

ARAGON

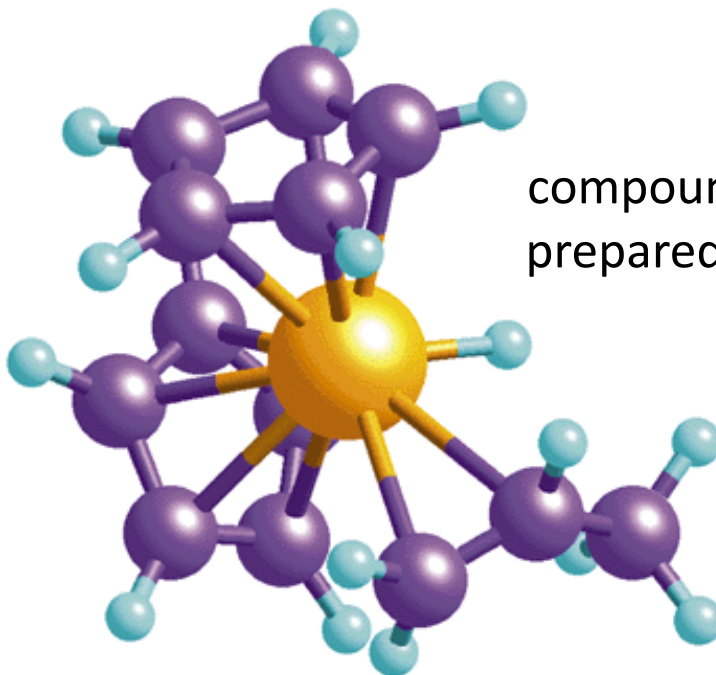
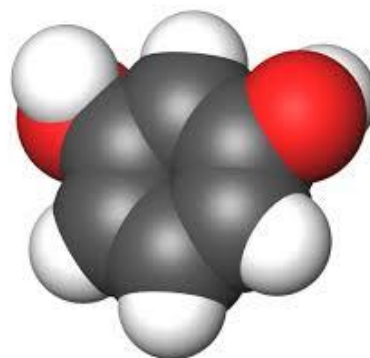
UNIQUE FILTERING MATERIAL



ARAGON is a Resorcinol–Based Polymer

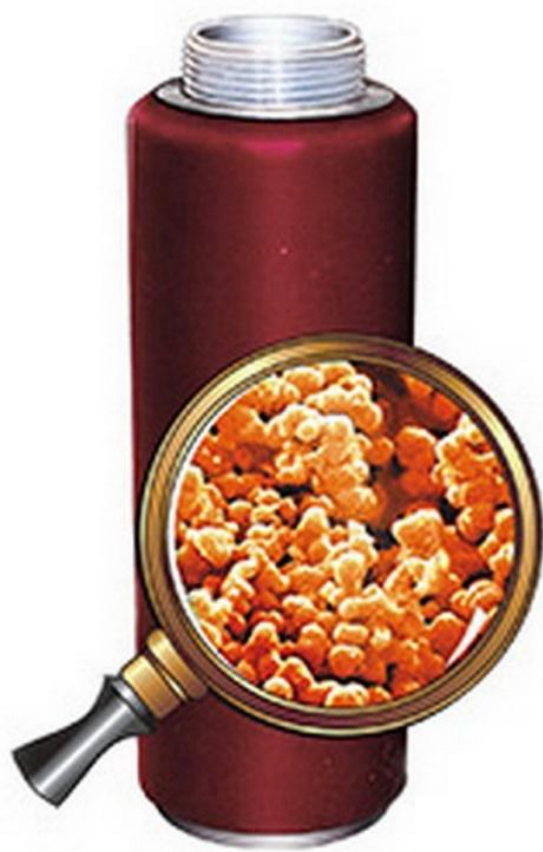
Best Water Decontamination Performance

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



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

SGS-Polymer Filtering Cartridge



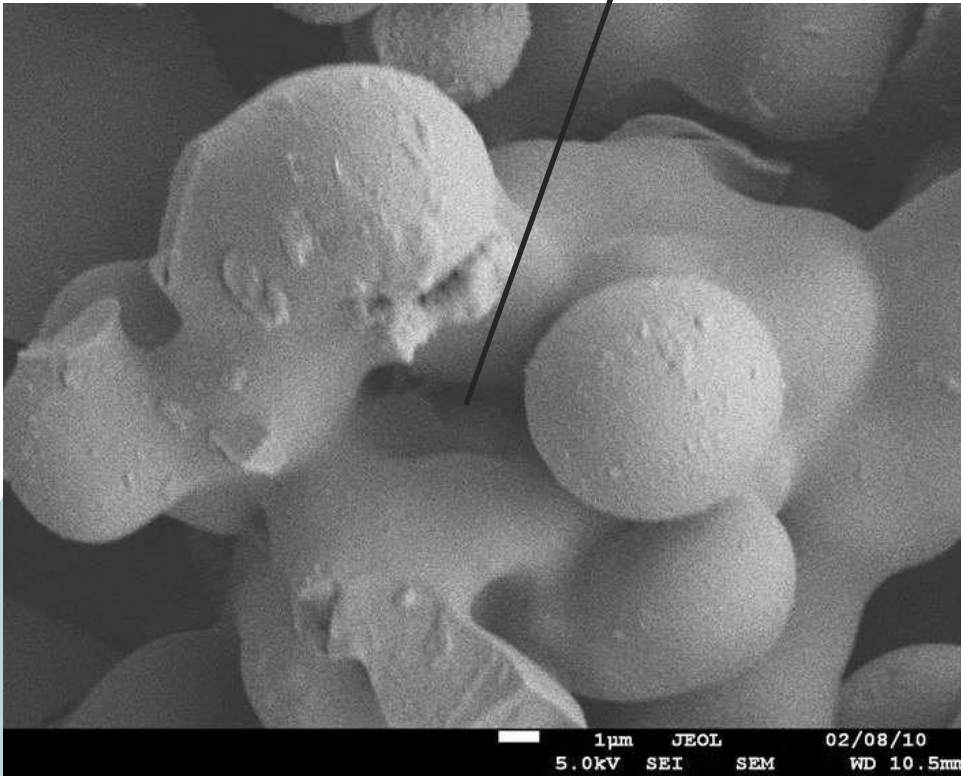
The SGS-polymer's structure is formed by **spherocolloids** with the size of **1 to 3-7 μm** (which is **2 orders of magnitude less** than standard granulation ion-exchanging materials (0.5-0.7 mm)), therefore volumetric flow rates of solutions through the SGS-polymer are significantly higher.

The spherocolloids form a regular highly-permeable porous structure.

Pores' sizes distribution is $\pm 10\%$.

Spherocolloids

1 μm pore

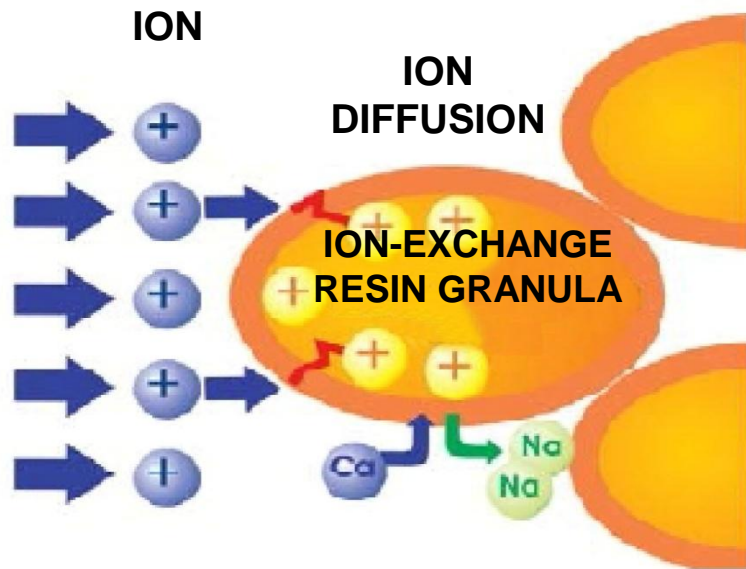


Photos of ARAGON made by an electronic microscope

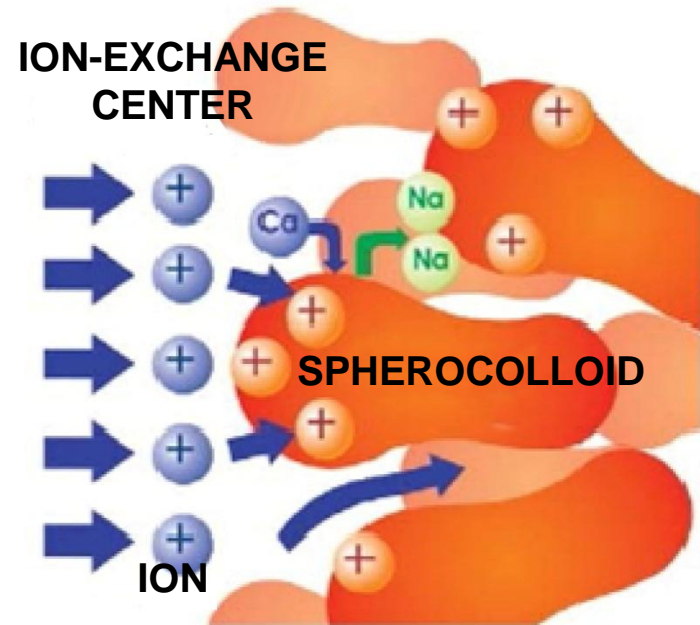
The spherocolloids are long polymeric chains, which combined form a mechanically strong structure with the internal surface size up to $500 \text{ m}^2/\text{g}$.

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

How SGS-Polymers work



ION-EXCHANGE RESIN

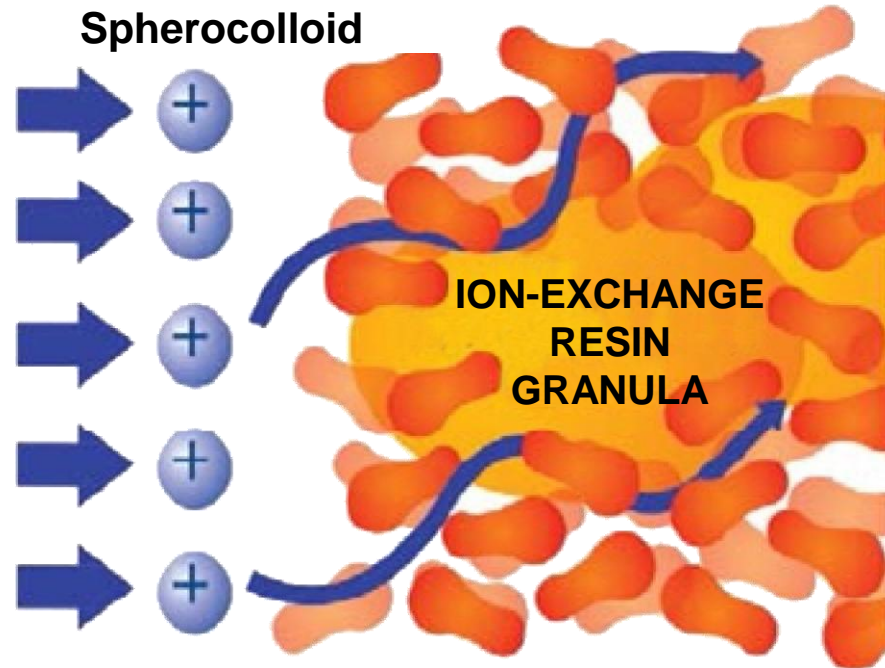


SGS-POLYMER

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

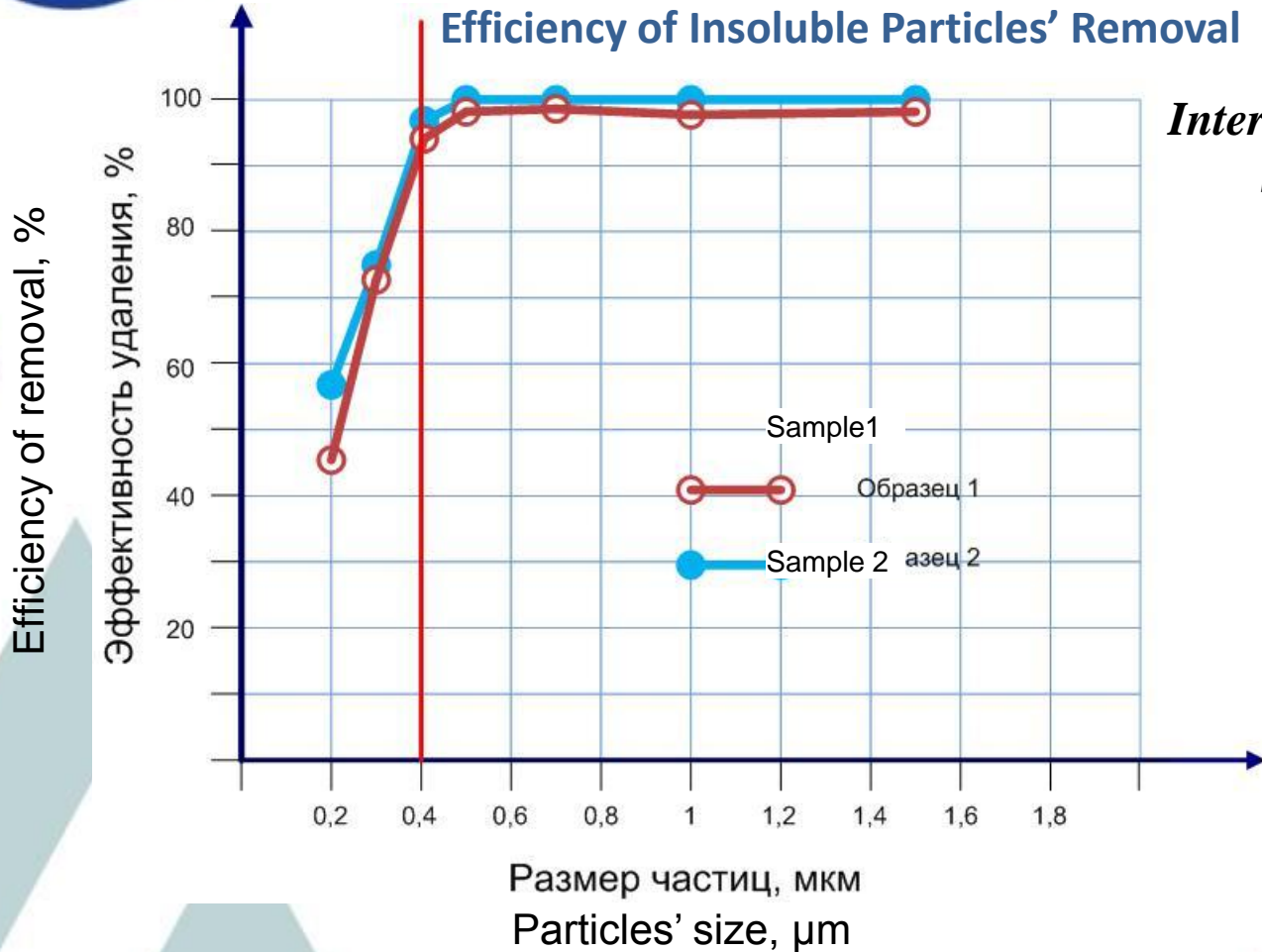


The inclusion of ion-exchange resin granulae in the polymer structure enables to increase the material's ion-exchanging capacity **twelve-fifteenfold**.

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



Removal of Insoluble Particles by Aragon BIO Cartridge



International Filter Testing Services IFTS, France

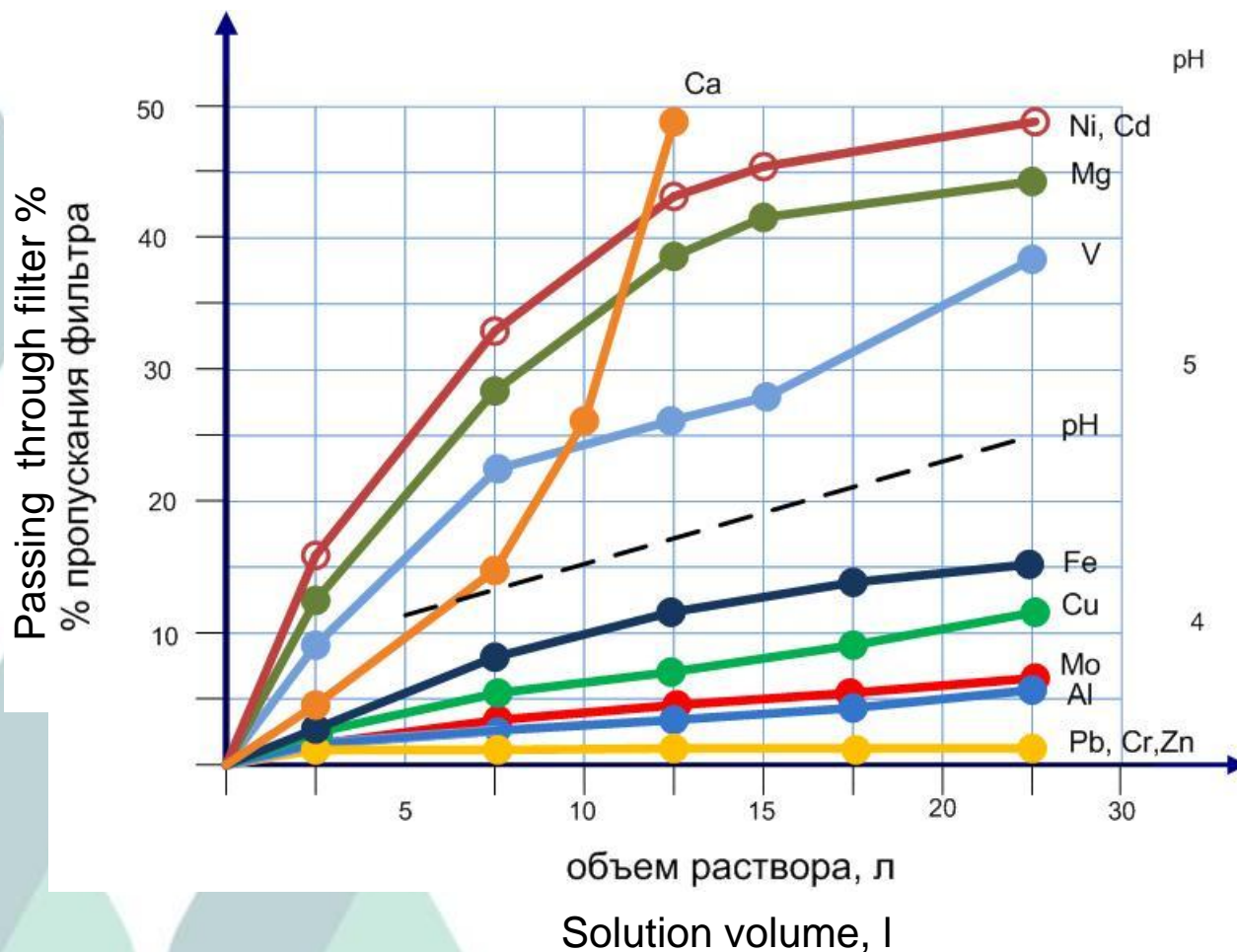
Efficient removal of suspended particles of a preset sieving threshold, including bacteria and viruses.

Metals removal efficiency, including radioactive ones

ARAGON Ion-Exchange Properties.



The V.G. Khlopin Radium Institute

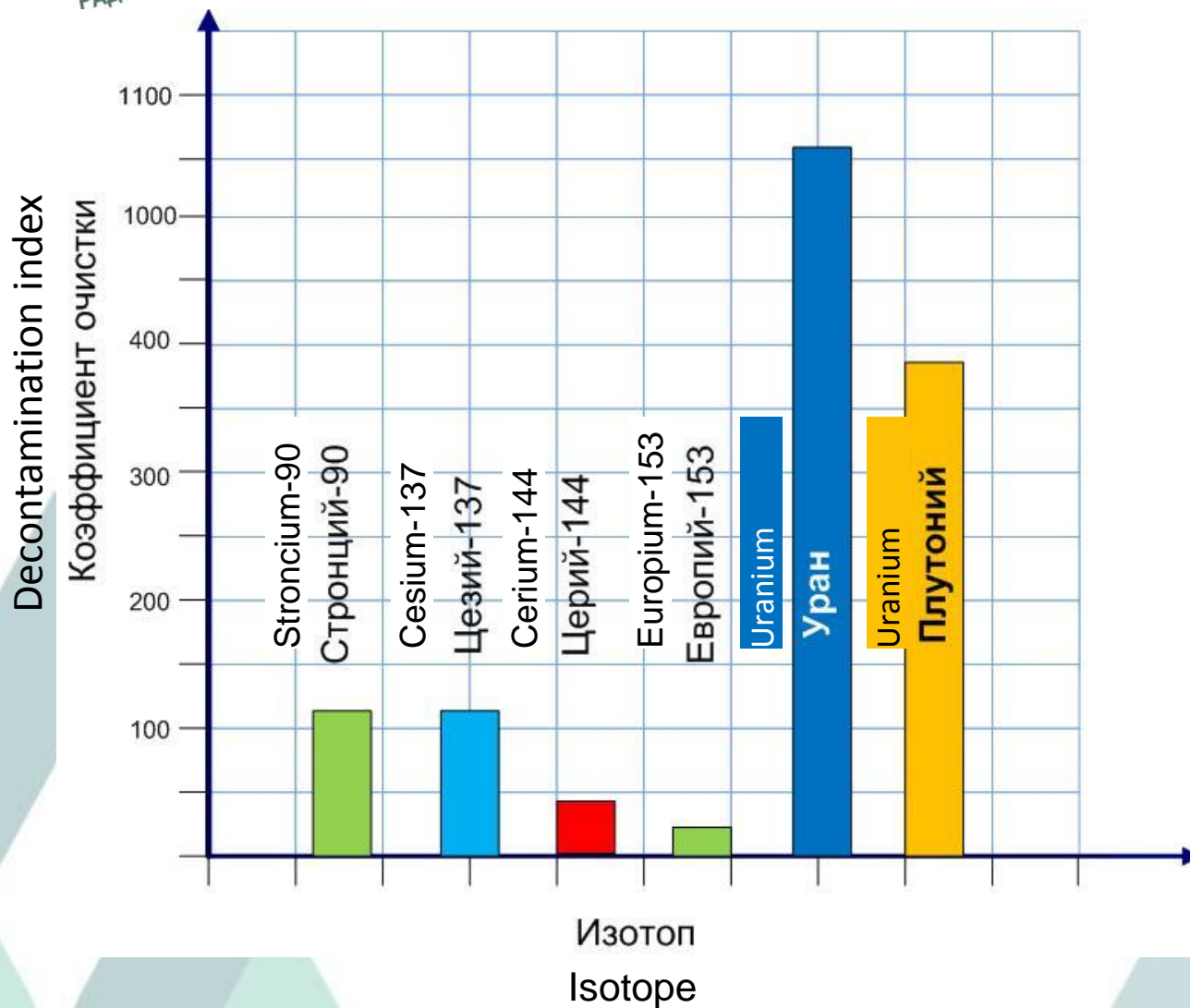


Elements' concentrations in the test solution, mg/l
концентрации элементов в модельном растворе, мг/л

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



Treatment Efficiency of Water Contaminated by Radioactive Elements

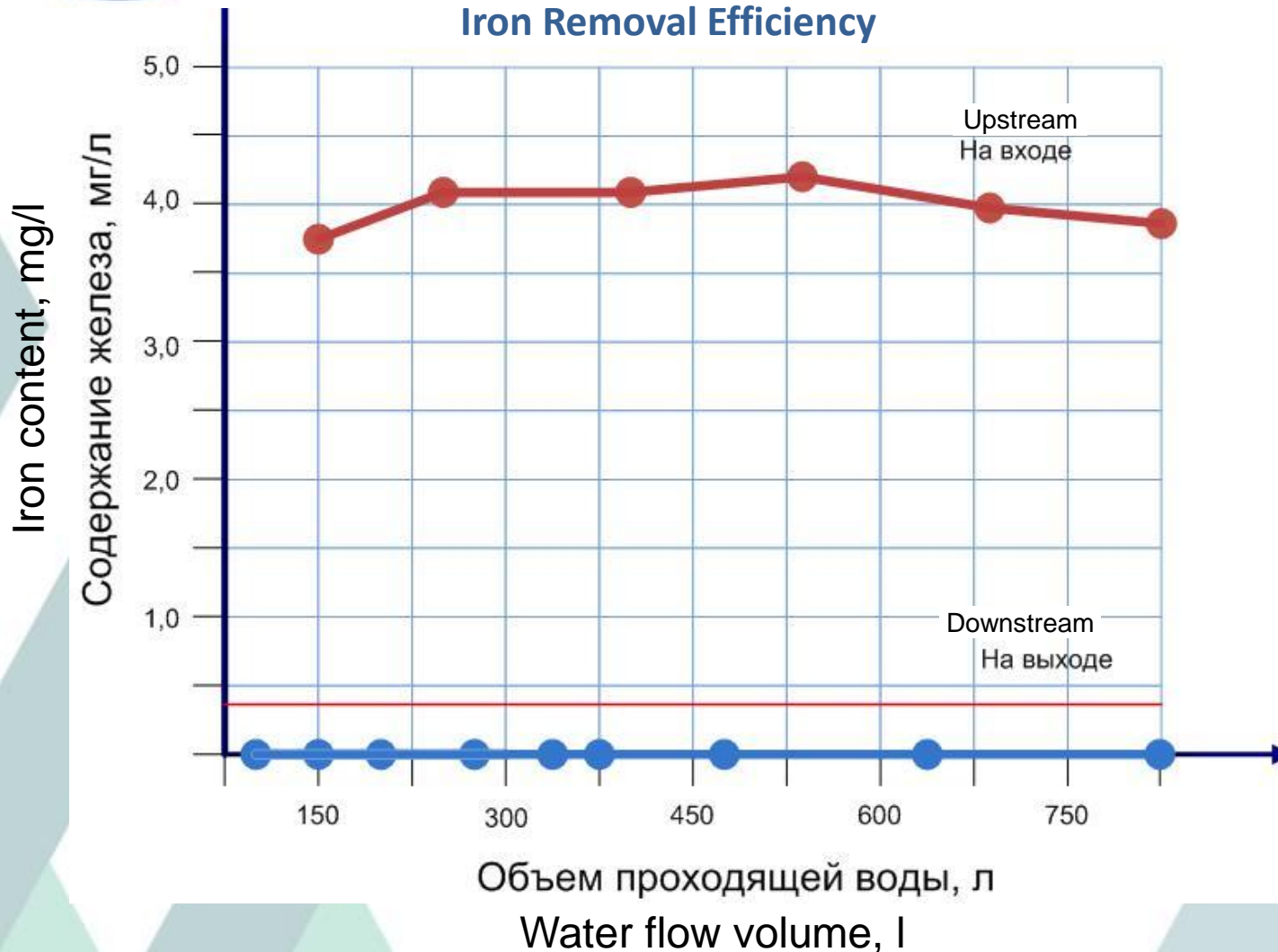




Cartridges' ARAGON Test Data

Institute of Filtration and Separation Techniques
IFTS, France

Iron Removal Efficiency



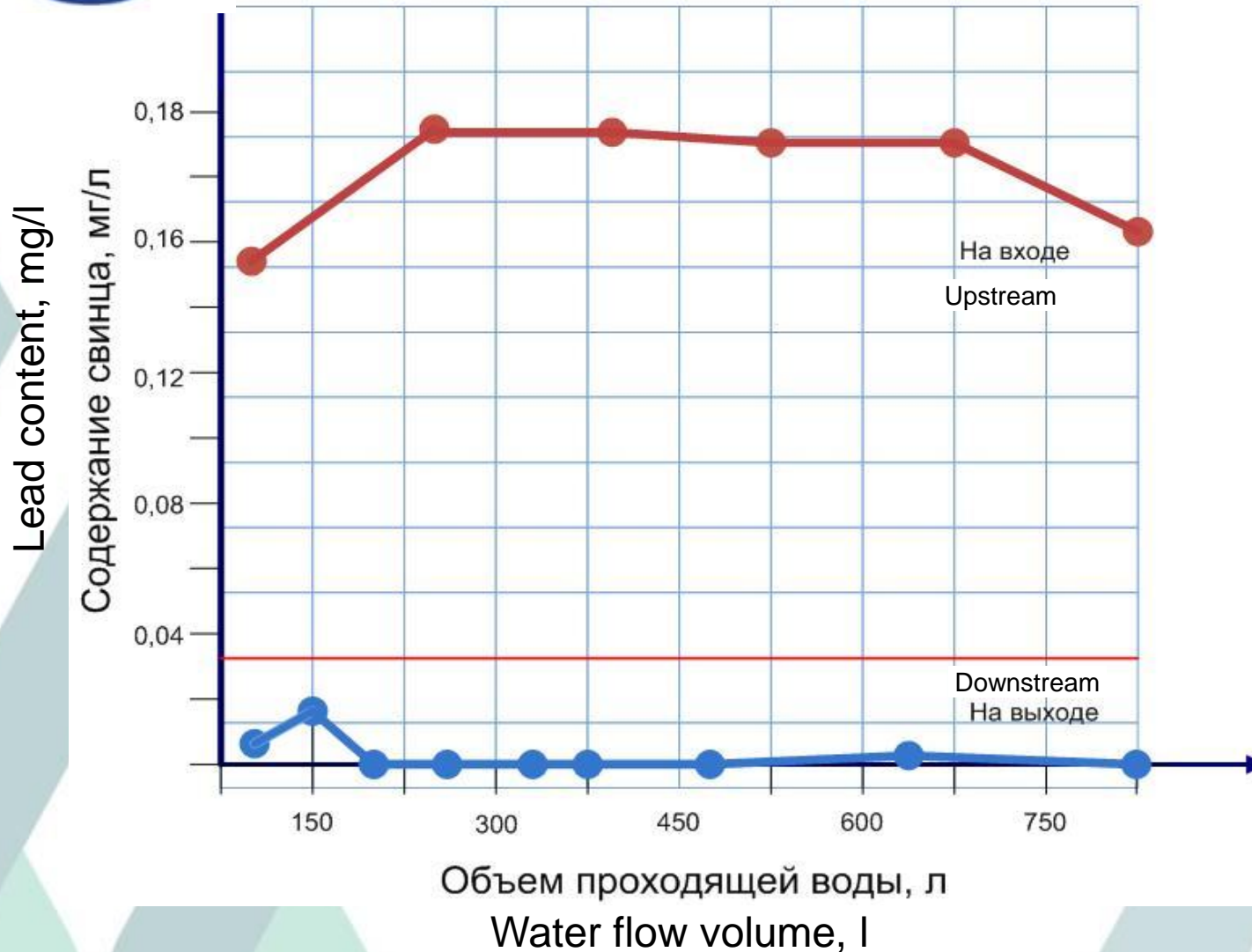


Cartridges' ARAGON Test Data

Institute of Filtration and Separation Techniques

IFTS, France

Lead Removal Efficiency

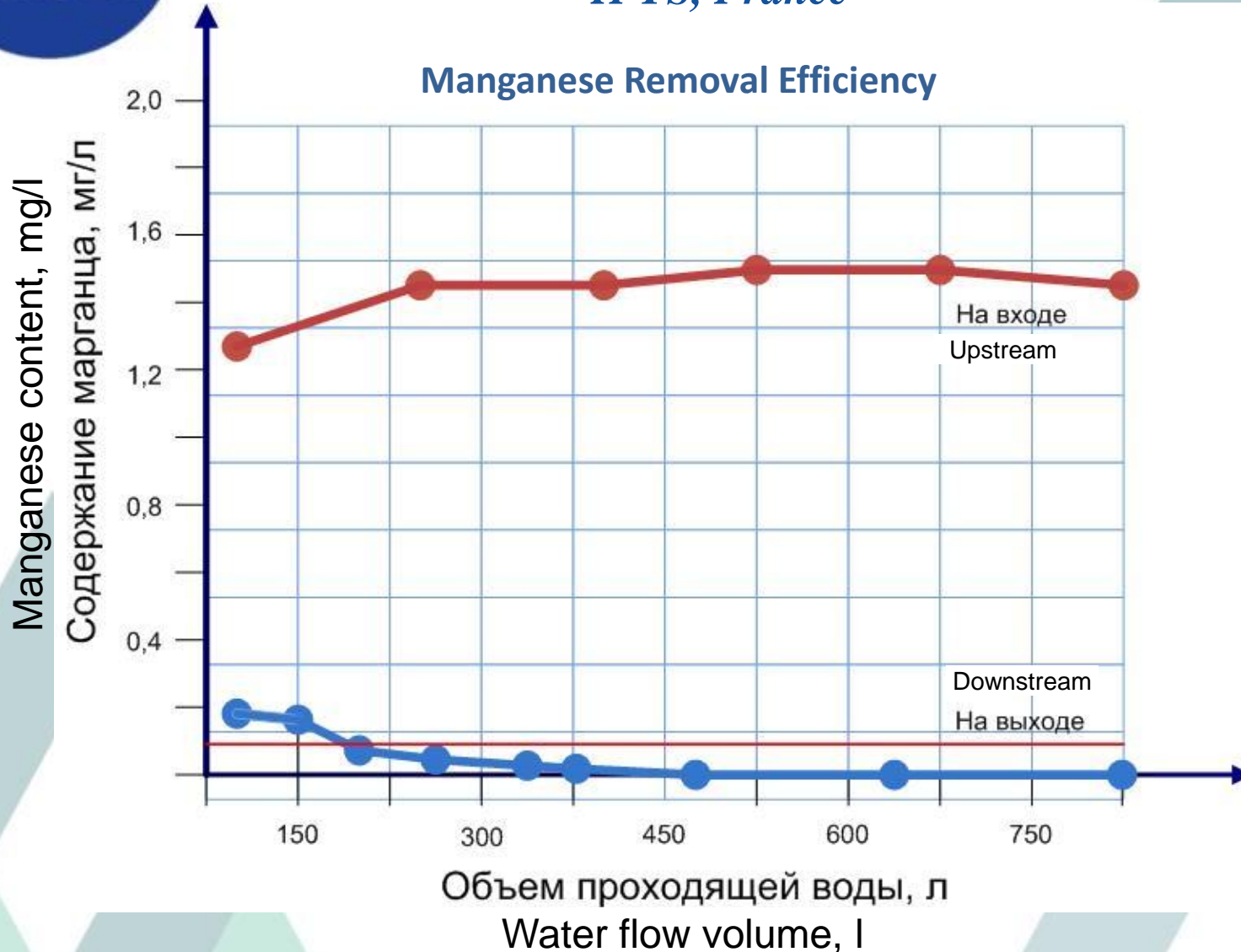




Cartridges' ARAGON Test Data

Institute of Filtration and Separation Techniques

IFTS, France

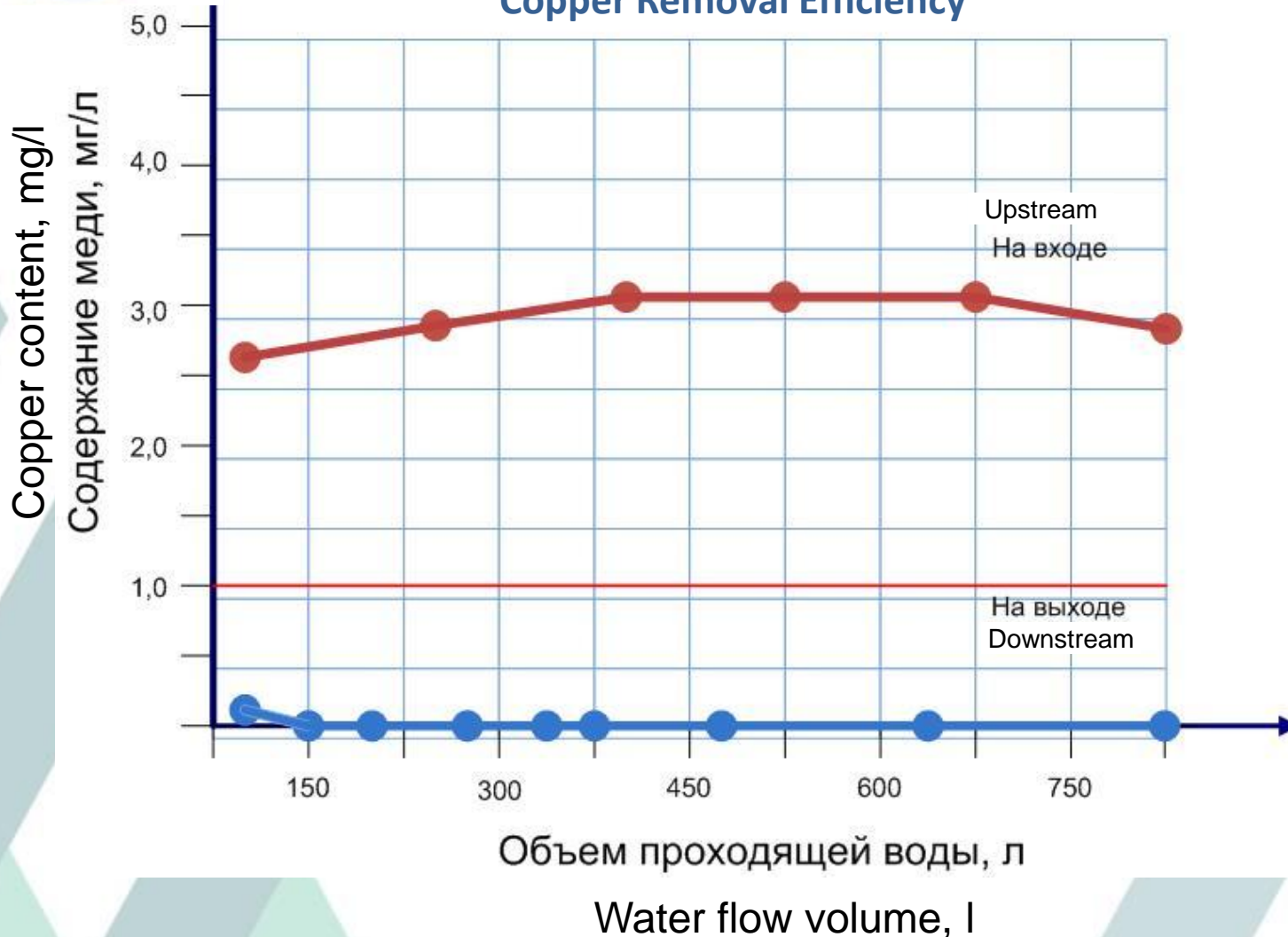




Cartridges' ARAGON Test Data

Institute of Filtration and Separation Techniques
IFTS, France

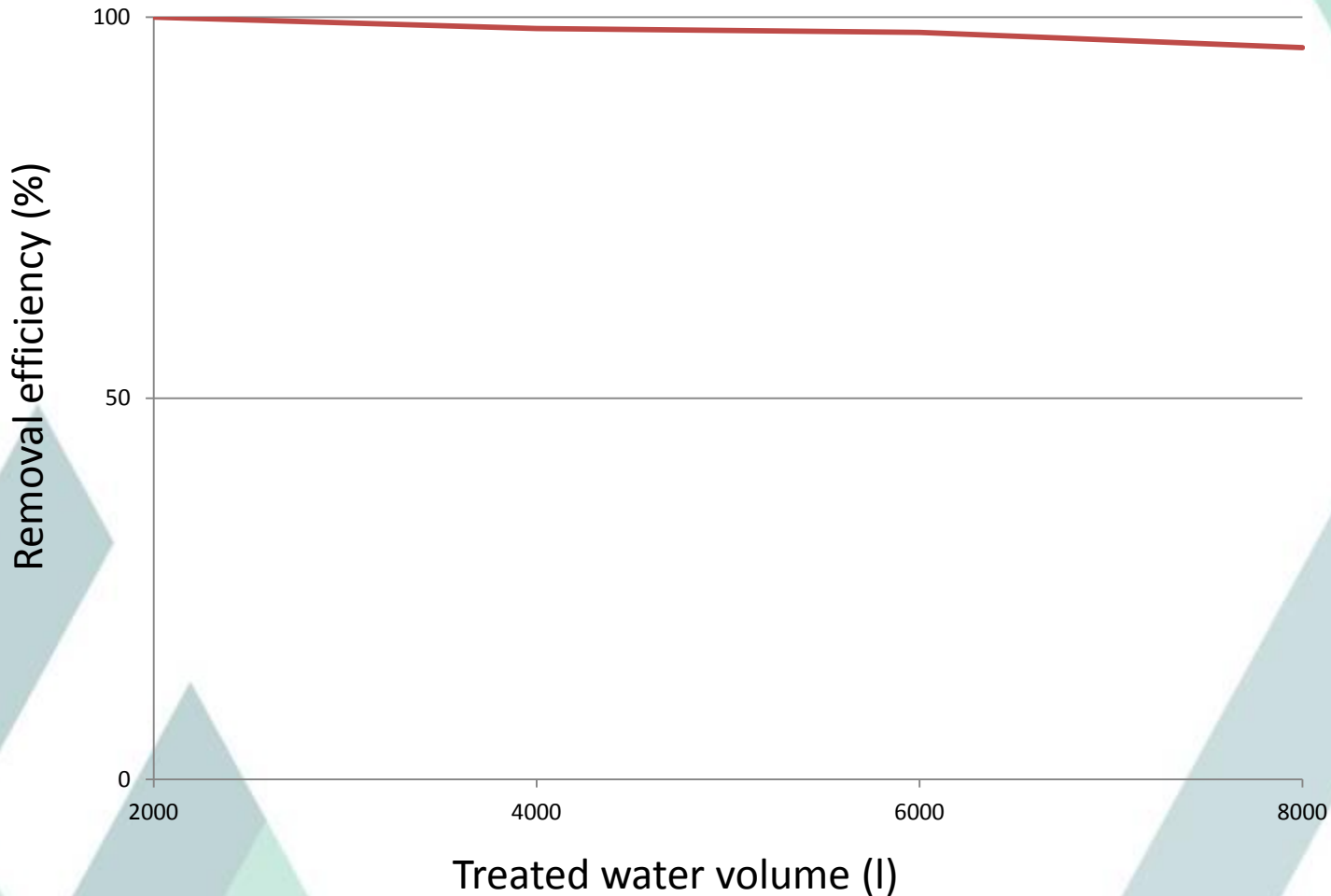
Copper Removal Efficiency





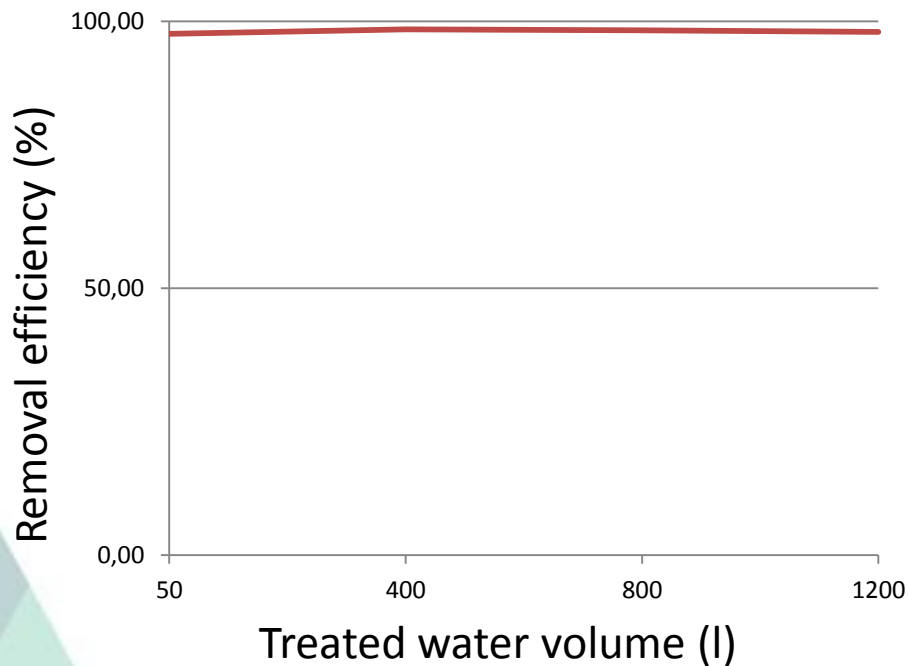
Removal of Contaminants. ARAGON Sorption Properties.

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



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



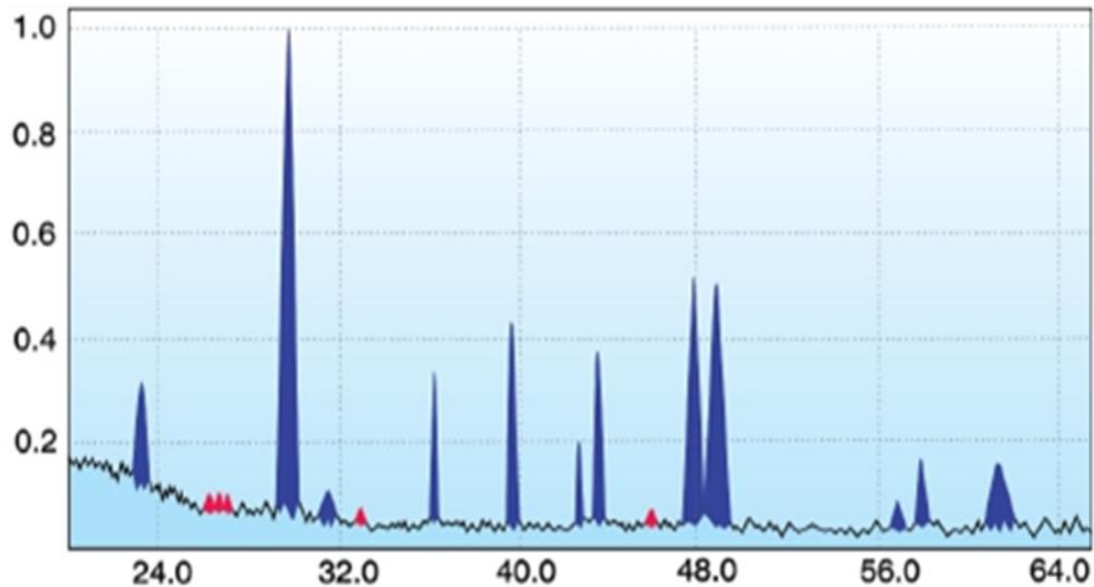
Aragonite



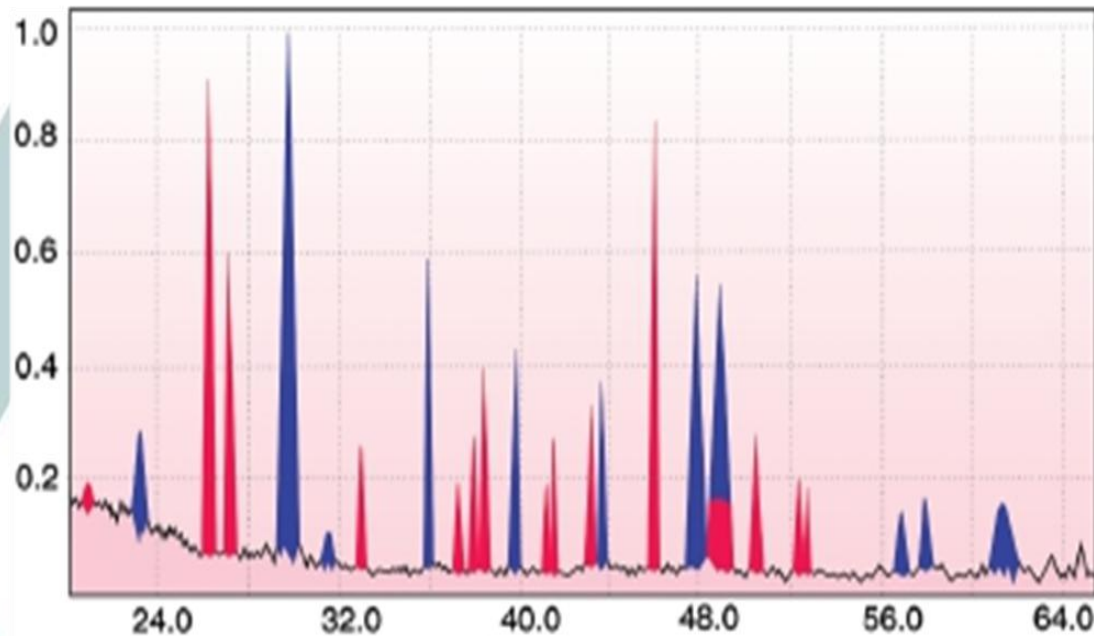
Calcite

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 Calcspars 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



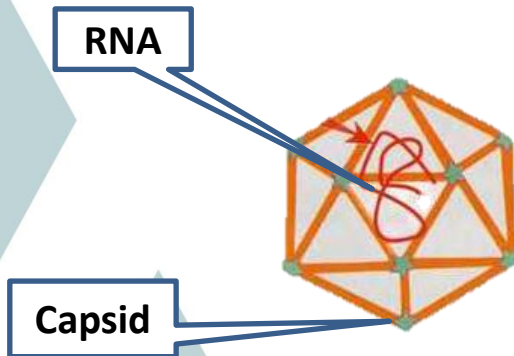
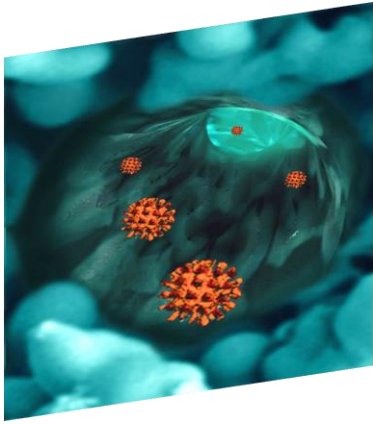
Ordinary hard water:
5% aragonite
95% calcspar



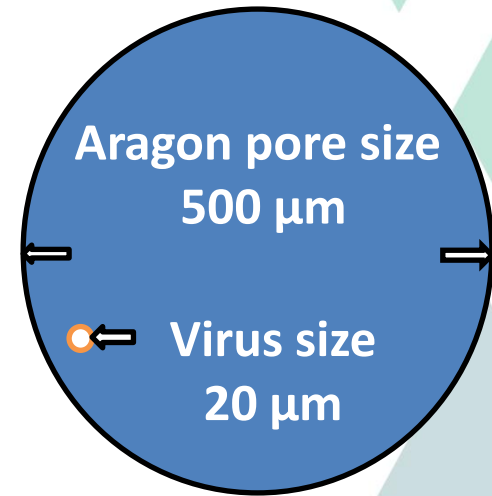
Treated water:
40% aragonite
60% Calcspar

The 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.



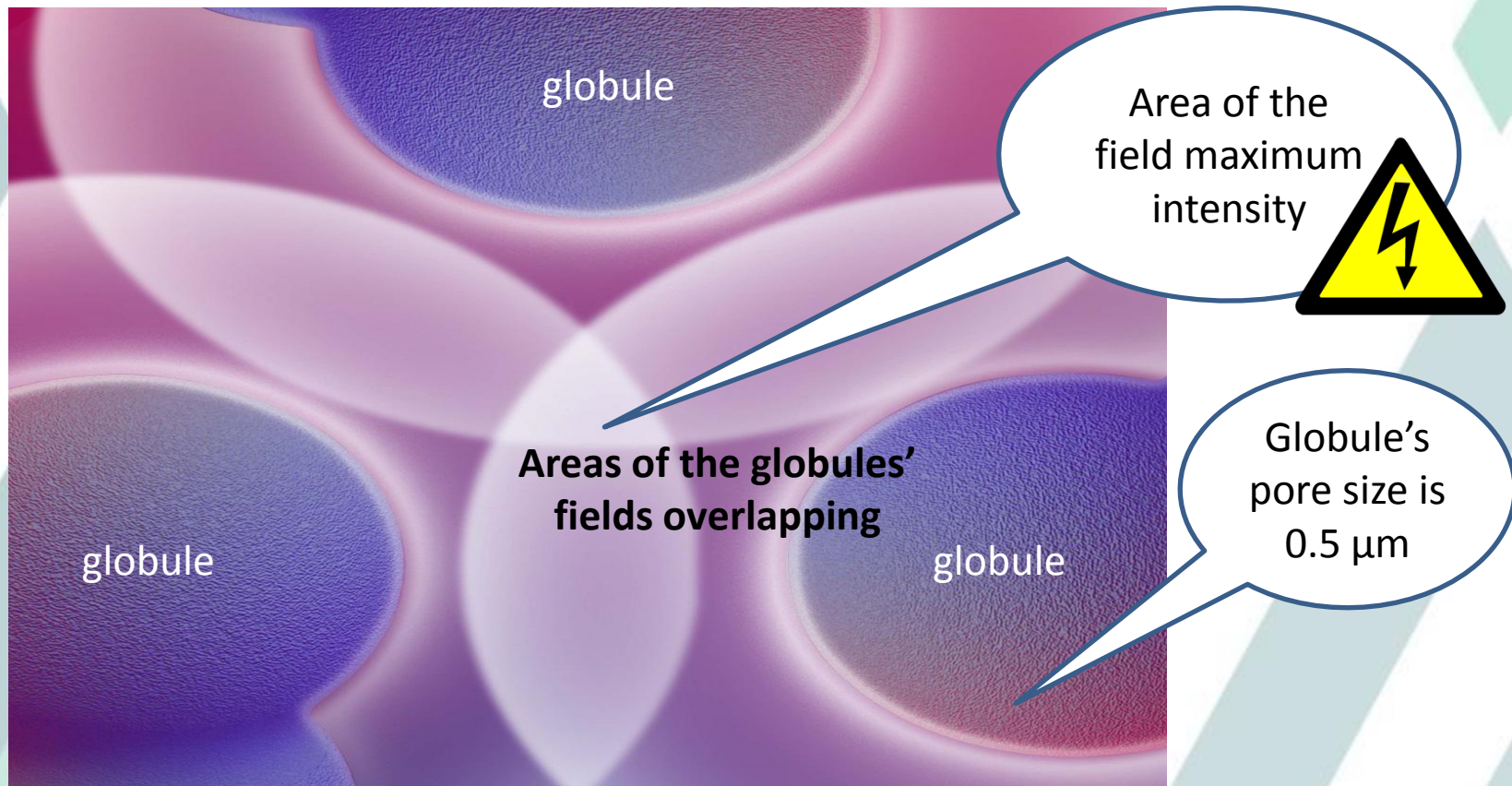
Most of the viruses have an envelope (capsid) protecting RNA in which the division process is preprogrammed. To neutralize a virus it is enough to destroy the capsid or damage RNA.



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.

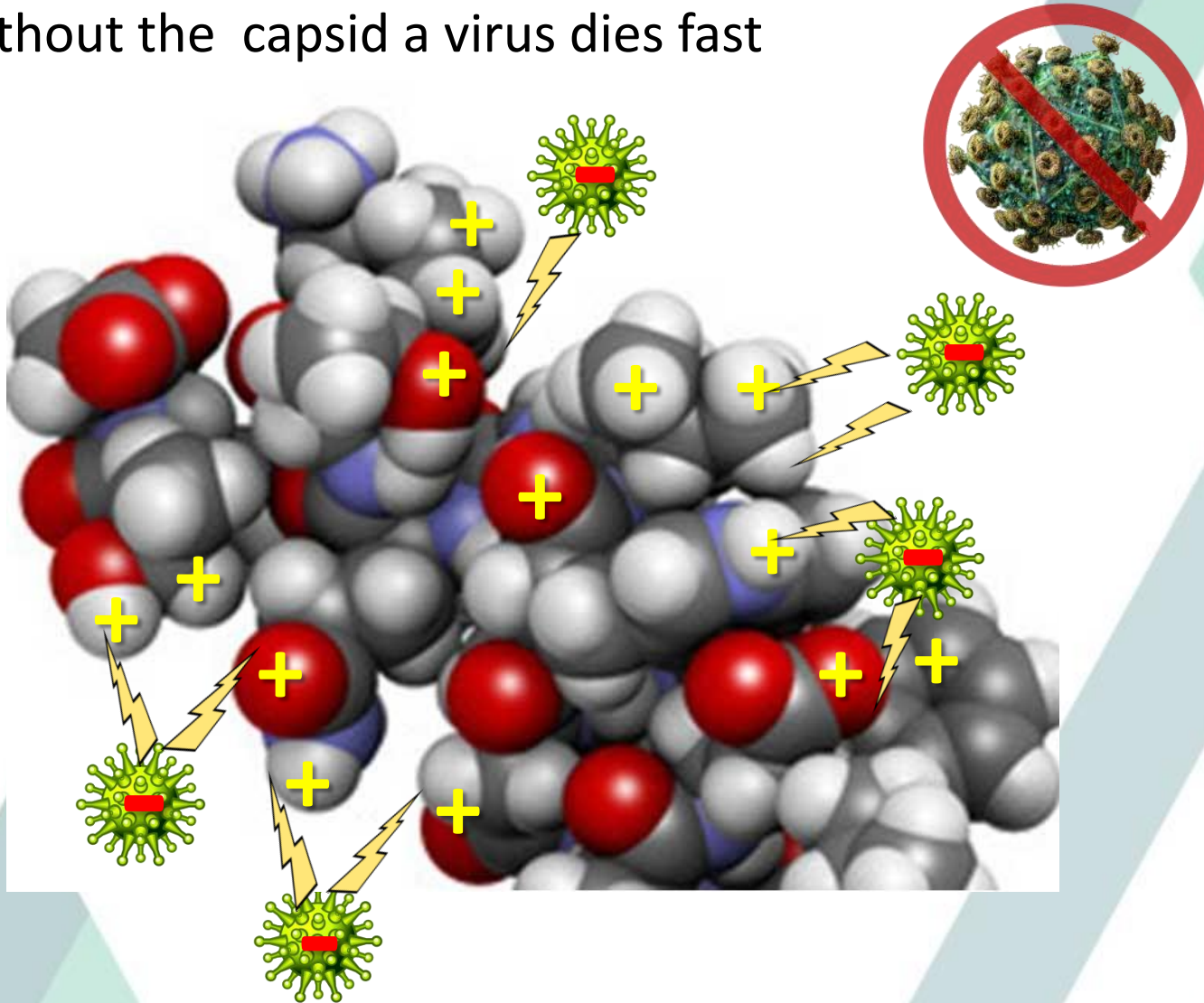
The Electric Field Inside the Pore

The surface of a globule has negative charge and forms strong magnetic field developed around it. That covers the entire pore fully As a result of overlapping of individual globules' fields, high gradient electric field of high intensity is formed inside the pore.

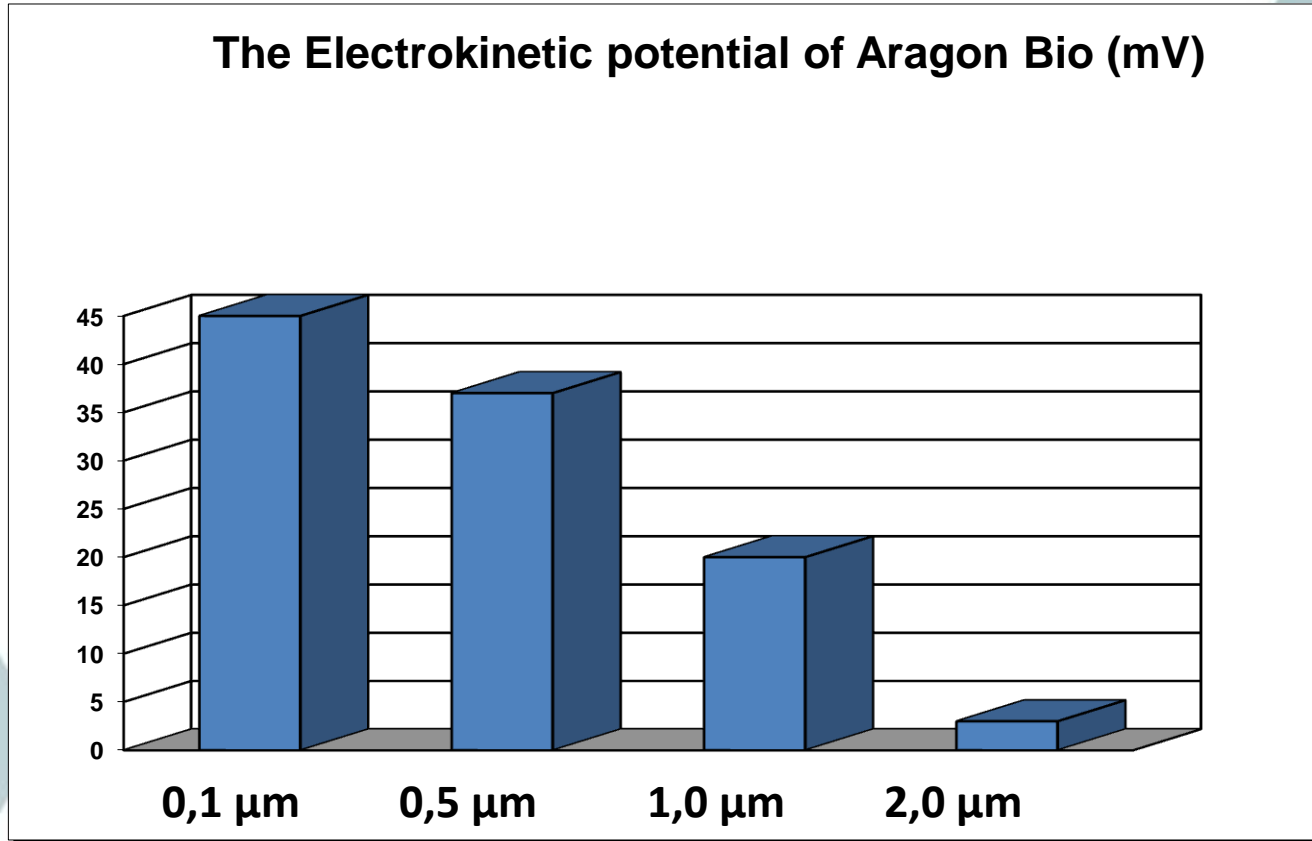


Electro kinetic mechanism of impact on viruses

The electric field destroys the external protective cover of a virus (capsid). Without the capsid 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 Environmental Health named after A.N. Sysin
2011



The Research Institute of Influenza
2011



Università di Ferrara
2012 г.



Institut Pasteur de Lille
2014 г.



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.

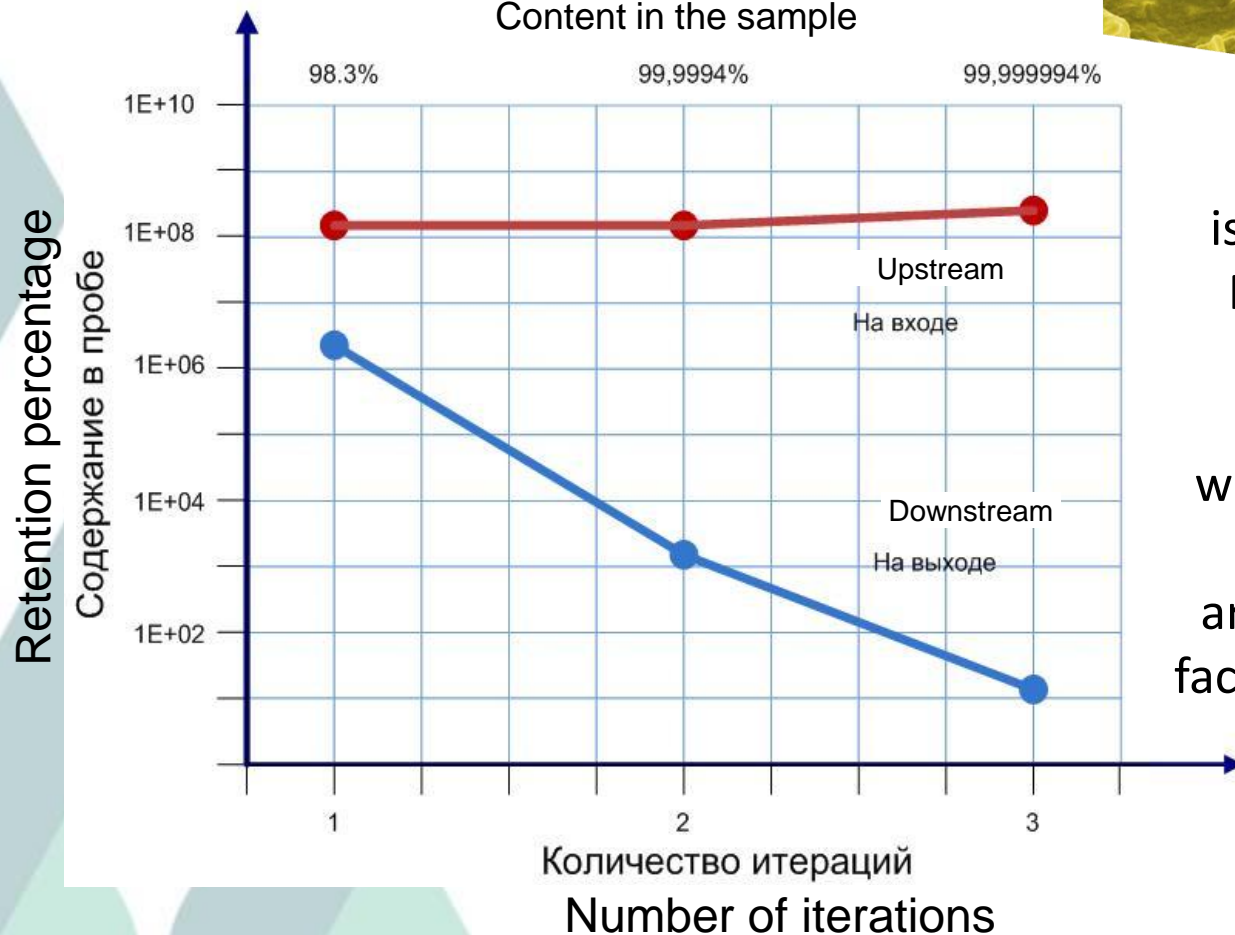
Photo: the modules and the housing presented to the Institut Pasteur de Lille



Removal of Salmonella



Процент удержания
Content in the sample

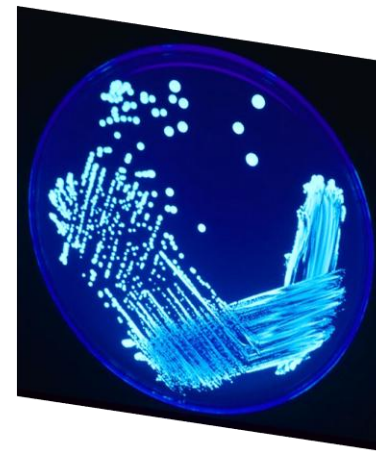


Salmonella

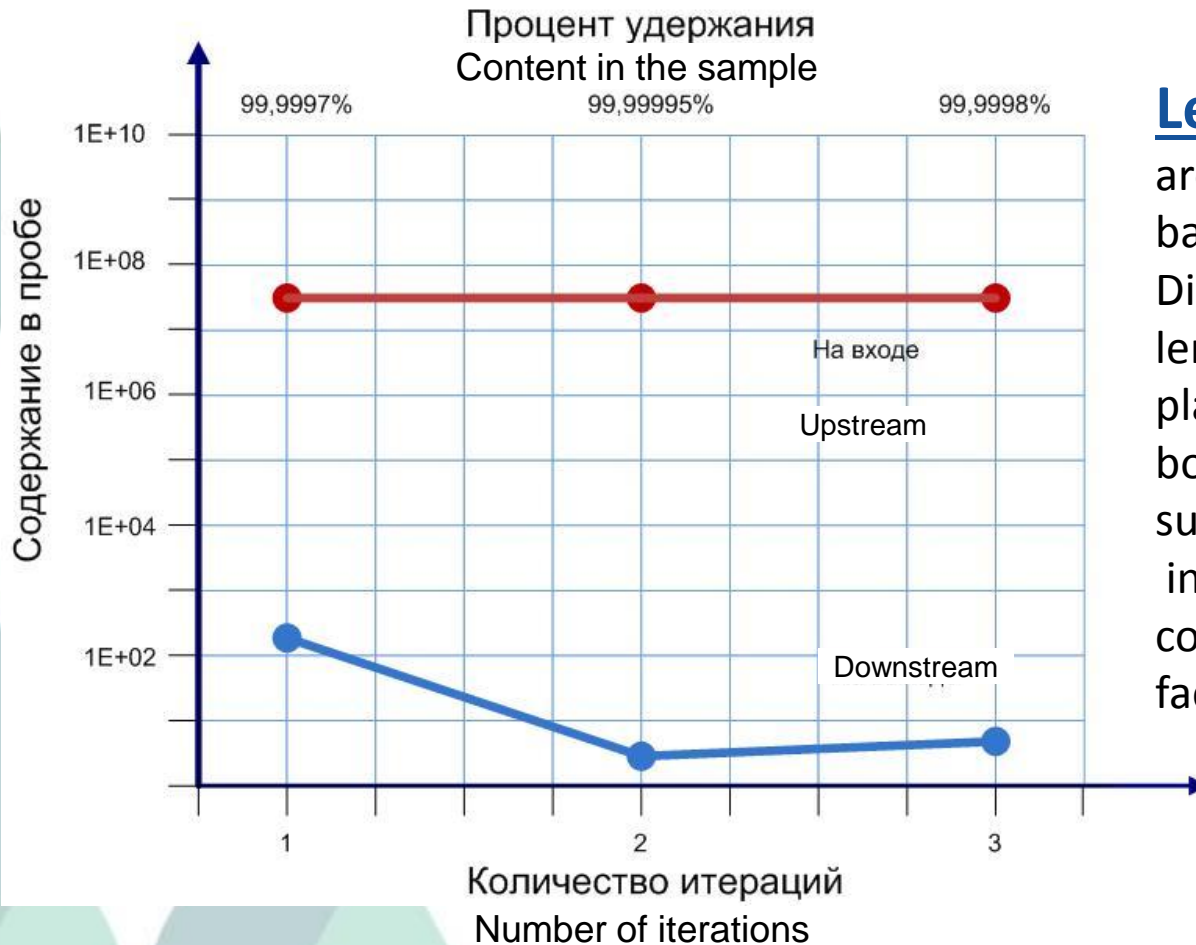
is a mouse typhus agent.
Nonspore-forming rod-shaped bacteria.
Length: 1-7 μm ;
width: around 0.3-0.7 μm .
The salmonellas are gram-negative mobile facultative-anaerobic bacilli.



Removal of Legionella



Retention percentage



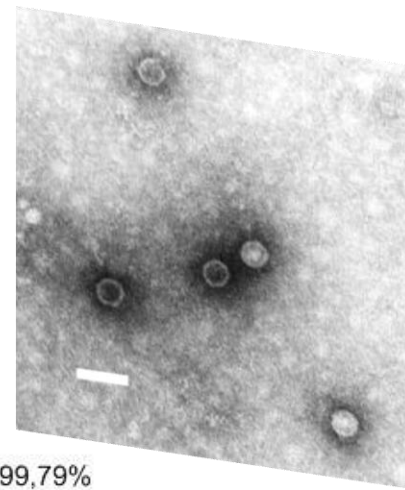
Legionella pneumophila

are pathogenic gram-negative bacteria.

Diameter: 0.2 to 0.7 μm , length: 2 to 20 μm . 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.

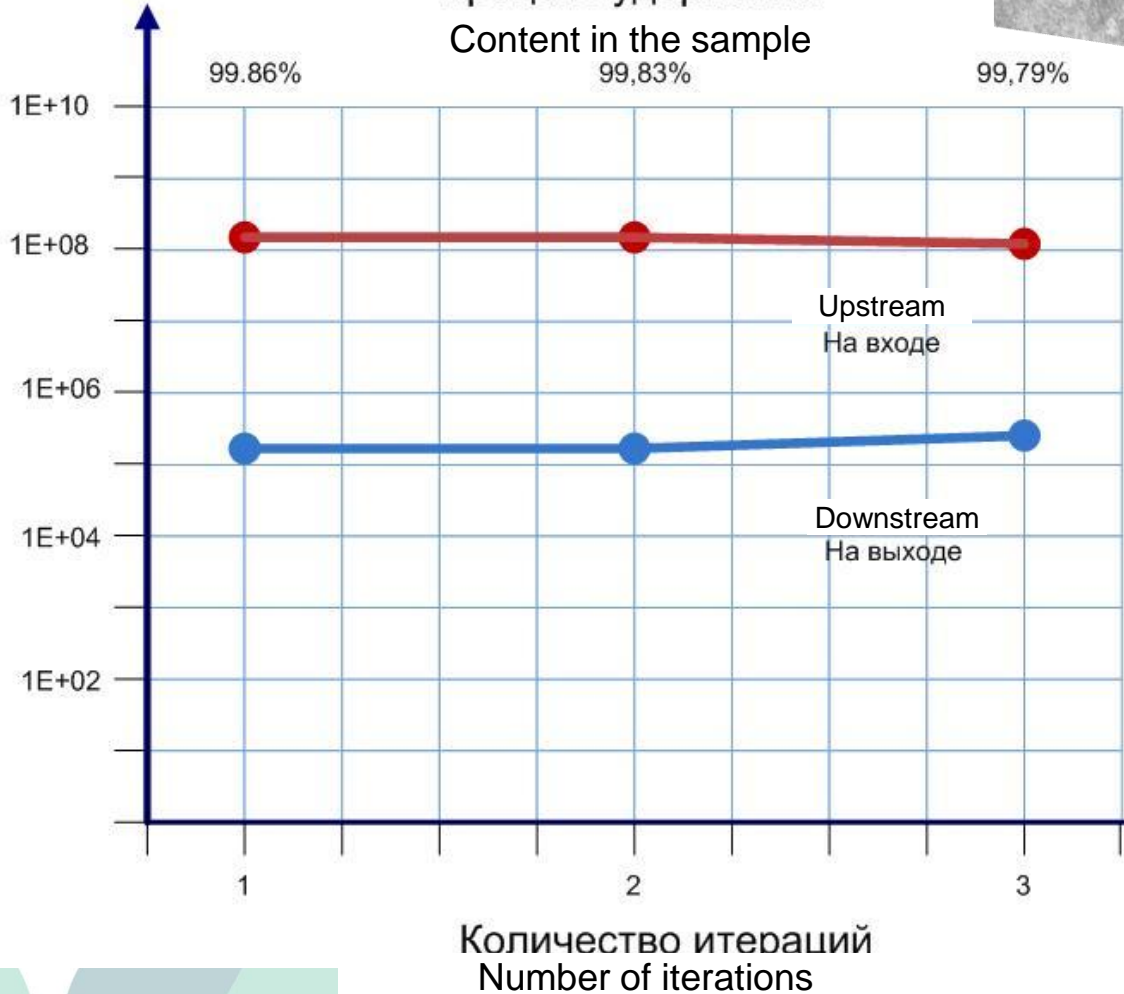


Removal of Poliovirus



Retention percentage
Содержание в пробе

Процент удержания
Content in the sample



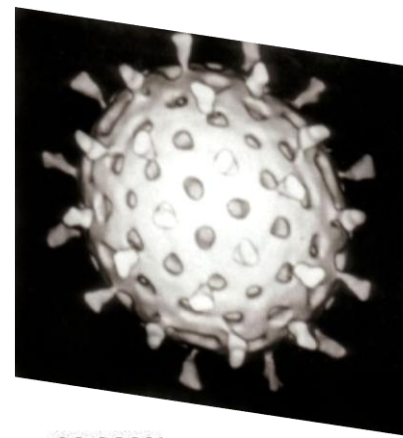
Poliovirus (Poliovirus strain Sabin type I)

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

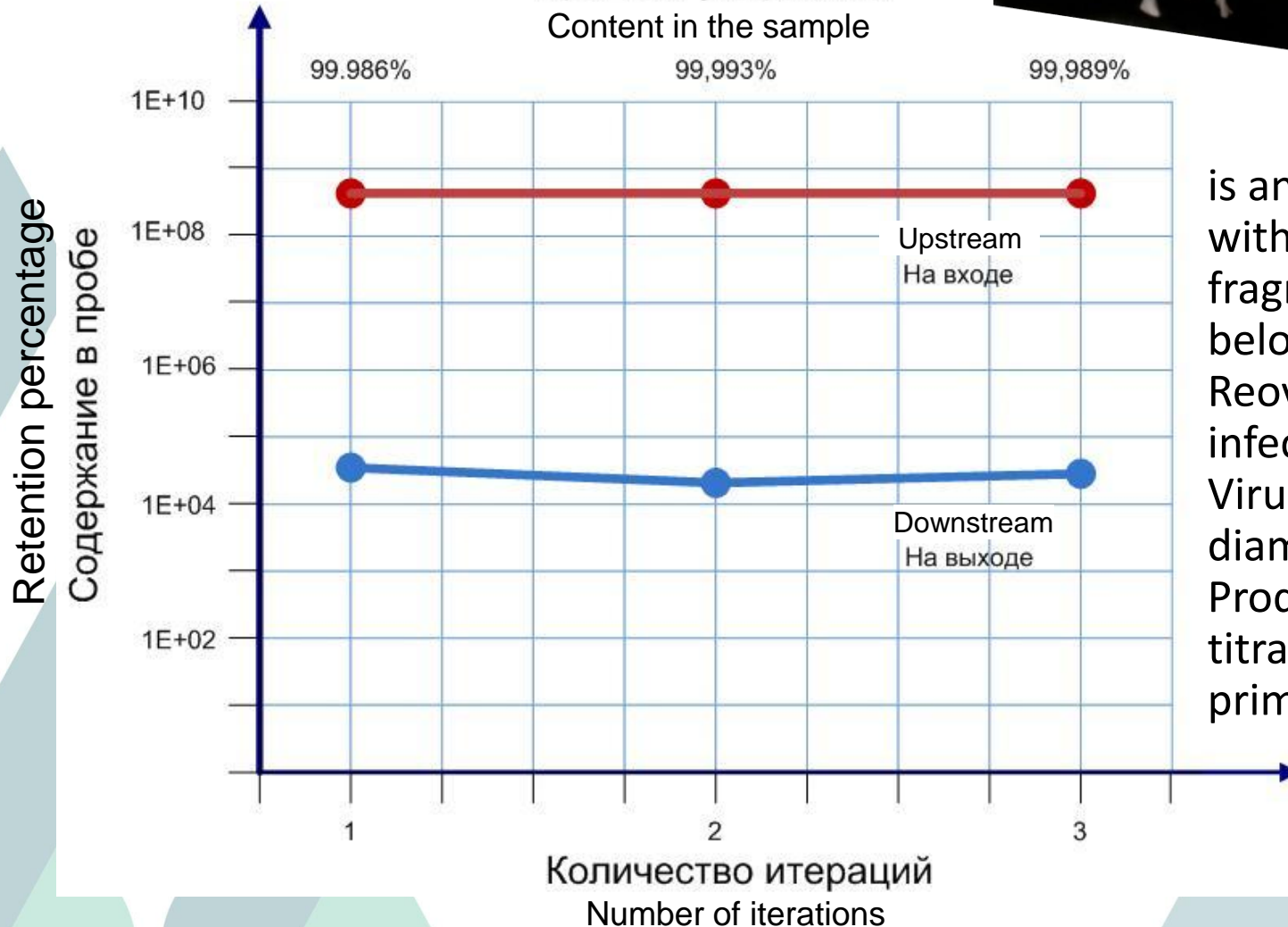
Production and titration were on the BGMK cells (African green monkey's kidney).



Removal of Rotavirus



Процент удержания
Content in the sample

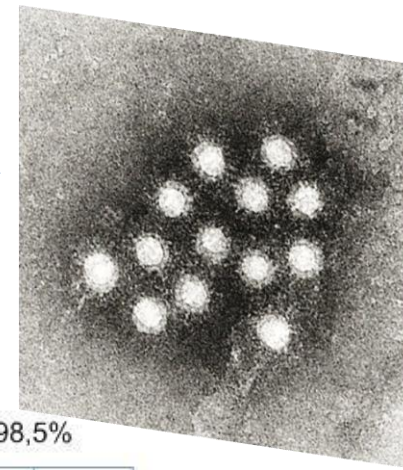


Rotavirus

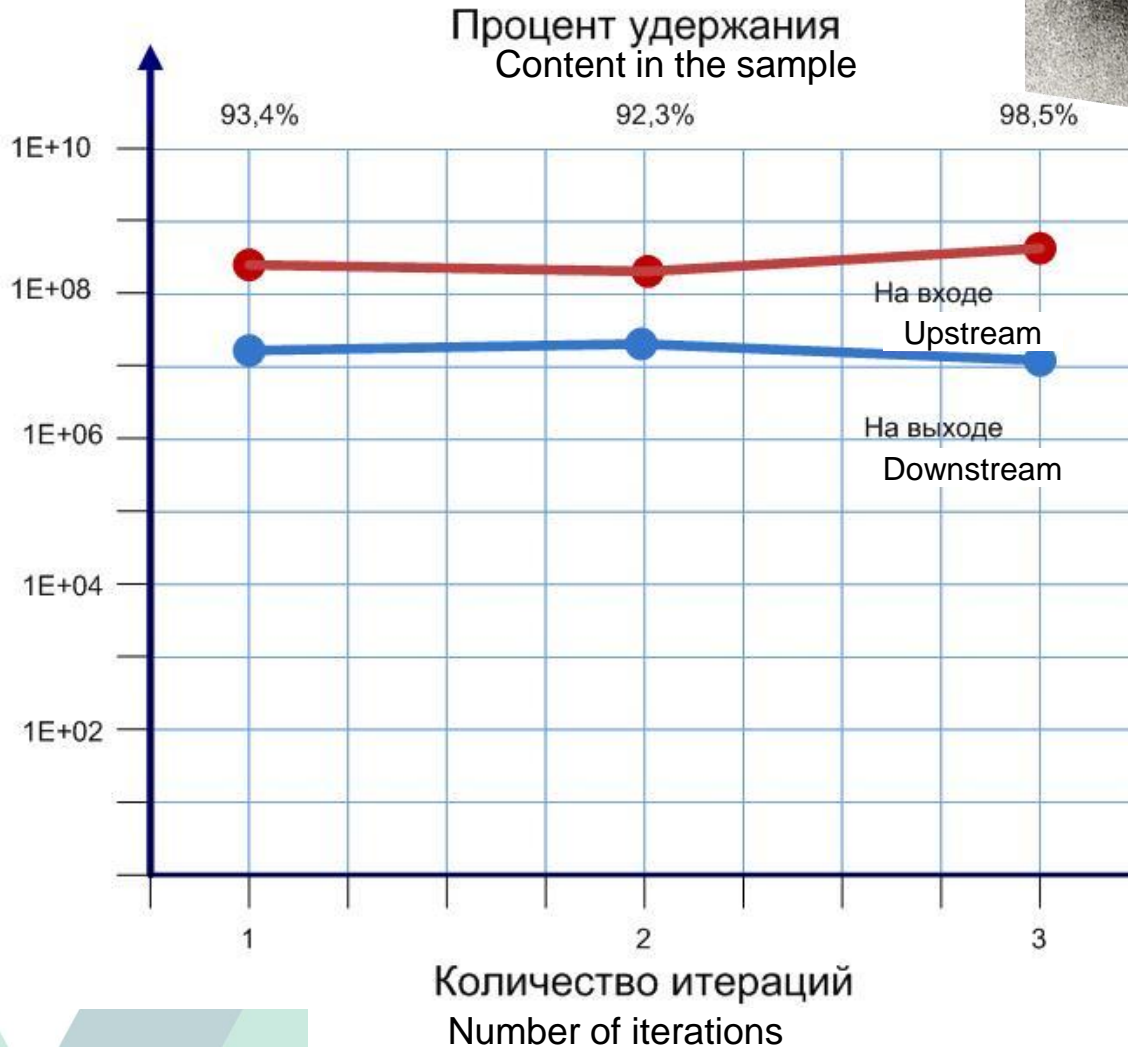
is an enveloped virus with two-strand fragmented RNA belonging to the family Reoviridae, rotavirus infection agent. Virus size: 76.5 μm in diameter. Production and titration were on the primates MA104 cells.



Removal of Hepatitis A



Retention percentage
Содержание в пробе



Hepatitis A

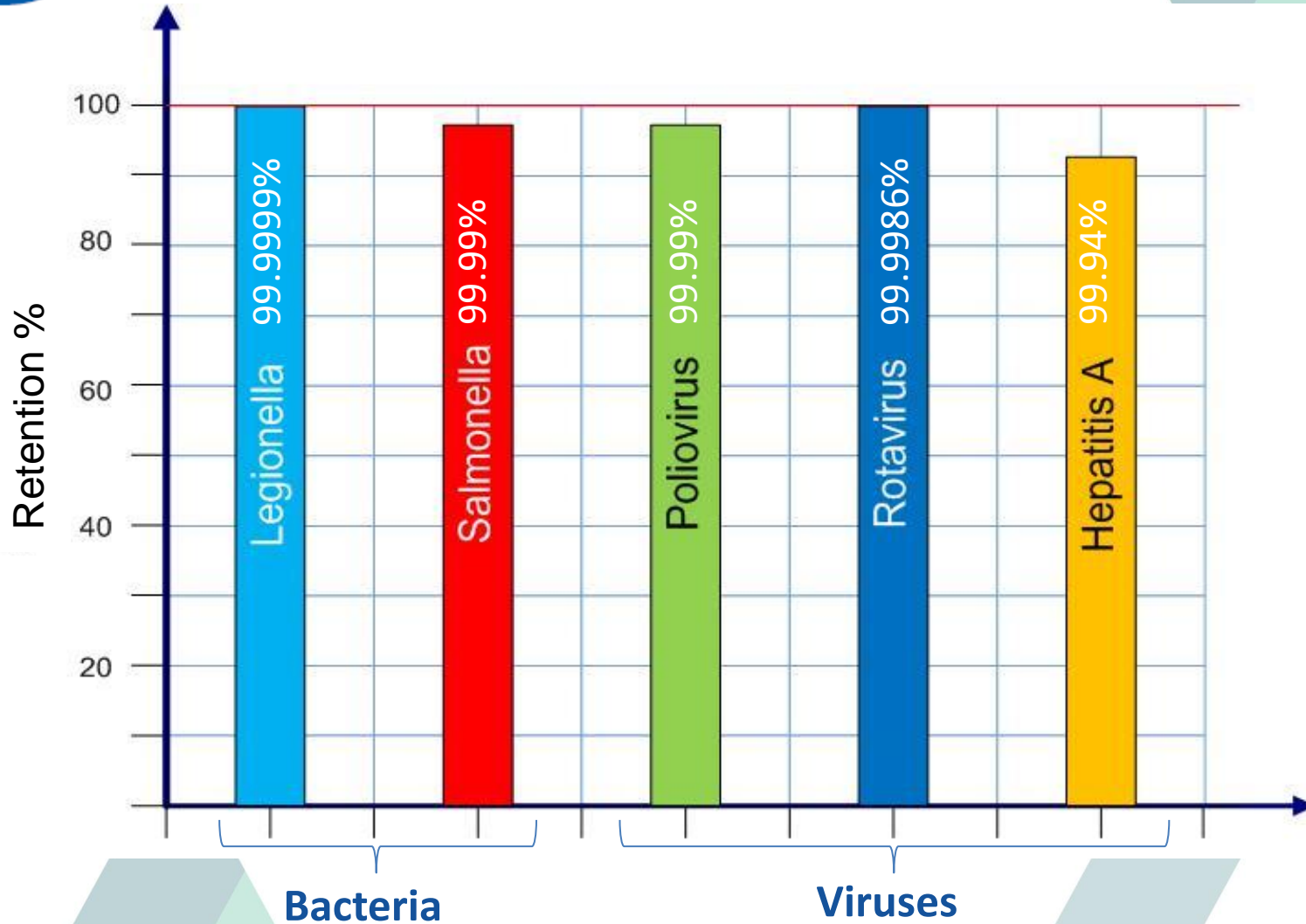
(formerly known as infectious hepatitis) belongs to Picornaviridae family of viruses.

It has no envelope and contains (+) single-stranded RNA packaged into protein capsid.

Size: 27 μm in diameter.



Efficiency of Viruses and Bacteria Removal





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.

Domestic use

- ✓ Potable water filtration both at home and outdoors
- ✓ Water supply of house
- ✓ Water purification in emergency zones, (radioactive pollution conditions)
- ✓ Water treatment in mainlines

Commercial use

- ✓ Treatment and purification systems for discharges
- ✓ Hot water supply (boilers)
- ✓ Pre-filtration in the membrane filtering systems
- ✓ Pre-filters for mainlines

THANK YOU FOR YOUR ATTENTION!

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