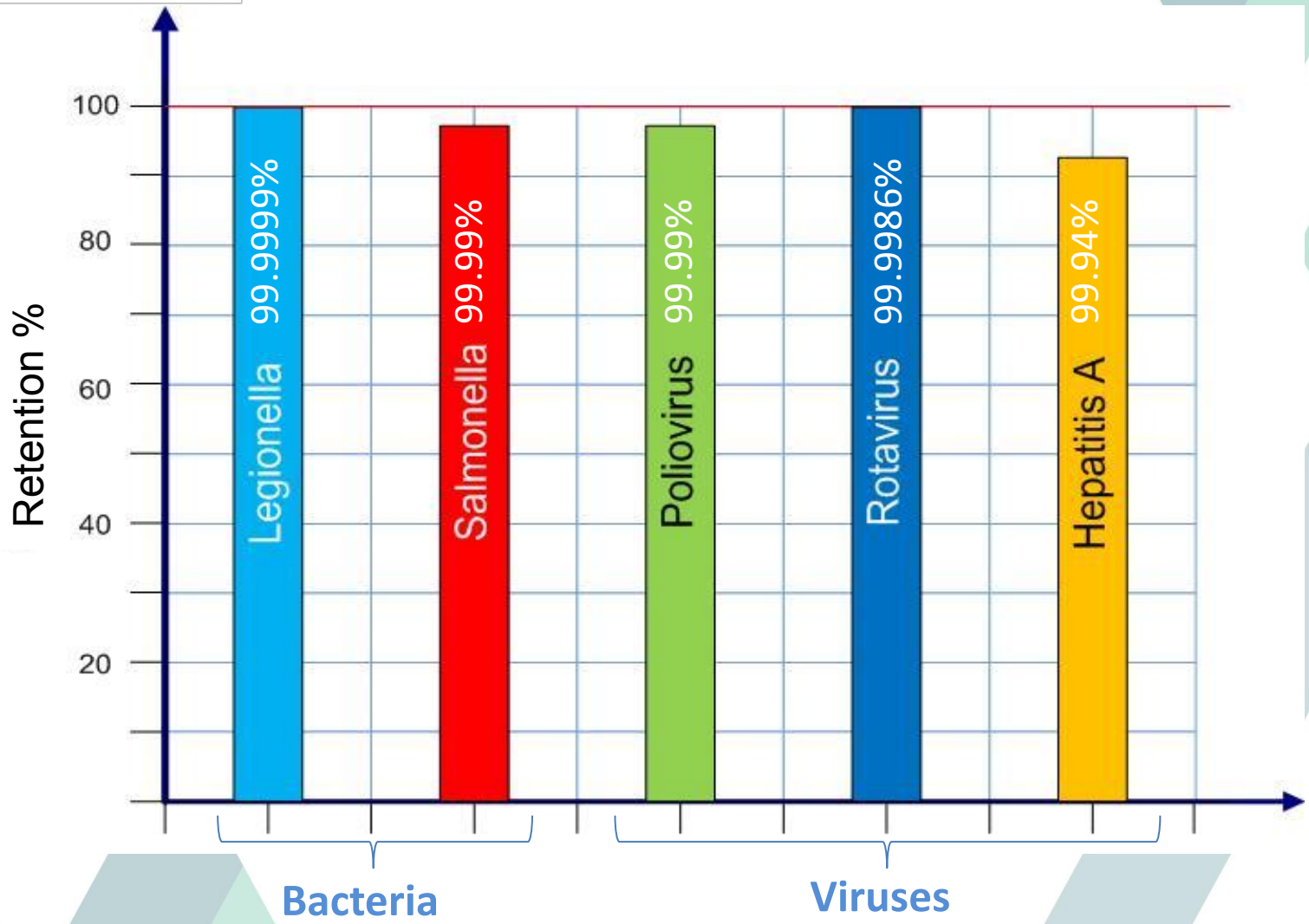
Size: 27 µm in diameter.

Production and titration were on the primates FRhK4 cells.

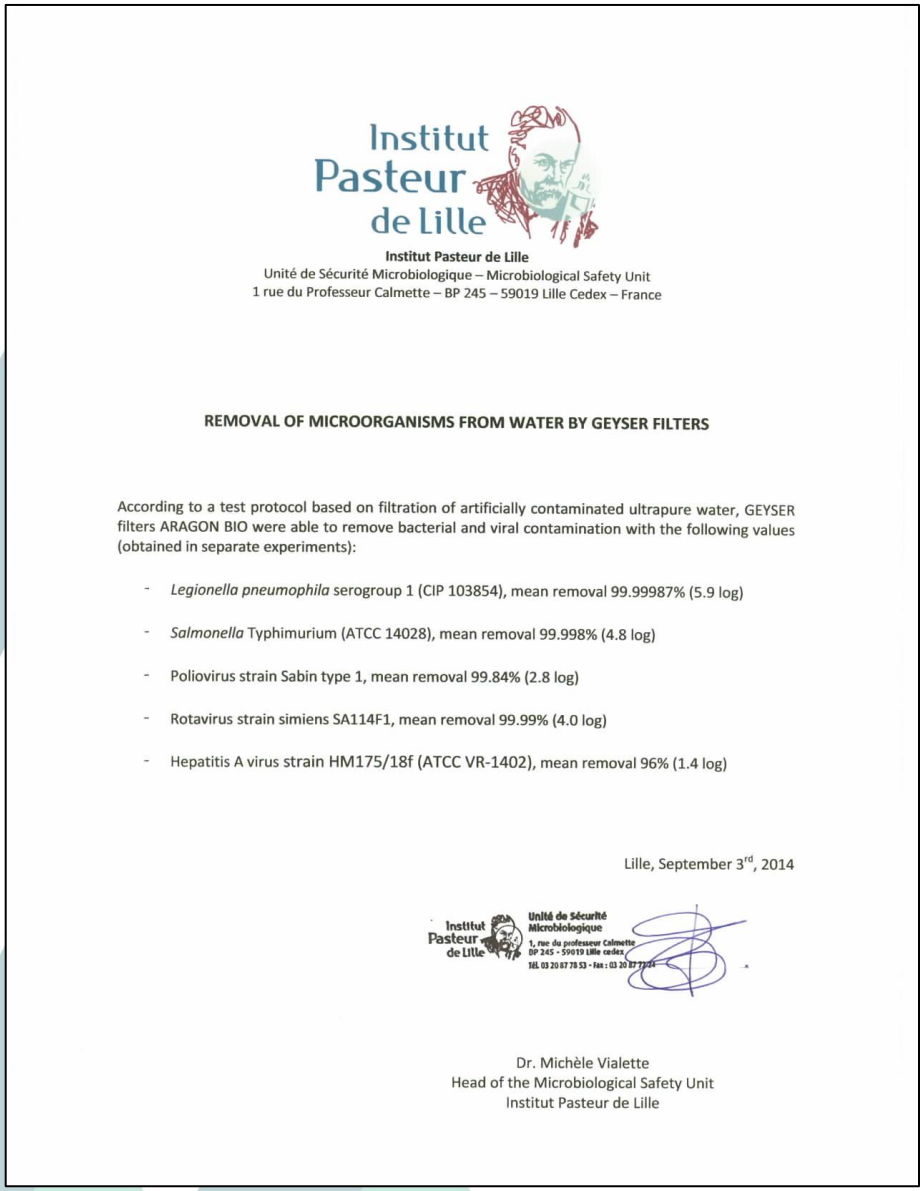
Removal of Hepatitis A



Efficiency of Viruses and Bacteria Removal



TheInstitut Pasteur de Lille (France) Conclusion



Institut Pasteur de Lille

Institut Pasteur de Lille
Unité de Sécurité Microbiologique – Microbiological Safety Unit
1 rue du Professeur Calmette – BP 245 – 59019 Lille Cedex – France

REMOVAL OF MICROORGANISMS FROM WATER BY GEYSER FILTERS

According to a test protocol based on filtration of artificially contaminated ultrapure water, GEYSER filters ARAGON BIO were able to remove bacterial and viral contamination with the following values (obtained in separate experiments):

- *Legionella pneumophila* serogroup 1 (CIP 103854), mean removal 99.99987% (5.9 log)
- *Salmonella* Typhimurium (ATCC 14028), mean removal 99.998% (4.8 log)
- Poliovirus strain Sabin type 1, mean removal 99.84% (2.8 log)
- Rotavirus strain simiens SA114F1, mean removal 99.99% (4.0 log)
- Hepatitis A virus strain HM175/18f (ATCC VR-1402), mean removal 96% (1.4 log)

Lille, September 3rd, 2014

Institut Pasteur de Lille
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1, rue du professeur Calmette
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The Geyser filters were able to remove the tested bacteria from water, with log reductions ranging from 5.3 to 7.3. Removal efficiency was lower concerning the viruses with mean log reductions of 2.8 (poliovirus), 4.0 (rotavirus) and 1.4 (hepatitis A).

ГЕЙЗЕР®
фильтры для воды

Summary

Saint Petersburg, 2014

The Market Opportunities of ARAGON

- **Domestic use**
  - Potable water filtration both at home and outdoors
  - Water supply of houses
  - Water purification in emergency zones, including areas under the radioactive pollution conditions
  - Water treatment in mainlines

- **Commercial use**
  - Treatment and purification systems for discharges
  - Hot water supply (boilers)
  - Pre-filteration in the membrane filtering systems
  - Pre-filters for mainlines

Conclusion

Aragon BIO represents the most up-to-date technology for water treatment and viruses, bacteria and cists removal. That makes it possible to get completely safe and health-promoting water without boiling.

Aragon BIO can be used as well as the main element in water treatment and decontamination systems and as one of the pre-treatment stages, e.g. as a part of the membranes protection against bio contamination.

Aragon BIO is comparable to polymeric UF/MF membranes (that are for domestic use) in efficiency. But it has greater productivity and significantly lower pressure drop.

Aragon BIO provides higher efficiency of filtration and kinetic absorption as compared to standard nonwoven fabrics including granular activated carbon.

Aragon BIO is absolutely environmentally-friendly. It can be used for potable water treatment and decontamination according to GOST R 51871-02, 51232-98.

THANK YOU FOR YOUR ATTENTION!

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