Department of Microbiological
And Hygiene Products

[LGA logo]
Industrial Institute of Bavaria

Industrial Institute of Bavaria– postal box 30 22 – 90014 Nuremberg, Germany

Bavarian Ministry for State Development and Environmental Affairs

Mr. Hurler, the Ministerial Adviser

Postal box 810140

81901 Munich

Your message	Your reference No	Our reference No	Reporter in charge	Telephone No	Nuremberg
dated 08.06.1998 r.	10/7-4413.5-1998/1	MIH/M.Uhr	Michael Uhr	(09 11) 65 55-741	26.06.1998

Drinking water filter manufactured by Provitec GmbH, Passau

Dear Mr Hurler

In your letter from 08.06.1998, addressed to the Chamber of Industry and Commerce in Passau, among others things you request for the Industrial Institute of Bavaria to assume certain attitude towards its press announcement 55/1997, concerning the drinking water filter mentioned above, as well as to discuss issues enumerated in the document. As an attachment to this letter we enclose responses to the most important questions concerning the filter.

Sincerely Yours

Industrial Institute of Bavaria
Department of Microbiological and Hygiene Products

[signature unreadable]	[Round Stamp of the Industrial	Micheal Uhr
Dr Doroethee Boeck	Institute of Bavaria]	
Senior Adviser for Chemistry Affaires		MSc Engineer

Copy for the attention of Provitec GmbH, Passau

Attachments:

Copy of the Press announcement

Answers for questions being asked

LGA – MIH – Tillystraße2 -90431 Nuremberg, Germany

Tel. (09 11) 65 55-741 – Fax (09 11) 65 55-739

Department of Microbiological
And Hygiene Products

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Industrial Institute of Bavaria

Attitude of the Industrial Institute of Bavaria
towards the letter from 08.06.1998,
issued by the Bavarian Ministry for State Development and Environmental Affairs

Concerning question a)

„What operating and maintenance conditions were present while testing the PROaqua 4200 filter?"

Test water was accumulated in the container of volume equalled to 70 litres. It was pumped through the water filter with the water pump, according to user manual elaborated by the manufacturer, at the flow rate equalled to 2 litres per minute. Before the experiment was started, the samples were collected from the container, in order to define the initial concentration of certain parameters. They were designated in the tables as "after 0 litres".

Than the water samples, after it was filtered with the filter, were collected, according to the testing routine designed by the Ordering Party.

The manufacturer maintenance conditions were not taken into account, in accordance with effective agreement, so that the issues of safety, efficiency and filtering quality of the drinking water filter PROaqua 4200, could be observed in this extreme conditions.

Concerning question b)

„What properties did the water being tested exhibit?"

For the sake of chemical examination being performed, the syntactical water that originated from the Nuremberg pipeline system was manufactured, with addition of selected substances: nitrate, "sediments", ammonium, lead, nickel, chlorine (from sodium hypochlorite), tetrachloromethane and plant protection agents: atrazine, dezethelatrazine, simazines, and metazachlor. From time to time, extremely high input concentrations that practically cannot be observed in normal conditions were being used, depending on parameters under test. Despite the fact such high filtering loads were used, the results achieved by the filtering system PROaqua 4200 remain flawless. The examination was performed according to corresponding DIN regulations, concerning given parameters. The Analytical Centre of the Industrial Institute of Bavaria is the accredited research laboratory.

Also for the sake of microbiological examination being performed, the syntactical water that originated from the Nuremberg pipeline system was manufactured with addition of strains of bacteria from Coli and Escherichia Coli group. The examination was performed according to attachment 1 of Regulation concerning drinking water and to requirements defined in norms DIN 38411-K5, as well as DIN 38411-K6. All examination results were conforming to expectations and flawless, namely:

The bacteria filter manufactured by the SATORIUS, Göttingen Company, being used in the PROaqua 4200 system is employed in parallel with respect to other filtering elements. It means that all microorganisms that may be present in well water, pipeline system water or drinking water, are eliminated completely. The microbiological properties of the water, after it went through the drinking water filtering system PROaqua 4200, are of similar values to those of typical pipeline system water.

Abstract from technical documentation of the Satorius AG, Göttingen Company
(among others, the manufacturer of bacterial filter Sartobran-P and –PH)

Solutions susceptible to high temperature, such as those containing tissue culture serums, are not to be sterilized by means of autoclave action. Cold sterilization by means of membrane filters is safe and simple. It may also be recommended when liquids used for autoclave action are to be rapidly sterilized. Validated membrane filters of pore width equal to 0,2 µm, capable of retaining bacteria and bigger microorganisms are used for sterilization. Safety is the crucial concern when performing sterilization. Penetration of separated microorganism may not be possible, even at high fluctuations or pressure hits (pressure difference of 5 bars).

The material being used during the production of the membrane filter does not arouse any concerns from the medical point of view; it does not exhibit any toxic properties (verified according to pharmaceutical norms effective in USA), and it is being manufactured in cleanness class 10.000 conditions (according to pharmaceutical norms effective in USA). Multi-level control of the final product quality guarantees required safety standard while using the product as the sterilizing filter.

Main application:

Sterilization of water, water solutions, nutrition solutions susceptible to high temperatures, vitamin solutions, serums, virus vaccines, plasma fractions, enzymes (0,2 mm).

Taking into consideration the described area of application of the bacteria filter being used in PROaqua 4200 system, the safety issues in terms of using the product as the microbiological contaminations filter are not of any concern, which can be taken for granted. Thus, the bacteria filter being used exceeds the level required for the application of the PROaqua 4200 system. Nevertheless safety remains the key issue for all taken activities. Basically one should assume that filtered water fulfils given requirements, otherwise no physician could apply serums of vaccines.

While microbiological examination of the PROaqua 4200 system was being performed, the negative influence on the durability of used bacteria filter of bacteria growth and deposition of bio-film over the filter and other filtrating media was verified. As the experiments indicated, such a bacteria filter would “expand” within a week, due to bio-film creation, causing the water flow to stop.

Appropriate filtering technique, used materials and various preparatory agents used in filtration system, restrain to great extent the bacteria growth, thus limiting the bio-film creation on the filter, which was confirmed by the observations made. Even after 4 months of exploitation of the bacteria contaminated drinking water filter under heavy load conditions, no reduction of flow rate could have been observed, whereas the results of microbiological experiments remain beyond reproach.

According to our knowledge and information, the PROaqua 4200 filtering system is being used since autumn 1996 and until today no flow rate reduction, due to e.g. bio-film creation has been observed. It is the very long period of application of the described bacteria filter that ensures safety, as well as unparalleled technical parameters of the PROaqua 4200 system, first and foremost with respect to microbiological aspect.

Based on the observations we have made during the research that have been carried on since 1990, on various prototypes by the system PROaqua 4200 inventor Mr Roland Bilz, we concluded that he managed to significantly optimized the construction of the filter, thus fulfilling the essential initial requirements to enable for the use of the bacteria filter in the PROaqua 4200 system.

Taking into consideration quality requirements of the bacteria filter, manufactured by the SATORIUS company and financial aspect of employing the PROaqua 4200 system for filtering drinking water, one should draw a conclusion that using the PROaqua 4200 system, even without any maintenance service being done, produces microbiologically faultless drinking water.

Concerning question c)

„To what extent were the health services and public pipeline system representatives taken into account while performing the research?"

Neither health services, nor public pipeline system representatives were included throughout the course of research, because objective interpretation, as well as estimation of presented research results and employed filtering techniques, could have been done by a person with sufficient level of competences in the given area alone. Moreover, the results achieved during the research are self explanatory. According to the conversation with the drinking water PROaqua 4200 filter manufacturer, the research reports are to be treated as comprehensible.

Nuremberg, 26.06.1998
Notes/Annotations:

Industrial Institute of Bavaria
Department of Microbiological and Hygiene Products

[signature unreadable] Dr Doroethee Boeck Senior Adviser for Chemistry Affaires	[Round Stamp of the Industrial Institute of Bavaria]	[signature unreadable] Micheal Uhr MSc Engineer

Bavarian Ministry for State Development and Environmental Affairs

Bavarian Ministry for State Development and Environmental Affairs, 60792 Munich

Government of the Lower Bavaria
Regierungsplatz 540

84028 Landshut

Your reference No, Your message dated	Our reference No, Our message dated	Telephone (089)	Telefax (089)	Permit number	Munich,
	VII 3/5279-41/8/00	1261-2388	1261-2169	E 227	27.01.00

Application of drinking water filters at household water intakes

In general terms, the drinking water supply should be realized – due to health protection issues – by means of quality faultless subterranean water that does not require filtering. The use of filters for the sake of drinking water filtering (e.g. the PROVITEC products) may be however advisable in some particular cases, especially when drinking water, confirming to hygiene and quality requirements, temporarily may not be supplied by means of own, or isolated water supply installations, as well as when permanent water supply source is not operational for the time being (e.g. due to connecting to central drinking water supply installation, overhaul being done within existing water intake, inclusion of protected water reservoirs by a new water intake).

Yours sincerely
[Signature unreadable]

Dr Gran
Ministerial Adviser

Prof. D. med. Gert Frösner
Clinic Virology Research Group

Max von Pettenkofer - Institute

For Hygiene and Medical Microbiology

Ludwig Maximilian University of Munich

Pettenkoferstr. 9a

80336 Munich, FRG

Tel. (089) 5160-5260

Laboratory: -5228

Fax (089) 51605292

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28 of January 2000

Expertise concerning elimination of

polyvirus from water by means of

Drinking water filter PROaqua 4200

Manufactured by PROVITEC company

94036 Passau, Germany

I. Essential aspects of performed examination of drinking water filtering system, concerning reduction of virus presence in water

By means of filtering processes, adsorption and ion exchange, appropriate drinking water filtrating systems are able to remove from water most suspensions, heavy metals (lead, cadmium, nickel), halons, chlorine, anions (nitrates, nitrites, sulfates), as well as bacteria.

Environmentally resistant viruses being, apart from bacteria, an important pathogenic agent, may be also present in water. Picornaviruses (polio-, echoviruses and Coxsackie viruses) in particular are one of the viruses present in the excrement contaminated water, as well as retroviruses. Picornaviruses may cause many different diseases (e.g. Heine - Medina disease, meningitis, myocarditis, and hepatitis, various types of cold and even pneumonitis). On the other hand retroviruses are well known, main cause for virus originated diarrhoea diseases. For this cause, the knowledge concerning the ability of the water filtering system to contribute to reduction of virus contamination is crucial.

Because viruses are 100 to 1000 times smaller than bacteria and their diameter, equalled to 15 – 300 nanometres, is significantly smaller than the size of pores used during filtering processes in the filter, the reduction of viruses' concentration may not be realized by means of filtering. However there is high probability of reduction of viruses' concentration by means of absorption of viruses in filtering system. This principle of absorption is successfully employed in air filtering systems, used in sterile production plants as well.

The main goal of carrying the research on drinking water filter PROaqua 4200, manufactured by the PROVITEC company, was to examine the reduction of polyviruses that were previously added highly concentrated to water. Polyviruses were chosen to act as test viruses due to the following reasons:

1. The virus of diameter equal to about 27 nanometres is one of the smallest of known groups of viruses. The reduction of concentration of viruses by means of filtering that would be possible to a lesser extent in case of bigger viruses, has been eliminated in this case.

2. Polyvirus exhibits utmost high immunity. What is worth mentioning is that the spontaneous deactivation of the virus during the examination was not to be accredited to filtering processes and does not have to be included herein.

3. The polyvirus may be treated as a representative for the whole family of piconaviruses, to which many of the water present viruses, causing human diseases belong.

4. The polyvirus can be easily produced in tissue culture in a great quantity for the research purposes. The Plaque-Test provides the method for simple evaluation of infection viruses' particles.

Because of the two last points, the polyvirus has been also chosen as a representative test virus for efficiency testing of disinfection of appliances. Due to significant methodological difficulties, as well as high level of necessary workload, the virological research on disinfection agents is currently performed only as a suspension research. The concentration of disinfection agent can be called efficient if at the given exposure time it would diminish the infection level of a virus by at least 4 orders of magnitude (4 orders of log10, or unitary multiplicity of ten thousands). Procedure for virological research of disinfection agents, as well as assessment of the test results, is defined by the directive (Directive of the Federal Ministry of Health and the German Association against Virus Diseases defining The Conditions for Examination of Chemical Disinfection Agents in terms of their efficiency against viruses, journal of laws of the Federal Ministry of Health, 25: 397-398; Kuwert and Spicher: Comment to the Directive of the Federal Ministry of Health and …; journal of laws of the Federal Ministry of Health, 26: 413-415, 1983).

It is to be examined if the reduction of concentration of the virus, similar to the one required while testing the disinfection agents, can be achieved also in case of drinking water filtering system manufactured by PROVITEC company.

II. Drinking water filtering system under examination

Drinking water filtering system PROaqua 4200 is being distributed by the PROVITEC company, Max-Emmanuel-Str 2, 94036 Passau, Germany. The device is designed to be mounted under cupboard (total height 45.6 cm, diameter 22.7 cm) and after it is connected to the building public water supply system it delivers up to 2 litres of filtered water per minute. The filter case contains various layers (graveller, activated carbon, nitrates removing resin, dolomite filtering deposit, Redoxol wool, bacteria filter) that are separated from one another by the filter fleece. The brand new filtering system was passed for testing at our laboratory at the beginning of December 1999, by the company executive, Mr. Rolanda Bilza.

III. Research methodology

Test virus: The polyvirus type 1 (Mahoney strain) was chosen for examination of filter efficiency of operation.

Cells of tissue culture: The production of polyvirus suspension is performed in the HeLa cells. The Minimum Essential Medium (MEM; Flow, Meckenheim) substance with addition of 10% bovine foetal serum was used as the growth factor for cells.

Production of virus suspension: The virus suspension required for the examination purposes, was produced in cells “plant” (Nunc, Heidelberg). The MEM substance with 100 U/ml of penicillin and 100 µg/ml of streptomycin addition was used as the cell growth factor, to which 10-percent bovine foetal serum was added. The obtained substance, which was used to virus infect the cells layer, included 2.5% of bovine foetal serum.

After about 80% of cells exhibit the cytophaticity effect, the cultures were covered with 1/10 of the initial agent capacity, without the bovine foetal serum and were frozen and defrosted for three consecutive times. After the rest of cells was centrifuged (3000g, 10 minutes) the residues containing viruses was divided into batches and stored in the temperature of -70°C for the examination purposes.

Procedure during examination of reduction of viruses' concentration with the water filtering system being used.

Devices set up: The water to be filtered was fed to the system with the hose being part of the system's delivery scope, from the glass vessel situated 1.5 meter above the bottom of the filtering system. After water passed through the filtering system it was transferred with the hose to the second glass vessel, whose bottom was situated 0.5 meter below the filtering system bottom. The hydrostatic pressure employed to force the water flow was therefore equal to the water column of 2 meters. It enables for the flow rate equal to about 1 litre per minute. In order to terminate the water flow, the inlet and outlet hoses were clasped with the surgery pliers.

Sterilized, demineralised water (Ampuwa, Fresenius) was used for all the examination procedures.

Addition of viruses to the water and sample collection before and after filtering: before water containing polyviruses was introduced to the system, it was aquafloated with 6 litres of water. Than the **water sample** was picked at the system outlet in order **to perform toxicity control**.

Afterwards, 2 litres of water containing approximately 10^8 of infective polyviruses per millimetre (to 6 ml of polyviruses suspension, that exhibit 10^{11} of infective units per millimetre, as the previously performed titrimetry showed, 2 litres of water was added) were let in the system. **The samples were collected from the prepared testing water in order to define the initial concentration of** polyviruses**.** Afterwards the water containing the polyviruses was let in the filtering system. The filtering system aquafloating, realized as the following step was done with the polyviruses-free water again.

Due to the fact that the rated capacity of the system equals according to manufacturer information approximately 2 litres, the first two litres of the water flowing out were not included in research. For the examination for possible presence of polyviruses after the water was filtered; **the sample was collected after 3 litre of water flowing**. Moreover **samples from 3rd and 4th litre of water flow were collected**.

In order to be able to distinguish possible consecutive virus flow, another **sample was picked after 6th litre of water** flowing through the filtering system.

In order to be able to distinguish possible consecutive settlement of absorbed viruses, the filtering system was aquafloated with 2 litres of water again after **24 hours, 48 hours and after 7 days.** Another sample was collected from this volume of water being filtered in order to perform polyvirus detection examination.

Infectiveness titrimetry during the plaque test: all water samples were diluted 1:10 with MEM, which consisted of 10% bovine foetal serum.

Every 2 wells of the culture multi-dishes (Facon 3046) with 6 wells of flat bottom (Becton Dickinson Labware, Lincoln Park / New Jersey), containing dense HeLa cells structure were inoculated with each millimetre of the dilution (sample dilution by 10^{-1}) and consecutive decimate dilution. After the virus adsorption time of one hour, at ambient temperature, remaining fluid was drained. Then the layer of cells was covered with 2ml of 2% agarose condensed by ebullition (Serva Feinbiochemica / Heidelberg, high EEO, reinst, catalyst No 11397), mixed with double concentrated MEM with 3% bovine foetal serum in 1:1 ratio and that was water cooled to the temperature equalled to 40°C. After the agarose solidification at ambient temperature the dishes were incubated at the temperature equal to 37°C for two days in the CO_2 incubator.

During this time under the layer of agar in every place of cells structure where infective virus molecules were injected, the region of dead cells was developed (plaque). Thus the size of the plaque indicates the quantity of the infective virus particle, being present in given dilution of the settlement. The plaques were by means of colouring method. To every well 1.0 ml of 0.1% Brilliant Blue R (Sigma Chemie, Deisenhofen, catalyst No B0149) with 20% methanol and 5% acetic acid was added for 30 minutes. The uncoloured plaques were easily distinguishable from blue dyed cells structures. From every two settlements of the given dilution, the average number of plaques was calculated.

IV. Research results

1. Results of control experiments

Cell cultures control: in order to eliminate the undefined destruction of cell structure as well as to confirm the normal growth of cell culture, 2 wells of the multidishes were not inoculated with water samples. Normal, dense and well coloured cell structure was to be observed in these wells.

Toxicity control: in order to eliminate the possibility of the filtered water being toxic for the cell culture, the described above toxicity sample was added to those two wells being diluted by 10^{-1}, 10^{-2} and 10^{-3}. In this case also a normal, dense and well coloured cell structure was to be observed. Thus toxicity was not present even for water sample diluted by 10^{-1}.

2. Measurement of virus reduction by means of water filtering

Quantity of added polyviruses: titrimetry of the sample of added water, containing polyviruses exhibits complete cell structure destruction up to the level of dilution equal to 10^{-6}. For the dilution of 10^{-7} 85 to 73 plaques were observed. **Thus, the output concentration of the polyviruses in water for the cell culture was equal to 7.9×10^{8} of infective molecules per millimetre.** Thereby, along with 2 litres of water 1.58×10^{12} of polyviruses altogether were introduced to the filtering system.

Measurement of virus concentration after water filtering: after passing through the filtering installation, for the sample that was collected after flow of 3 litres of water diluted by 10^{-1}, in one of two dishes 3 plaques of viruses were observed. For the dilution level of 10^{-2} and bigger, no plaques could have been observed. It reflects the virus concentration equalled to 1.5×10^{1} molecules per millimetre. Because the rated capacity of the filtering installation equals approximately 2 litres, the water sample collected after flow of 3 litres belongs to the middle part of the flashing water, used for aquafloating the 2 litres suspension of polyvirus, containing $7{,}9 \times 10^{8}$ virus molecules per millimetre. Thus, while flashing, the polyvirus concentration was reduced by more the 10^{7} times.

The water sample collected after 3 and 4 litres of flow after the polyvirus was added does not exhibit creation of any plaques at dilution of 10^{-1}. Thus the virus concentration equals to less than 10 virus molecules per millimetre.

Also the water samples that were collected after the flow of 2 litres of water after 24 hours, 48 hours and 7 days does not exhibit existence of any plaques when examined at dilution level of 10^{-1}.

V. Evaluation

The research carried out on the drinking water filter PROaqua 4200, manufactured by the PROVITEC company revealed, that the concentration of polyviruses being present in feeding water was reduced in the filtering installation by a factor greater than 10^7. It must be stated that 2 litres of water being fed in the system exhibit extremely high concentration of virus equalled to 7.9 x 10^8 infective molecules per millimetre. The real values of the concentration of the virus that may be present in untreated water before filtering are at most times at the limit of detection of the virus. It is common that the efforts to detect the virus are only successful after increasing its concentration from bigger water volume. Due to this fact one can assume, that the filtering system under examination reliably eliminates the viruses being present in the water at all times.

The recorded reduction of the concentration of the virus by more than 7 log 10 (to the value smaller than one to ten million of initial quantity) is a very good result. When examining disinfection agents for their efficiency against viruses, the control directive requires the reduction of their concentration by at least 10000 (4 log 10 orders of magnitude) in order to state mentioned efficiency. The drinking water filter PROaqua 4200 manufactured by the PROVITEC company can be therefore recognized as a tremendous technical solution, contributing to elimination of pathogenic viruses from drinking water.

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Prof. D. med. G. Frösner

The Johannes Gutenberg University of Mainz

ESWE Institute for Water Research And Water Technology GMBH

AN Institute of The Johannes Gutenberg University of Mainz
Regional Centre of Competence
Hessenwasser GmbH & Co

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Laboratory research results report

Separation of natural radioactivity of drinking water by means of PROaqua 4200 filter

for

Provitec Trinkwasseraufbereitungstechnologie GmbH

Kapellenweg 10d

94155 Otterskirchen

Author:

Doctor of Natural Sciences Sascha Wisser

February 2005

ESWE Institute for Water Research And Water Technology

Kurfürstenstr. 6

65203 Wiesbaden

1. Introduction

1.1 Introduction to research

During the past years natural radioactivity becomes more and more often the subject of public interest. It applies especially to health hazards that may result from the presence of radioactive substances in drinking water. The amended regulation concerning drinking water (hereunder referred to as TrinkwV 2001) defines for the first time the "total admissible dose" of received natural and artificial radionuclides with drinking water that is in effect since the 1 December 2003. Moreover, there are debates taking place currently, concerning the limit value for chemical toxicity of the uranium element which is probably going to be equal to approximately 15µg/l and will be effective for numerous drinking water reservoirs in Germany.

The ESWE Institute deals with the subject of eliminating radionuclides during water filtering for more than twenty years. In our current research we drew our attention to the Proaqua 4200 filter, manufactured by the Provitec company, which thanks to the employed Multi Barrier technology, exhibits promising properties in terms of separation of radioactivity from drinking water. Thus the Provitec company decided to outsource the execution of the research described herein to the ESWE Institute, in order to evaluate in laboratory conditions the capability to separate radioactive substances from drinking water by the PROaqua 4200 filter.

1.2 Main tasks and goals

As discussed with the investor the goal of the project was first of all to examine the following two issues:

1. Defining the percentage separation of natural radionuclides from radioactively contaminated test water, by means of PROaqua 4200 filter in laboratory conditions.

2. Description and evaluation of application of the PROaqua 4200 filter in private household conditions.

The tests were of strictly laboratory nature and were to be performed in the ESWE Institute for Water Research and Water Technology in Wiesbaden. The radioactive test water was to be produced in ESWE Institute and to exhibit chemical properties resembling to these of drinking water. In the scope of the laboratory research it was to state whether the PROaqua 4200 filtering system is capable of educing radioactive substances from drinking water. Neither the durability of separation, nor the durability of the filter in case of the radioactivity presence, were not to be observed in due course of the laboratory research. Keeping this in mind, the total volume of 1000 litres of water was expected to be let in the filter with simple laboratory equipment. Radioactivity of the test water should be of the same level, as it is or might be, in case of water being drawn from German reservoirs of drinking water.

2. Course of research

In order to perform the laboratory research, the ESWE Institute was given the free, typical PROaqua 4200 filter, available to be commercially purchased. According to manufacturer information, the drinking water filtering system was designed to remove harmful substances from drinking and untreated water, independent of their nature and concentration. In order to verify this statement with respect to radioactivity, six batches of 170 litres each of test water with increased concentration of radioactive substances was produced altogether and collected in a container (picture 1).

Picture 1: Container used for examining separation of radioactive substances from drinking water

The content of radioactive substance in test water was determined precisely before the research had been started. The filter was activated at the ESWE Institute on the 1st of November 2004 by the Provitec company employee, Mr. Klaus-Jürgen Paetsch. Before activation, the filter was connected precisely according to instructions of the manufacturer, thus in the same manner as it is being done during typical installation at client's premises. Then, the selected amount of water was passed through the filter, according to the schedule for a few weeks. Filtered water („clean water") was being examined in regular intervals for the presence of radioactive substances. Afterwards the clean water was transferred to a sewerage system.

3. Results

In order to simplify the analytical tasks, only the **total alfa activity** of the water samples was measured. This common parameter encapsulates all water present alfa radioactivity sources, including uranium and radium. It must be also stated that both uranium and radium are important radioactive isotopes, being present in drinking water.

While measuring the total alfa activity, as a result all major radionuclides present in water were covered. All measurements were done in our certified research laboratory, by means of liquid scythyloscope. In order to purify the samples the method of freezing and drying was used.

3.1 Filter inlet (test water)

The test water used during research was ground water from the Saar-Nahe-Becken reservoir, with added solution of uranium and radium. Six batches of water were produced altogether (each of approximately 170 litres), all of them were practically identical in terms of their chemical properties. One of the conditions defined by the researchers was to use such test water that would contain approximately 1.0 Becquerel of radioactive substances per litre (Bq/l). The table below illustrate the content of radioactive substances in consecutive batches of test water:

Table 1: Properties of test water, used for examining the separation of radioactive substances

	Total alfa activity (Bq/l)	**pH value**	**Temperature (°C)**	**Conductive capabilities (µS/cm)**
Test water batch 1	0,82	7,69	22,8	638
Test water batch 2	1,01	7,74	15,1	652
Test water batch 3	1,04	7,64	18,5	629
Test water batch 4	1,03	7,58	18,3	616
Test water batch 5	1,02	7,63	17,2	633
Test water batch 6	1,11	7,45	18,0	625
Measurements uncertainty of total alfa activity : ±12				

There were only minor differences of parameters' values between batches of test water. The temperature differences were present because of fluctuations of temperature inside the laboratory. Apart from the above differences, all six batches of test water were almost identical in terms of their chemical properties.

3.2 Filter outlet (clean water)

As a part of six experiment series on the trial of test water batches described above, a sample was collected at the filter outlet every 10 litres of water flow. Approximately 100 samples were collected in this manner during the whole scope of experiment. Then the measurements of total alfa activity were performed in the ESWE laboratory. All measured samples of clean water exhibit results at the limit of detection of the used measurement technology. The following table presents only maximum values of total alfa activity for each experimental series.

Table 2: Results of six performed series of experiments

	Test water Total alfa activity (w Bq/l)	**Clean water/outlet Total alfa activity (in Bq/l)**	**Separation percentage in %**	**Amount of water flow (total)**
1. experiment series	0,82	0,007	99,1	170 litres
2. experiment series	1,01	0,012	98,8	340 litres
3. experiment series	1,04	0,008	99,2	510 litres
4. experiment series	1,03	0,010	99,0	680 litres
5. experiment series	1,02	0,012	99,8	850 litres
6. experiment series	1,11	0,012	98,9	1020 litres
Measurements uncertainty of total alfa activity : ±12				

One states that for all water samples collected at the filter outlet, they exhibit only minor content of radioactive substances. Their separation percentage was equal to at least 98% for total alfa activity parameters. **Thus the content of uranium and radium in test water was almost entirely removed.**

4. Conclusions

The obtained results of carried experiments presented in point 3 confirm unparalleled efficiency of operation of the filtering system in terms of removing radioactive substances. Drinking water filter type PROaqua 4200 managed to remove almost entire radioactive content of tested water. During the simple laboratory experiments it was stated that the radioactive substances are being removed by the Multi Barrier system of the Proaqua 4200 filter.

Wiesbaden, 17 February2005

ESWE Institute for Water Research And Water Technology

Acting executive: D Sascha Wisser

[logo of GFG] Complex Basic Science Centre, Wiesbaden

Bernd Bruno
Rudolf-Vogt-Straße 11
66187 Wiesbaden
Tel. 0611/84 31 01
Fax 0611/9 81 27 20

Research Report

Testing of drinking water filtering device - „PROaqua 4200 D", manufactured by the PROVITEC company – according to our new as well as standard methods

Preliminary remarks:

Development of drinking water filtering device that would encapsulate all common and known water filtering systems should be treated as pioneer achievement of the manufacturer. It was made possible by introduction of the effective modular system.
Employment of the PROaqua 4200 D in practice does not cause any problems even for beginners.

Research

The drinking water filter PROaqua 4200 D was subjected to low - molecular - weight examination in the Complex Basic Science Centre, according to our new elaborated water maturing method. Thus we were given the opportunity to made surprising observations:
The drinking water filtering device PROaqua 4200 D encapsulates various filtering materials and technologies in such a way (according to manufacturer's instructions) that improvement of information quality could have been observed.
Moreover, the PROVITEC company has in its offer the empty filtering cartridges that allows for use of materials to be energized. Thus the end user is able to improve the energy by means of approved information medium.

In due course of the research we started with rain water, which after all exhibits averagely intense natural energy. After the rain water was passed through the water filtering system PROaqua 4200 D, manufactured by the PROVITEC company, the information content increased significantly. In case of rain water, we only observed the structures of moss flowers and snow crystals, however in case of PROaqua 4200 filtered rain water, we managed to observe structures, whose leaves and flowers look alike.

Because we are not aware of any other manufacturer, who would offer filtering devices of comparable level of energising, the fact the system under tests creates the complex set of several filters within a single unit enabling for efficient energizing is worth being emphasized.

Good quality of drinking water may be also attested taking into consideration its “low - molecular – weight”. According to our new water maturing method, it is now possible to evaluate the rate of energizing already energized water, by means of the water energizer.

We would like to refer herby to the well proven research method of “Hagalis”, however we start with “living water” instead of “Spagiryk”.

In order for the method to be performed, we need the special „initial substance” that would enable for initiation of proper images presentation. Our research procedure features many properties, which play crucial role also in case of “Emoto”.

Thus, highly energetic, strong vibrations are much more difficult to be observed in case of artificial WRM (water maturing method).
Existing natural structures prove to be much more stable and can be sensed also after being stored in water for the prolonged time. If it is not glass that would be used as a storing medium (the vibrations of which are the most beneficial for Si), the maturing structure will undergo rapid creation processes again and may turn into non-energized states again (pipeline system water).

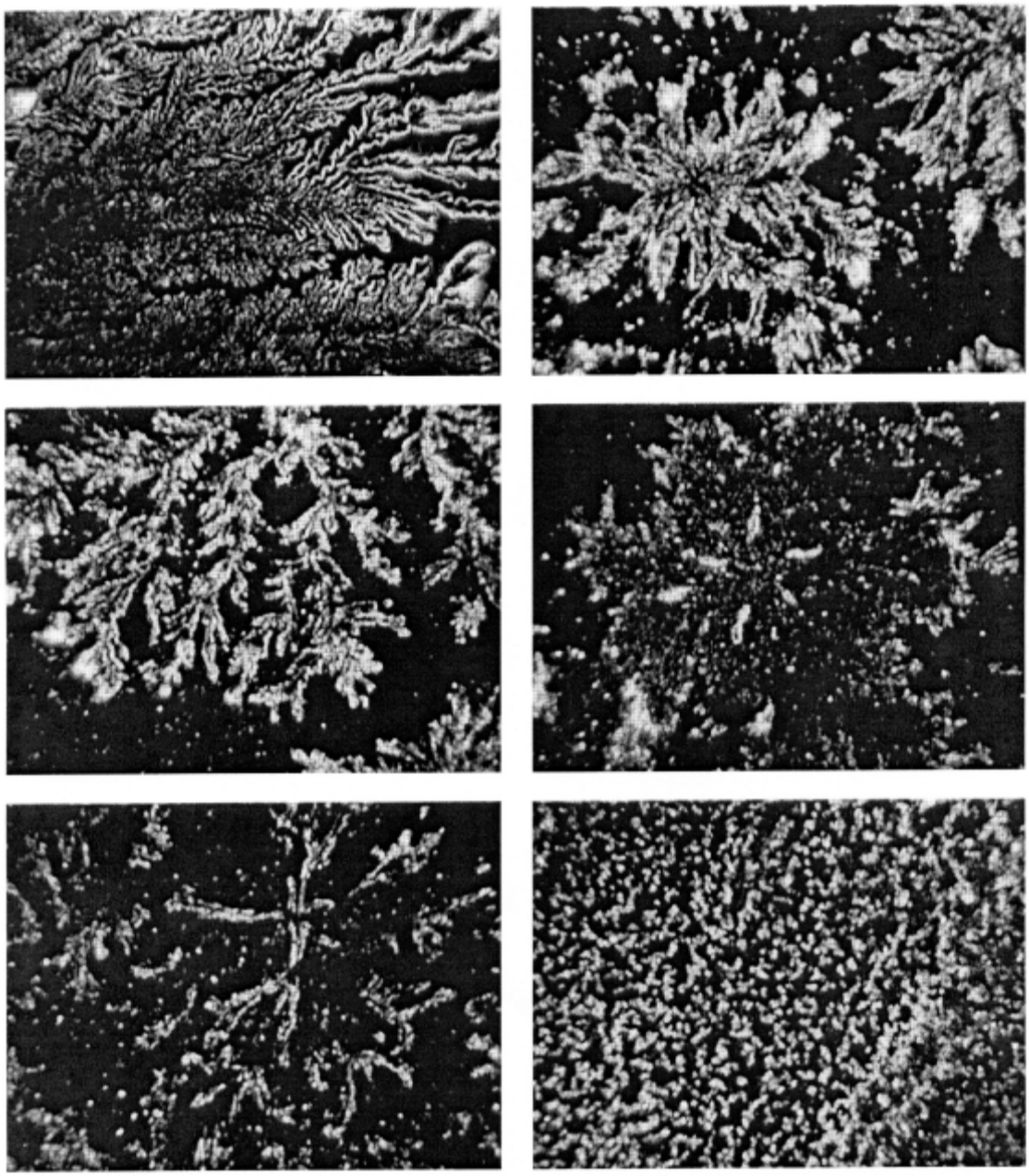
The positive, right hand sided vibrations are being evoked, while the product of the PROVITEC company is being used. In conjunction with the rain water, but not the pipeline system water, it enables for further improvement of the low - molecular - weight of water. In case of the pipeline system water, the evaluated results can be extrapolated.
In order to gain insight into development of such structures, we present extraordinary shapes and objects in a few attached pictures.

Final conclusions:
As it was said at the beginning, the versatility of filtration possibilities offered by the PROaqua 4200 D water filter was a great positive surprise to us.

By means of our new low – molecular – weight research method, we are also able to prove that the drinking water device designed by the PROVITEC company constitutes extremely mature commercial product.

Wiesbaden, April 15, 2005

PROVITEC – the rain water structure



From the esthetical point of view there cannot be anything better to see!
The colour plant photographs – shiny, with their filigree, finely branched structures (fractals) are a true delight for one's eyes.

We observe the structures of the rain water being treated by the drinking water PROaqua 4200 D filter, manufactured by the PROVITEC company, exhibiting the parameters of the flawless drinking water. The treated rain water was not "energized" additionally, thus it provides such esthetical visual sensations

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg

Abstract from the research report No UAZ 9670833 dated 17.07.1996

1. Definition of tasks

During the series of experiments one examined the operation in terms of eliminating various water contained substances and metals by the water filter PROaqua 4200 Standard 1, equipped with the Aktiv/PLUS cartridge along with two resin cartridges for removing of nitrides. For this purpose the filter was exposed to extremely high concentration of organic substances, lead, chlorine, as well as nitrides. Thus the operation of the PROaqua 4200 Standard 1 filter (minimum/standard fixture of the filter) was to be evaluated when subjected to unexpected, high concentration of the harmful substances.

For the sake of the research being performed, the syntactical water that originated from the Nuremberg pipeline system was produced, with addition of nitrates, chlorine (from sodium hypochlorite), tetra chloromethane, tetrachloroethane and plant protection agents: atrazine, dezethelatrazine, simazines, and metazachlor. The quantity of these added substances was equal to the doubled limit value, defined by the Regulation concerning drinking water (Attachment 2). Copper, zinc, as well as silver were to be examined based on the filter settlement; thus with respect to these elements, no additional dosing was introduced.

Test water was accumulated in the container of volume equalled to 700 litres. It was pumped through the water filter with the water pump, at the flow rate equalled to 2 litres per minute. Before the experiment was started, the samples were collected from the container, in order to define the initial concentration of certain parameters. They were designated in the tables as “after 0 litres”. Than the water samples, after it was filtered with the filter, were collected, according to the testing routine designed by the Orderer.

The research was to be suspended if the content of nitride, equal to 10 mg/l (nitride residuals), would be exceeded. After the defined measurements limits are achieved, the filter may be subject to regeneration.

2. Experimental procedure

The measurements of individual parameters were conducted according to data summarized in the following table:

Parameter	Method
Value of pH	DIN 38404-C5
Free available chlorine	DIN 38408-G4-2
nitrate	DIN EN ISO 10304
Lead	DIN 38406-E6
Silver	DIN 38406-E18
Copper	DIN 38406-E7
Zinc	DIN 38406-E8
Plant protection agents (triazine)	Capillary gaseous chromatography with the use of solid phase extraction treated phosphorus and nitrogen sensitive detector
Chlorinated free volatile hydrocarbons	Capillary gaseous chromatography with the use of n-hexane extraction treated electrons sensitive detector

3.1 results

Parameter	Value of pH	Free available chlorine (Cl_2)	Nitrate (NO_3)
Limit value – Regulation concerning drinking water	6,5 – 9,5	0,3	50,0
Measure	-	Mg/l	Mg/l
Limit of detection	-	0,01	0,5
After 0 litres (1 sample)	**-7,79-**	**-0,25-**	**-116-**
After 10 litres	-	-	u.d.
After 30 litres	-	-	u.d.
After 60 litres	-	-	u.d.
After 100 litres	7,79	u.d.	u.d.
After 200 litres	-	-	u.d.
After 300 litres	7,75	0,02	u.d.
After 400 litres	-	-	u.d.
After 500 litres	7,87	0,03	u.d.
After 600 litres	-	-	u.d.
After 700 litres	8,00	0,03	1,9
After 800 litres	-	-	9,1
After 900 litres	7,94	0,03	22,0
After 1000 litres	-	-	44,4

u.d. – unable to be detected

In case of the given configuration, the drinking water filter subjected to nitrides load of 116 mg/l, is to be regenerated after treating of max 800 litres.

3.2 Results

Parameter	Lead (Pb)	Silver (Ag)	Copper (Cu)	Zinc (Zn)
Limit value – Regulation concerning drinking water	0,04	0,01	3*)	5*)
Measure	mg/l	mg/l	mg/l	mg/l
Limit of detection	0,005	0,001	0,02	0,05
After 0 litres (1 sample)	**-0,060-**	**-**	**-**	**0,13**
After 30 litres	-	-	u.d.	0,22 (0,09)*)
After 100 litres	0,013	u.d.	u.d.	0,40 (0,27)*)
After 300 litres	0,022	u.d.	u.d.	0,38 (0,25)*)
After 500 litres	0,022	u.d.	u.d.	0,39 (0,26)*)

u.d. – unable to be detected

*) auxiliary value according to Attachment 7, Regulation concerning drinking water

*) measurement value adjusted including the initial value

The Aktiv/$PLUS_G$ filtering cartridge used in this filter configuration exhibits in reference to lead the protective function only, with respect to possible existing heavy metals contaminations. In case of practically acknowledged lead concentration equalled to 0,060 mg/l, the PROaqua 4200 filter must be additionally equipped with special heavy metal removing unit (REDOX-SM).

3.3 Results

Parameter	**atrazine**	**dezethelatrazine**	**simazine**	**metazachlor**
Limit value – Regulation concerning drinking water	0,1	0,1	0,1	0,1
Measure	µg/l	µg/l	µg/l	µg/l
Limit of detection	0,05	0,05	0,05	0,05
After 0 litres (1 sample)	**-1,66-**	**-1,37-**	**-0,84-**	**-1,29**
After 100 litres	u.d.	u.d.	u.d.	u.d.
After 300 litres	u.d.	u.d.	u.d.	u.d.
After 500 litres	u.d.	u.d.	u.d.	u.d.

u.d. – unable to be detected

Parameter	**Tetrachloromethane (CCl_4)**	**Tetrachloroethane (C_2Cl_4)**
Limit value – Regulation concerning drinking water	3	7*)
Measure	µg/l	µg/l
Limit of detection	0,5	0,3
After 0 litres (1 sample)	**-2,3-**	**-2,3-**
After 100 litres	u.d.	u.d.
After 300 litres	u.d.	u.d.
After 300 litres	u.d.	u.d.

u.d. – unable to be detected

*) in connection with other chlorinated free volatile hydrocarbons

The PROaqua 4200 drinking water filter exhibits very high capabilities of capturing as much as 6 harmful substances, whose concentration during the experiment was exceeding even 16 times the permissible levels. In real life scenarios there are no more than 3 organic compounds present in water.

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg

Abstract from the research report No UAZ 9771289 dated 19.03.1997

1. Definition of tasks

During the series of experiments one examined the operation in terms of eliminating various water contained substances and metals by the water filter PROaqua 4200 Standard 1, equipped with the Aktiv/PLUS cartridge along with two settlement removing units. For this purpose the filter was exposed to extremely high concentration of ammonium, water hardness, lead as well as bacteria. Thus the safety of operation of the PROaqua 4200 Standard 1 filter (minimum/standard fixture of the filter) was to be evaluated when subjected to unexpected, high concentration of the harmful substances.

For the sake of the research being performed, the syntactical water that originated from the Nuremberg pipeline system was produced, with addition of heavy metals, lead, nickel, as well as ammonium, calcium and magnesium (in order to obtain total hardness). The quantity of these added substances was equal to 5 times the limit value, defined in the Regulation concerning drinking water (Attachment 2). For ammonium the value was equalled to 10 mg/l and the total hardness was defined at the level of 25 ° dH. Copper and zinc were to be examined based on the filter settlement, thus with respect to these elements, no additional dosing was introduced.

Test water was accumulated in the container of volume equalled to 700 litres. It was pumped through the water filter with the water pump, at the flow rate equalled to 2 litres per minute. Before the experiment was started, the samples were collected from the container, in order to define the initial concentration of certain parameters. They were designated in the tables as “after 0 litres”. Than the water samples, after it was filtered with the filter, were collected, according to the testing routine designed by the Orderer.

The research was to be suspended after the “ammonium” parameter value exceeded the limit of 0,5 mg; in case of the “total hardness” parameter, the suspension took place after the hardness value exceeded 10 °dH. After the defined measurements limits are achieved, the filter may be subject to regeneration.

2. Experimental procedure

The measurements of individual parameters were conducted according to data summarized in the following table:

Parameter	**Method**
Value of pH	DIN 38404-C5
ammonium	DIN 38408-E5-1
Calcium/magnesium/total hardness	DIN 38406-E3-2 and DIN 38406-E3-3
lead	DIN 38406-E6
nickel	DIN 38406-E22
copper	DIN 38406-E7
zinc	DIN 38406-E8
microbiology	DIN 38411-K5 and DIN 38411-K6

3.1 Results

Parameter	Value of pH	Total hardness		ammonium
Limit value – Regulation concerning drinking water	6,5 – 9,5	-*)	-*)	50,0
Measure	-	°dH	mmol/l	mg/l
Limit of detection	-	1	0,18	0,01
After 0 litres (1 sample)	**-7,77-**	**-24,5-**	**-4,37-**	**-9,9-**
After 10 litres	8,12	u.d.	u.d.	u.d.
After 100 litres	8,10	u.d.	u.d.	u.d.
After 200 litres	-	u.d.	u.d.	0,02
After 300 litres	7,93	u.d.	u.d.	0,03
After 400 litres	-	u.d.	u.d.	2,45
After 500 litres	7,89	u.d.	u.d.	-
After 600 litres	-	2,4	0,43	-
After 650 litres	-	7,7	1,38	-
After 700 litres	-	15,4	2,75	-

u.d. – unable to be detected

*) according to attachment 4 of the Regulation concerning drinking water the limit value in force for calcium equals to 400 mg/l ,and for magnesium it equals to 150 mg/l. After recalculation it results in the limit value equalled to 90 ° dH.

In case of the given configuration, the drinking water filter subjected to ammonium load of 10 mg/l and for the water hardness of 24.5 °dH, is to be regenerated after max 300 litres in case of ammonium, and after approximately 650 litres in case of water hardness.

For the drinking water content of ammonium less than 0.5 mg/l, deposition of the “settlement” may probably take place only after approximately 900 litres.

3.2 Heavy metals elimination research results

3.2 Results

Parameter	Lead (Pb)	Nickel (Ni)	Copper (Cu)	Zink (Zn)
Limit value – Regulation concerning drinking water	0,04	0,05	3*)	5*)
Measure	mg/l	mg/l	mg/l	mg/l
Limit of detection	0,005	0,01	0,02	0,05
After 0 litres (1 sample)	**-0,23-**	**-0,20-**	**u.d.**	**0,22**
After 10 litres	0,006	u.d.	u.d.	u.d.
After 100 litres	u.d.	u.d.	u.d.	u.d.
After 300 litres	0,014	u.d.	u.d.	u.d.
After 500 litres	0,018	u.d.	u.d.	u.d.

u.d. – unable to be detected

*) approximated value according to Attachment 7 of Regulation concerning drinking water

3.3 Microbiological research results

Parameter	Quantity of gems 20° C/44h	Quantity of germs 36°C/44h	Escherichia Coli	Germs of Coli form
Limit value – Regulation concerning drinking water	100	1000	u.d.	u.d.
Measure	Colony building units	Colony building units	-	-
After 0 litres	**212**	**2400**	**Able to be detected**	**u.d.**
After 300 litres	0	0	u.d.	u.d.
After 600 litres	0	0	u.d.	u.d.

u.d. – unable to be detected

"At the initial concentration value equal to 212 germs (at the temperature of 20° C after 44 ± 4 h), or 2400 germs (at the temperature 36 ° C after 44± 4h) even after water flow value of 600 litres and performing research according to DIN 38 411 Part 1 no germs were discovered. It was unable to discover the presence of the Escherichia Coli and Coli form germs.

Abstract from the technical documentation of the Sartorius AG company, Göttingen
(The manufacturer of bacteria filters Sartobran-P and PH)

"The pharmaceutical products, such as for example items designed for injections, or infusions, as well as products that have contact with open wounds, must subject to strictly defined quality requirements. The proper quality of the final product may be achieved only when the production process as a whole will be secured against contamination. In the critical areas, where molecular or microbiological contamination may take place, in order to secure the required quality of the final product, complying with given pharmaceutical requirements, among others the membrane filters technology, is being employed."

5.1 Basis for definition of marks in the integration tests
"Acknowledgement of presence of correlation between ability to restrain germs by a sterile filter and practical, non-destructive integration tests has a crucial meaning for the filtration safety."

"According to the instructions of the Health Industry Manufacturers Association (HIMA) from 1983, as well as FDA (Guideline On Sterile Drug Products Produced By Aseptic Processing June 1987), a filter used for sterilization purposes must provide sterile filtration outcome, at the germs contamination level of 10^7 Pseudomonas diminuta/cm^2 of the filtrating surface."…

During the test, the filtration surface was subjected to contamination by approximately 660 billion of germs.

... The table indicates that filtering candles of diffusion value ≤ 3,8 ml/min must produce the sterile filtrate at all times, which means restraining 100% of the test germs Pseudomonas diminuta ." …

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg

Abstract from the research report No UAZ 9771401/1-5 dated 07.07.1997

1. Definition of tasks

The aim for the series of experiments was to examine the microbiological characteristics of the water filter PROaqua 4200 with initial, high contaminating dose of bacteria, as well as extremely prolonged idle state of the filter.

The water filter PROaqua 4200 being used for the series of experiments to elaborate the research report No UAZ 9771289 from 19.03.1997, was installed in the research laboratory at the temperature equal to approximately 20 °C. On 01.07.1997 five water samples were collected from the drinking water filter, in order to undergo the microbiological research, after the idle period of approximately four (4) months. The results of the research were summarized in the following table.

2. Experimental procedure

The microbiological research was conducted according to methods enumerated in the following table:

Parameter	Method
Number of colonies at 20° C after 44 ± 4 h	Attachment 1of the Regulation concerning drinking water
Number of colonies at 36 ° C after 44 ± 4 h	Attachment 1of the Regulation concerning drinking water
Coli form germs	DIN 38411-K6
Escherichia Coli	DIN 38411-K6

3. Microbiological research results

Parameter	**Quantity of germs 20°C/44 h**	**Quantity of germs 36°C /44 h**	**Escherichia Coli**	**Germs of Coli form**
Limit value according to Regulation concerning drinking water §1 (3)	100	100	u.d.	u.d.
Measure	Colony building units	Colony building units	-	-
Initial concentration as for the 19.03.1997 test	212	2400	Possible to be detected	u.d.
Final concentration after idle period of ca. 4 months	countless	Countless	u.d.	u.d.
Results achieved after filtering and rinsing period of 10 minutes	5	18	u.d.	u.d.

u.d. – unable to be detected

"With countless initial concentrations of germs (at temperature 20° C after 44 ± 4h, or at temperature 36° C after 44 ± 4 hours), no germs worth being noticed were present after short rinsing period, equalled to 10 minutes. Nor were the Escherichia Coli and Coli form germs present.

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg
Abstract from the research report No 69253854 dated 17.11.1992

1. Determination of tasks
The aim for the series of experiments was to examine the bactericidal characteristics of the saturated solution of table salt for the regeneration of drinking water filter prototypes, designated as:

NSP 600 or 2 + 4 Wasserturm (without bacteria filter)

Thus the quantity of germs being present in unused drinking water filter was to be examined.
The following samples were collected for the sake of experiment:

Device 1: the sample collected on the 25.08.1992, used for examination (water flow of approximately 600 litres), subsequent idle period of 8 weeks at the ambient temperature.
Device 2: the sample collected on the 26.11.1992; new, unused device.

2. Experimental procedure
Drinking water filtering (water originated from the pipeline system, chlorine free)
According to the operating manual of the device
Regeneration of the used filter: both filter elements were rinsed separately with the table salt solution, according to the operating manual of the device
Microbiological research: determination of the quantity of colonies, according to the Attachment 1 of the Regulation concerning drinking water

3. Results

Parameter	**Quantity of colonies /ml**	
	20° C/44h	**36° C/44h**
Experiment 1: Used device after 8 weeks idle period; samples collection after the 10 litres water flow	2630	1800
Experiment 2: Used device, same as in case of the experiment 1, subjected to regeneration with the table salt solution; samples collection after the 5 litres water flow	0	0
Experiment 3: Brand new device; samples collection after 20 litres water flow	3	2

Description of results:
As the results indicate, the used filter after the idle period equalled to 8 weeks, exhibits features of germs infection. After the regeneration is performed, the device exhibits flawless microbiological parameters. The bactericidal performance of the saturated table salt solution was thus proven by the special regeneration observed in the water filter. No noticeable contamination of filtered water with bacteria germs could have been observed in case of unused device.

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg

Abstract from the research report No 69253854 dated 17.11.1992

1. Determination of tasks

The aim of the series of experiments was to examine the creation of microorganisms during the operation of the drinking water filter. The experiment was to deliver data concerning the bacteria load of the filter being operated.

The following sample was collected to be examined:
The experiment covered the drinking water filter prototype "2+4 Wasserturm" (without bacteria filter) that had been operated for a long time and was left in the ambient temperature for the period of 6 weeks.

2. Experimental procedure

Drinking water filtering (water originated from the pipeline system, chlorine free)
According to the operating manual of the device
Each day, apart from Saturdays and Sundays, 3 litres of water were filtered. Every Tuesday the filtered water was subjected to microbiological examination.

Determination of colonies quantity:
Method 1: according to the attachment 1 of the Regulation concerning drinking water
Method 2: Agar breeding in order to count the number of plaques, 3 days at temperature 30° C

3. Results

Parameter	**Quantity of colonies /ml**		
	Method 1		**Method 2**
	20 ° C/44h	**36° C/44 h**	**36° C/44 h**
Unfiltered pipeline system water at the beginning of experiment	2	0	-
At the beginning of the 3rd week	-	-	3
Water filtered during the 1st week	1	0	-
Water filtered during the 2nd week	3	20	-
Water filtered during the 3rd week	-	-	55
Water filtered during the 4th week	-	-	185

Evaluation of results:

As the results indicate, the regenerated filter exhibits flawless characteristic from the microbiological point of view. No noticeable contamination of the consecutively operated bacteria filter could have been observed. Thus the idle period in terms of filter operation is possible even up to a few years.

Industrial Institute of Bavaria (LGA Bayern) in Nuremberg

Abstract from the research report No 5471260 dated 01.07.1997

1. Definition of tasks

The aim of the series of experiments was to examine the creation of microorganisms on all internal surfaces of the housing of the drinking water filter PROaqua 4200. The experiment was to result in conclusions concerning the creation of so called “bio film”.

I. Microbiological research

1. Examination of bacteriostasis according to SNV 195921

The evaluation scheme with the use of the research method SNV 195921

bacteriostasis area in mm	Film creation	description	evaluation	Designation in the outcome table
0	none	no bacteriostasis area, no film creation	Satisfactory operation	+
0	weak	no bacteriostasis area, almost unnoticeable film creation	At the limit of operation, however operation not satisfactory	-
0	average	no bacteriostasis area, film creation reduced by half with respect to control	Not satisfactory	--
0	complete	no bacteriostasis area, film creation not reduced, or weakly reduced with respect to control	Not satisfactory	---

The evaluation of the results was done according to criteria of control standards. The scale of film creation caused by the microorganisms for the element under examination, as well as the size of the film-free area around the element, represented the efficiency factor for the anty-microbacteriological filter fixture.

The research was conducted as simple quantitative determination.

2. The bacteriostasis area test according to SNV 195921

The material samples were bombarded with the microorganisms' suspense and then were subjected to microbes breeding for four weeks at the temperature of 30 ° C with the increased air humidity. Ensuring the state of growing of the microbes in time was checked on the regular basis.

Used control germs:

Fungus: - Alternaria alternata
- Aspergillus niger
- Penicillium chrysogenum

Bacteria: - Pseudomonas aeruginosa
- bacteria isolate (isolated from the water sample, collected while performing the drinking water filter regeneration)

Results:

Sample designation	**Result**
Plastic made cover	No growth
Sealing ring	No growth

II. Results summary

The bacteriostasis test according to SNV 195921
Creation of bacteriostasis area was not observed in case of any of fungus being used during the test. As the results of the performed research indicate, no fungicidal substances diffused from the material under test into the medium that could lead to creation of the bacteriostasis area. At the same time the material itself was not covered with mildew. In general terms, the material is to be evaluated as satisfactory in this respect.

Growth determination experiment
Both samples of plastic for which the tests were performed, did not exhibit susceptibility to microorganisms' growth. One may thus conclude that the material does not contain any substances acting as medium for the microorganisms used during the experiment.

Test results according to test method SNV 195921

Sample: the sample of material (plastic made cover)

Test organism	Growth	Bacteriostasis area in mm	Evaluation
Alternaria alternata	None	0	+
Aspergillus niger	None	0	+
Penicillium chrysogenum	None	0	+

Sample: the sample of material (sealing ring)

Test organism	Growth	Bacteriostasis area in mm	Evaluation
Alternaria alternata	None	0	+
Aspergillus niger	None	0	+
Penicillium chrysogenum	None	0	+

The research performed according to the SNV 195921 directive reveals that in case of both samples, with respect to all three used test fungus, the sufficient fungicidal reaction is present.

Institute of biological and chemical analysis, Pocking
Abstract from the research report No 97040439 dated 22.07.1997

1. Determination of tasks
The aim of the series of experiments is to examine the mildew contamination of the prototypes of the drinking water filter designated as:

„NSP 600" or „2+4 Wasserturm" (without bacteria filter).

For the sake of examination the used drinking water filter of the operation period equalled to 4 years and water flow of approximately 11,200 litres was employed. The filtered was stored for about 3 months in the laboratory at the ambient temperature, then the filter was rinsed for about 15 minutes, and finally the samples were collected, in order to determine the quantity of mildew and germs.

2. Experimental procedure
The microbiological examination was performed according to the methods enumerated in the following table:

Parameter	**Method**
Number of colonies at the temperature of 20 ° C after 44 ± 4h	Attachment 1 of the regulation concerning drinking water
Number of colonies at the temperature of 36 ° C after 44 ± 4h	Attachment 1 of the regulation concerning drinking water
Mildew	LMBG – 01.00-13

3. Results

Parameter	**Number of colonies colony building units/ml**		**Mildew**
	20 ° C/44 h	**36 ° C/44 h**	**Colony building units / l**
Experiment: Device being used for 4 years, after 12 weeks of idle operation. Sample collection after the water flow for 15 minutes	0	0	0

Evaluation of results
As the results of the experiment indicate, the used filter did not exhibit any signs of germs contamination, after the idle period of 12 weeks and being rinsed for approximately 15 minutes. Neither were the mildew cultures being present.

Institute of biological and chemical analysis, Pocking

Determination of tasks

Acting in agreement with the representatives of the Bad Füssing commune and the health department of Griesbach, the PROaqua 4200 filter was installed in 5 households, equipped with their own drinking water supplies. Thus the possibility of employing the drinking water filter PROaqua 4200 was to be evaluated by the well owners, as an alternative solution to the cost ineffective external water connection. The testing period was defined to be 6 months.

The aim of the series of experiments was to evaluate the operation of the **PROaqua 4200** drinking water filter, equipped with the active carbon cartridge, as well as two resin cartridges for removing of nitrides, with respect to its capabilities to remove harmful substances – nitrides in particular. Moreover the bacteriological characteristic of the filter was examined in real life applications. During the course of experiments neither the filtering devices, nor any fixtures were rinsed, or fired. The reversed germs contamination was also examined.

Date of drinking water filter installation: 31 of October 1996

Samples collection on the 04 November 96, by the laboratory of the Institute of Biological and Chemical Analysis

Parameter	Limit value Regulation concerning drinking water	Result before filtering	Result after filtering
Nebether family samples collection			
Quantity of nitrates in mg/l	50	122	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	0	0
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	0	0
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.
Lechner family samples collection			
Quantity of nitrates in mg/l	50	137	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	0	0
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	0	0
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.
Bründl family samples collection			
Quantity of nitrates in mg/l	50	90	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	0	0
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	0	0

Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.

Nebether family samples collection

Quantity of nitrates in mg/l	50	108	u.d.
Sum of triazine in µg/l	0,5	u.d.	u.d.

Leitner family samples collection

Quantity of nitrates in mg/l	50	108	u.d.

u.d. – unable to be detected

Samples collection on the 17.01.1997 by the laboratory of the Institute of Biological and Chemical Analysis – without rinsing and firing

Parameter	Limit value Regulation concerning drinking water	Result before filtering	Result after filtering

Nebether family samples collection

Quantity of nitrates in mg/l	50	ca. 122	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	130
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	98
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Bründl family samples collection

Quantity of nitrates in mg/l	50	ca. 90	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	14
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	2
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Frankenberger family samples collection

Quantity of nitrates in mg/l	50	ca. 108	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	30
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	0
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Leitner family samples collection

Quantity of nitrates in mg/l	50	ca. 108	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	10
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	2
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Parameter	Limit value Regulation concerning drinking water	Result after filtering Before regeneration	Result after filtering After regeneration

Lechner family samples collection

Double quantity of water was collected at the Lechner family (ca. 20 litres a day for washing, washing machine, etc.). In case of such water intake, the filter is to be regenerated after 4-6 weeks. The regeneration was performed on the 20.01.1997.			
Quantity of nitrates in mg/l	50	115	u.d. after regeneration
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	0	-
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	2	-
Escherichia coli in 100/ml	u.d.	u.d.	-
Coli form germs in 100/ml	u.d.	u.d.	-

u.d. – unable to be detected

<u>Samples collection on the 10.03.1997 by the laboratory of water research S. Ziegler, Fürstenzell. Ordered by the Bad Füssing commune and the Griesbach health department – without rinsing and firing</u>

Parameter	Limit value Regulation concerning drinking water	Result before filtering	Result after filtering

Bründl family samples collection

Quantity of nitrates in mg/l	50	ca. 90	3
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	0
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	0
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Frankenberger family samples collection

Quantity of nitrates in mg/l	50	ca. 108	2,6
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	140
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	20
Escherichia coli in 100/ml	u.d.	-	u.d.
Coli form germs in 100/ml	u.d.	-	u.d.

Leitner family samples collection

Quantity of nitrates in mg/l	50	ca. 108	2,9
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	-	3
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	-	9
Escherichia coli in 100/ml	u.d.	-	u.d.

Coli form germs in 100/ml	u.d.	-	u.d.

Parameter	**Limit value Regulation concerning drinking water**	**Result after filtering Before regeneration**	**Result after filtering After regeneration**

Nebether family samples collection

The bigger quantity of water was collected for the experiment series purposes at the Nebether family, in order to demonstrate the regeneration process. For doubled water consumption, the regeneration period equals to 4-6 weeks. The regeneration was performed on the 21.03. 1997.			
Quantity of nitrates in mg/l	50	76	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	2	-
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	1	-
Escherichia coli in 100/ml	u.d.	u.d.	-
Coli form germs in 100/ml	u.d.	u.d.	-

Lechner family samples collection

Double quantity of water was collected at the Lechner family (ca. 20 litres a day for washing, washing machine, etc.). In case of such water intake, the filter is to be regenerated after 4-6 weeks. The regeneration was performed on the 21.03. 1997.			
Quantity of nitrates in mg/l	50	110	u.d.
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	1	-
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	1	-
Escherichia coli in 100/ml	u.d.	u.d.	-
Coli form germs in 100/ml	u.d.	u.d.	-

u.d. – unable to be detected

Evaluation of results of 6 months test session

The PROaqua 4200 drinking water filter exhibits very high capability to remove nitrates, even at their very high concentration (up to 137 mg/litre of nitrates). In case of “normal” drinking water consumption (ca. 10 litres a day) the PROaqua 4200 drinking water filter is to be regenerated after ca. 3 months. In case of extremely high water consumption level, equalled to approximately 25 litres a day, the PROaqua 4200 drinking water filter is to be regenerated after about 4-6 weeks. Such regeneration may be easily performed on one’s own by the filter user. The costs of the process are ca. 0.25 Euro cents.

The microbiological research indicates flawless results during the whole scope of the tests, despite continuous water consumption (see Regulation concerning drinking water – page 18aa). The reverse germ contamination of the outlet unit – regeneration chamber, outlet hose and outlet valve – is extremely low.

Institute of biological and chemical analysis, Pocking

Determination of tasks

Acting in agreement with the representatives of the Bad Füssing commune and the health office of Griesbach, the PROaqua 4200 filter was installed in 5 households, equipped with their own drinking water supplies. Thus the possibility of employing the drinking water filter PROaqua 4200 was to be evaluated by the well owners, as an alternative solution to the cost ineffective external water connection. The testing period was defined to be 6 months.

During the series of experiments the operations of the PROaqua 4200 drinking water filter was evaluated in terms of its bacteriological characteristics after 10 months period of practical application.

Sample 1: sample collection without rinsing and firing.

Sample 2: sample collection after 10 minutes of rinsing with firing.

Samples collection on the 28 August 1997, by the laboratory of the Institute of the Biological-Chemical Analysis: Research report 970777

Parameter	**Limit value Regulation concerning drinking water**	**No rinsing and no firing**	**After 10 minutes of rinsing and firing**
Leitner family samples collection			
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	10	2
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	10	0
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.
Frankenberger family samples collection			
Quantity of colonies in the temperature equal to 20° C in 1/ml	1000	2	2
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	10	0
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.

u.d. – unable to be detected

Institute of the Biological-Chemical Analysis, Pocking

Determination of tasks

The Tetzlaff family living in Teurow suffered from very high exposition to various harmful substances contained in drinking water. The range of harmful substances that could be eliminated by means of the single configuration of the **PROaqua 4200** filter was to be determined.

In the series of experiments the operation of the PROaqua 4200 filter equipped with the active carbon cartridges, REDOX-SM cartridge, resin cartridge for nitride elimination and settlement cartridge was evaluated in terms of elimination various harmful substances. Apart from that, the dolomite cartridge was used for enriching water with magnesium.

Data of drinking water filter installation: 19.09.1996

Analysis performed by the laboratory of the Institute of the Biological-Chemical Analysis

Parameter	Limit value Regulation concerning drinking water	Result before filtering	Result after filtering
Nitrate in mg/l	50	23	u.d.
Ammonium in mg/l	0,5	2,0	u.d.
Iron, total in mg/l	0,2	1,6	u.d.
Manganese in mg/l	0,05	1,2	u.d.
Potassium in mg/l	12	380	0,63
Calcium in mg/l	400	-	u.d.
Magnesium in mg/l	50	-	35,10 Dolomite enriched
Total hardness (degree of hardness)	-	-	9,3 Dolomite enriched
Copper	3	-	0,009
Zinc	5	-	u.d.

u.d. – unable to be detected

Institute for environmental research, Karlsruhe

Master of Chemistry, engineer, expert for water and environmental analysis at the Karlsruhe Chamber of Industry and Commerce, publicly recognized and sworn expert in terms of drinking, ground and utility water
Expert: J. Horst PhD, chemistry engineer

Determination of tasks
The aim of the series of experiments was to evaluate the operation of the **PROaqua 4200** drinking water filter, equipped with the active carbon cartridge, as well as two resin cartridges for removing of nitrides, with respect to its capabilities to remove harmful substances – nitrides in particular. Moreover the bacteriological characteristic of the filter was examined in real life applications. The research was conducted without rinsing or firing.

Parameter	Limit value Regulation concerning drinking water	Result before filtering	Result after filtering
Sample collection: 14.01.1997			
Quantity of colonies in the temperature equal to 20° C in 1/ml	100	0	27
Quantity of colonies in the temperature equal to 36° C in 1/ml	100	0	21
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.
Sample collection: 24.01.1997			
Nitrates in mg/l	50	56,4	0,8
Sulphates in mg/l	240	93,1	< 2
Quantity of colonies in the temperature equal to 20° C in 1/ml	100	0	13
Quantity of colonies in the temperature equal to 36° C in 1/ml	1000	0	11
Escherichia coli in 100/ml	u.d.	u.d.	u.d.
Coli form germs in 100/ml	u.d.	u.d.	u.d.
Sample collection: 14.03.1997			
Quantity of colonies in the temperature equal to 20° C in 1/ml	100	-	3
Quantity of colonies in the temperature equal to 36° C in 1/ml	1000	-	3
Sample collection: 15.04.1997			
Quantity of colonies in the temperature equal to 20° C in 1/ml	100	-	1
Quantity of colonies in the temperature equal to 36° C in 1/ml	1000	-	0
Sample collection: 18.04.1997			
Nitrates in mg/l	50	Ok. 56	0,3
Sulphates in mg/l	240	Ok. 93	4,2
Sample collection: 02.07.1997 r.			
Quantity of colonies in the temperature equal to 20° C in 1/ml	100	-	0
Quantity of colonies in the temperature equal to 36° C in 1/ml	1000	-	1

u.d. – unable to be detected

After the period of approximately 6 months of operation of the filter and the quantity of consumed water equal to ca. 1 600 litres, the nitrates quantity is equal to less than 1mg/l with the regeneration being done in the meantime. The bacteriological examination reveals that the reverse germ contamination does not cause any noticeable presence of germs (see Regulation concerning drinking water – page 18aa).

Final remarks

The possibility to combine various agents and mediation technologies into more than 100 various variants, enables almost all known water contaminations to be nearly completely eliminated. The PROaqua 4200 drinking water filter may be thus individually adjusted for the sake of eliminating any existing harmful substance.

The design of the device provides at the same time optimal ratio of the water flow through the filtering media: active carbon, ion exchanger, Redoxol granulates, bacteria filter, gravel layer, etc. thus achieving the highest possible levels of quality of the filter as well as filtering results. The presence of the so called channelling effect was avoided.

Which harmful substances are being eliminated?

Depending on the water contamination level as well as expectations of the final user, the drinking water filter PROaqua 4200, manufactured by the PROVITEC company, may be equipped with various filtering media, such as:

- for elimination of nitrates, nitrites, sulphates:
Anion exchanger designed for nitrates elimination

- for elimination of organic compounds (e.g. pesticides, halons, chlorine, etc.):
Implemented active carbon, originated from carbonated coconut crusts

- for elimination of lead, zinc, iron, etc.
Various REDOX granulates

- for enrichment with mineral substances (e.g. calcium, magnesium)
Dolomite rock

- for elimination of settlements, ammonium, potassium, etc.
Cation exchanger

- for elimination of bacteria
Fractionated membrane filtering

The other test are being currently elaborated, e.g.
- long term active carbon test of various levels of concentrations and configurations of plant protection agents, halons, etc.
- long term REDOX granulates test of various levels of concentrations and configurations of heavy metals and trace elements

Moreover, the materials being currently employed in the PROaqua 4200 filter are certified by the Hygiene institute for their suitability for food contact. The certification was already prepared by the GS designation of the Industry Institute of Federal Land for prototypes "NSP 600".

Passau, January 1, 2003

Quality Assurance Certificate

This document is to certify that the designated product was manufactured by Sartorius in conformance with established Current Good Manufacturing Practice (cGMP) standards.

This product is developed, produced and distributed according to a Quality Management System that is certified for compliance with DIN/ISO 9001.

This product is registered with the Food and Drug Administration (FDA) under the Drug Master File No. 5967.

sartorius

This product has passed Sartorius' inhouse tests and thus meets Sartorius' stringent quality control standards.

Integrity test values: Each membrane filter element has been individually tested for integrity by means of diffusion and bubble point testing. These tests have been performed according to the procedures stated in the corresponding Validation Guide.

For this filter element the bubble point measured was
$\geq$ 3.2 bar/ 46 psi.

Diffusion rate measured for this filter was found to be
$\leq$ 3 ml/min, at a test pressure of 2.5 bar/ 36 psi.

For sterilizing - grade filters, these integrity test values have been fully correlated to the HIMA/ASTM F 838-83 Bacteria Challenge test, using a challenge level $\geq$ 1 x 10^7 CFU/cm^2 of *Brevundimonas diminuta*.

Biosafety: All materials of this filter element meet the requirements of the current USP Biological Reactivity tests < 88> for plastics Class VI, (Systemic Injection, Intracutaneous and Implantation tests).

Non fibre releasing: This filter product complies with the title 21 of the Code of Federal Regulations (CFR), section 210.3(b)(6) and 211.72.

In addition to these main tests, the following is checked on a regular basis:

Retention of B. diminuta: Quantitative retention of *Brevundimonas diminuta* is checked for every 0.2 µm membrane lot. Additionally, the retention of *B. diminuta* is checked by regular sampling of all sterilizing grade filter elements.

Oxidizable Substances: The filtrate of these filter elements shows a negative reaction when tested according to the current USP.

Extractable Substances: The total amount of extractables is well below the limits established by the current USP under "Sterile Water for Injection".

Bacterial Endotoxins: An 0.9% NaCl extract of this filter product contains less than 0.25 EU/ml, which was determined by using the Limulus Amebocyte Lysate (LAL) test.

Particulate Matter: This product releases particulate matter in quantities well below the requirements established in the current USP in "Large Volume Injections for Single Dose Infusion".

Thermal Stability: Filter cartridges that underwent multiple (25) steam sterilization cycles at 134 °C showed no loss of integrity.

Note: Details of the methodologies used in the tests mentioned above as well as more detailed test results are given in the respective Validation Guide.

11.10.2005
Date

Dr. Ralf Wawotzny
Director Quality Assurance

Sartorius AG, Biotechnology Division

PROVITEC

Commitment for life

The product has been verified and evaluated by:
- the Warentest Foundation; test conducted in January 2001
- Max von Pettenkofer - Institute for clinical virology
- Industrial Institute of Bavaria
- Bavarian Ministry of Health
- The Johannes Gutenberg University of Mainz
- Federal Ministry of Health

And obtained very good results

Drinking water filtering

PROaqua 4200 D

- System Multi Barrier –

Explanations and interpretation of the results of the research report conducted by the Warentest foundation – January 2001

Abstract from the research report of the Warentest Foundation (01/2001)

All test results obtained by the PROaqua 4200 filtering device were evaluated at the "very good" level.

According to the research report, the PROaqua 4200 is the only filtering device that "*is suitable for filtering water that does not conform to the legacy of the Regulation concerning drinking water*" and the only water filter, which "*reliably eliminates all harmful substances*".

- lead and copper: „very good result"

- nitrates: „very good result"

- biocides: „very good result"

- water suspensions: „very good result"

The Warentest Foundation research report – January 2001

as well as an attempt to misinform the users by the Warentest Foundation, by inappropriate interpretation of the results

	Everpure S - 100	**Filopur HU-ST Household device**	**Provitec Proaqua 4200**
Average price in Euro ca.	**140,00**	**120,00**	**840,00**
Price for one litre of water ca.[1])	0,09	0,32	0,24
Commentary of the authors	The drinking water filter Proaqua, manufactured by the Provitec company is **the most suitable** for filtering water that does not conform to requirements defined in Regulation concerning drinking water. This definitely most expensive device out of those taking part in the test reliably eliminates harmful substances. On the other hand is secretes sodium and chloride into water. Everpure and Filopur are **adequate for application under certain conditions**. The reduction of particular harmful substances is possible. However their **main cause of application** is to improve the taste of drinking water (for example by eliminating chlorine).		
Principle of operation	The filters are designed to be connected to the pipeline system. Water passes through them; they are also equipped with their own fittings. Everpure and Filopur contain active carbon as well as tiny filtering materials. Provitec Proaqua may be equipped with different cartridges, depending on the water composition (for example active carbon, ion exchangers, bacteria filters).		
Eliminating harmful substances and bacteria	**lead and copper:** both elements are being eliminated most sufficiently by the Provitec Proaqua ("very good" mark) Everpure and Filopur are not designed for such applications (however they do capture some compounds of these elements). **Nitrates** – the Provitec filter significantly reduces their quantity, "very good" mark. Both other filters are not appropriate for such applications. **Biocides** –All filters eliminates them "very well" **Suspensions** – are being "very well" or "well" (Everpure) **Germs** – can be captured to a great extent by all three filters. The risk of infection by germs is neglectable.		
Secreting of unwanted substances	The ion exchanger manufactured by the Provitec company secretes **sodium and chlorine** into water. Water treated with Filopur filter operation is subjected to addition of **silver** ("sufficient" mark)		
Maintenance	**Installation** of filters is slightly complicated. **Usage indicators** are missing. Thus the threat of missing the filter replacement or regeneration dates is present. Regeneration of the Provitec filter necessary to be performed each 3 months is problematic. The flow rate equals to approximately 1 to 2 litres per minute ("good" mark).		

Our recommendations

Most water filters are based on very limited principle of operation. Such products do not reliably eliminate particular harmful substances. They can even themselves secrete various substances into water. Apart from that, the required change of cartridges on the regular basis significantly increases the exploitation costs of a filter. Thus one should consider our recommendations written on page 56. From the evaluated filters (1 680 brands) the **PROaqua** filter manufactured by the **PROVITEC** company is the best in terms of reduction of drinking water contained harmful substances.

Commentary:

Despite the fact that the PROaqua 4200 filter obtained an outstanding mark in the test, it entirely eliminated all the harmful substances, such as: nitrates, lead, copper, biocides and water suspensions, and the achieved results were evaluated as "very good", the internet publication does not contain any information regarding this fact, or the test results are presented in shortened and general form:

"The filter is applicable only to a limited extent. Particular harmful substances are being eliminated partially only, or they are not eliminated at all."

The reader may be misinformed while reading such a publication.

The Warentest Foundation

Test concerns: Home and Garden test 1/2001

Water filters

Rather unnecessary

Drinking water in Germany is better than it is said to be. Strict limiting values defined by the regulation concerning drinking water are being observed almost everywhere. Despite this fact, water filters tenderers are trying to put this in question. Harmful substances contained in water are to be picked and eliminated only by a water filter. It also allows for the elimination of bacteria being present in the pipeline system water, as well as for refining water from lead and copper. The WARENTEST Foundation examined 11 water filters, designed for kitchen and household application as well as mobile (travel) filters.

Results: Filters are applicable only to a limited extent. Particular harmful substances are being eliminated partially only, or they are not eliminated at all. Some filters themselves are the source secretion into water substances such as sodium, chlorides, or silver. Thus the quality of water is even deteriorated. The application of filters is also expensive. On regular basis a liter of water costs up to ca. 15 eurocents. The cartridges of a filter must be replaced regularly, otherwise dangerous germs may be created.

Such filters are adequate for special purposes, for example for water softening, removing of chlorine aftertaste, or ensuring extraction of better coffee aroma. Travelers may benefit from mobile filters that provide protection against bacteria somewhere on a track. If one does not trust their drinking water – can have the issue clarified – the Warentest Foundation analyses the drinking water samples in terms of presence of lead, cadmium and zinc.

Definition of terminology:

Sodium chloride

Sodium chloride = table salt = food salt = valuable possession = substance indispensable for living

Salt as a stimulator for every motion

Sodium is a kitchen salt component, a chemical compound that from the very beginning has a crucial meaning for our lives. As it was already mentioned, all living creatures origin, in terms of their development, from the sea water. Body fluids still contain, as an important heritage of our origin, 0.9% of salt. Thus they are saline to the same extent as sea water is. It is crucial for the human body cells, especially for continuously happening water exchange taking place inside them. They are obliged and they want to continuously draw water from the extracellular fluids and then give it back. The process is realized by means of salt. From the point of view of a chemist, salt is nothing else than a sodium chloride that decomposes in water into two soluble ions (parts of an atom): positively charged sodium and negatively charged chloride. The sodium attracts water molecules, thus creating movement and water enters a stream.

Electrolytic economy

By means of changing the harmful substances into important, in terms of alimentation philosophy, mineral substances (sodium and chloride) the electrolytic economy of water will not be modified (opposite to osmosis).

In medicine the physiological solution of the kitchen salt (sodium chloride) is being administered in **a form of infusion**, in case of large bleeding or blood circulation problems, which exactly matches the blood concentration that equals to 9 grams per one litre of fluid. The human body must intake salt continuously while nourishing, because it is constantly lost in a form of urine, sweat and tears. An average inhabitant of Central Europe uses approximately 5 grams of salt every day. In warmer climate the use of salt is much bigger, due to increased sweating.

The table salt (sodium chloride) is being used while seasoning almost all kinds of food and it is necessary for human life.

Installation

The installation of the drinking water filter PROaqua 4200 is very simple. It can usually be done by the client himself. The installation takes about 30 minutes.

Regeneration

The regeneration can be easily done by a user himself. The preparation before and after the regeneration takes about 3 minutes – less than emptying and loading of the dish washer. The regeneration process itself takes about 2 hours and is realized automatically – as while rinsing dishes.

The regeneration is to be done every 3 months as a principle. A dish washer is being operated every day.

Salt

Value for life

Salt provides a great value for life. Only if one exaggerates with salting dishes it upsets the equilibrium of the body.

Salt does not need to be grown. It was formed million years ago – everywhere where seas are, or were centuries ago. Life was born in the salty water of pre-seas. Even today, every single cell of our organism is being washed by fluids containing big amounts of salt, similar to water of salty seas.

Salt binds water
The kitchen salt is a compound of sodium and chloride: sodium chloride. A single gram is capable of binding approximately 100 millilitres of water inside our body. In case of increased salt consumption, so much liquid volume may be bonded in the organism that heart and kidneys will suffer excessive load. However the average salt consumption being equal to approximately eight grams a day for a single person is absolutely normal and harmless. Only if one tucks in pre-processed soups, chooses eagerly ham and matjes herrings, and crunches chips on the evenings, the salt content may be excessively increased.

Be cautious with high blood pressure
On the other hand constant excess of salt may lead to critical condition. Especially in case of people suffering from high blood pressure, or people who are susceptible to it. Yet an abrupt abstinence in terms of salt consumption is not recommended even to people suffering to high blood pressure. Eliding from the fact that only one of two hypertonics is even susceptible to salt. The value of blood pressure of such people reacts on the excessive intake of salt to the organism – as well as to complete salt asceticism.

Salt deficiency
If one trains a lot, or works hard physically and sweats a lot as a consequence, he can quickly start suffering from salt deficiency. It is caused by big amounts of salt being excreted from the organism with sweat. After finishing the sport practice one needs to quench one's thirst with sodium rich mineral water. Sodium on its own does not cause increase of blood pressure. Chloride is necessary for this to occur as well.
Also elderly people suffer from sodium deficiency. They do not feel thirst, they do not drink enough thus they completely drain the organism. But even a single additional pinch of salt may arouse their thirst and balance the body fluids economy.

Types of salt
Age: millions of years
Rock salt
Ordinary kitchen salt or table salt is usually made of the rock salt. It is mined from the underground salt deposits that were created as the primeval inland seas were drying out. Such salt is being mined by the miners or obtained by dissolving in water (brine) or evaporating in salt-works (processed salt). An expensive and populate product: the primeval salt, being the bestseller in organic food stores is in fact such a rock salt – only being in unrefined state. Typical, commercially available kitchen salt is milled and refined. During this process, some part of mineral substances and trace elements is lost, however various contaminants are being eliminated as well. Special additions, such as potassium or sodium carbonate gain friability.

Sea salt
Sea water is a source of salt in its primeval form. In order to acquire it, water must be evaporated from the containers by means of sun and wind action. However refined sea salt, available in the market does not exhibit any important differences comparing to kitchen salt. It is composed mostly of sodium chloride. Other minerals constitute only approximately 2% of the total sea salt content. Not enriched sea salt plays only minor role in providing iodine to the organism and potassium, magnesium, zinc are being acquired by the organism from different food articles.

More salt
Central Europe is an iodine poor terrain and our nourishing routine is characterized by extremely low iodine content. Because of that, using the iodine food salt seems to be reasonable. It contains at least 15 and no more than 25 milligrams of iodine per kilogram. If one consumes 5 grams of iodinated salt every day every day, he intakes 0.1 milligram of iodine – which is still only the half of the amount required for a day dose. Sometimes also fluorine is added. It may prove helpful – also in case of adults – in dental decay prophylaxis. However it is to be used with precautions in case of little children who already take fluorine containing pills, because overdose of fluorine may be harmful as well. Spice and herbal salts contain at least 15 percent of seasoning additions apart from ordinary kitchen salt. Also instant seasonings, such as Fondor aroma and flavourings contain from 40 to 60 percent of kitchen salt, apart from taste intensifiers in the form of monosodium glutamate (E 621).

Himalaya salt
Cristal salt form the Himalaya Mountains is supposed to be hand grown and is extremely expensive. It contains, if one believes commercials, exactly 84 elements, from which the human body is composed. However apart from that, the mineral substance content in the salt is extremely low and, when reasonably dosed for consumption, it cannot satisfy existing needs for them – see rock salt.

Rather unnecessary

Nitrates, lead, pesticides or bacteria? Many people raise doubts concerning the quality of drinking water and eagerly reach for water filters. What protection do these mini water plants provide for our homes?

Anita K. worries about the most important consumable product: drinking water. The Berliner lives with her two children in an old building and she is afraid of the water supply pipes in the building are made of lead. This harmful substance is well known to affect the nervous system and negatively influences the children's ability to learn. Anita K. would like to choose the best water filter model, basing on the research carried out on these devices by the WARENTEST FOUNDATION (see page 57). And she asks: "If my water turns out to be contaminated, could you recommend the appropriate filter for me?"

There are many people like Anita. Numerous consumers are not sure of the quality of their drinking water. However it is the fact that the tap water is better than it is said to be. The pipeline system water suppliers and health departments perform controls on the regular basis. In Germany there is an effective Regulation concerning drinking water, which defines strict limit values that are met almost everywhere.

On the other hand, more and more pipeline system water suppliers in rural areas report problems with nitrates and pesticides. In places where farmers perform excessive fertilization and chemical spraying next to the area of well operation, the ground water is frequently contaminated. In other places – especially next to small, individual water supply installations – water may be so aggressive that it will attack copper pipes and emits metal ions. Only a few weeks ago, several pipeline system plants confirm that there still are areas, where pipes with internal side covered with pitch are present and they can cause slight emission of carbohydrates into water (PAK, see test 11/2000).

Although such harmful substances does not play absolutely any role in most of the German drinking water, many tenderers of small water filters try to question the quality of water being delivered to households. For example, the Kenwood water filter packaging informs about values of reduction of cadmium and other harmful substances, without informing about (minor) range of spread of these substances. The filter by Waterboy is being offered even to reduce the concentration of mercury in water that in fact is not present in Germany. The manufacturer of the Everpure brand declare that their filter will allow for "dirt and suspensions", "mildew and algae" elimination, and adds a very promising phrase: "The above mentioned substances are not always present in pipeline system water." The market leading product by Brita company is being commercialized with comparatively modest slogan "reduction of settlements and substances deteriorating taste of water".

We have evaluated to what extent the typical available in the market water filters, are capable of eliminating these harmful substances, which are truly present in some reservoirs of drinking water. The following filter types were included in the test

Our recommendation

Most water filters are based on very limited principle of operation. Such products do not reliably eliminate particular harmful substances. They can even themselves secrete various substances into water. Apart from that the required change of cartridges on the regular basis, significantly increases the exploitation costs of a filter. Thus one should consider our recommendations written on page 56. From the evaluated filters (1 680 brands), the **PROaqua** filter manufactured by the **PROVITEC** company is the best in terms of reduction of drinking water contained harmful substances. The Katadyn Combi (out of 300 brands) proved to be the most reliable in terms of bacteria elimination among travel filters.

If one wishes to soften the water for tea or remove the chlorine aftertaste, they can choose one of the little table filters. The Brita models (30 and 50 brands) and Kenwood (39 brands) slightly outscored the competition in this groups of products.

- six mobile table filters – all of them based on the same principle of operation. Water is poured from the top and it drains through the filtering cartridge and it is collected in a container.
- three filters, permanently attached to the kitchen pipeline system or to fittings and the water pressure is applied to them at least for some time
- two travel filters, used by travellers to filter surface water by means of hand operated pump, thus conditioning water and making it drinkable

The issue of effectiveness of these filters in terms of protection against the harmful substances and bacteria was checked by means of various water types (see "Chosen …", page 58). The filter cartridges of the table filter are usually composed of two elements: ion exchange mass and active carbon. The ion exchange takes place on the surface of the tiny sphere made of artificial resins. Minerals such as calcium and magnesium, but also dissolvable lead and copper (all positive ions) are being captured here – by means of hydrogen ions exchange. Thus the filtered water is mineral indigent and relatively soft, but on the other hand slightly sour. As long as the exchange capabilities will not be exhausted, the table filter will operate properly. However afterwards, the cartridge is to be replaced obligatorily.

Also the two specialist filters for elimination of nitrates were being tested. Their ion exchangers are designed to capture nitrates, being harmful for the environment, and release chlorides at the same time. Capability to perform the ion exchange was identified at such a low level, that it can only be evaluated as "sufficient".

While removing chlorine and organic substances contained in water, most of the filters use active carbon whose porous surfaces cause the organic substances, such as chlorophenol or atrazine pesticide, to attract one another. However during the test it turned out that the water passes quickly through the relatively small layer of active carbon in the table filter and harmful substances were only partially captured. The permanently attached filters, with their bigger and tinier active carbon filters, achieve better results.

Installation risk

Majority of the filters do not eliminate bacteria from water to the satisfactory extent. Although all the tested devices achieved decrease of bacteria quantity, but the user should not be satisfied by this fact. Nevertheless both travel filters, for which decontamination should be the crucial issue, achieved good results.

The question arises, whether the filters can cause germs contamination themselves – for example due to cartridge replacement with dirty hands. We checked this matter by means of test germs that were once poured at high concentration into the filter. Then the device was being used with harmful substances free drinking water and we verified the bacteria content in the filtering product. Almost no bacterial contamination was detected.

The reason: the active carbon contained in filters is usually silver treated and the silver exhibits bactericidal properties. However one should be cautious, since silver is being gradually washed out from the filter. At the same time the active carbon filters the organic contaminations and stores it, thus forming potential bacteria medium. The longer the recommended utilization period will be prolonged, the bigger the risk of infection. The tenderers are also aware of the risk and protect themselves against it. And thus in the user manual of the Kenwood product one reads: "Filtered water is to be boiled, before it can be consumed by children under 12 months.".

RECOMMENDATIONS

- **often not needed:** majority of pipeline systems and taps in Germany offer flawless drinking water. Additional filtering is simply not needed.
- **in case of raising doubts:** consult the representative of your pipeline system water provider, asking for nitrates and pesticides residues. You can also get information concerning water hardness and chlorination. Possible negative influence of hard metals on water from your home pipeline system can be verified by our water test (check on the right hand side).
- **hard water.** Hard water containing minerals is basically healthy. However if any tea amateur prefers soft water, he can make use of table filter. Rain water provides the less expensive alternative for watering plants.
- **problematic water:** In regions where drinking water of perfect quality is not available from the pipeline systems, a small water filter cannot be treated as an ultimate and safe solution. If there are harmful substances present in water, the reasons behind such a state are to be eliminated – for example old lead made pipes are to be necessarily replaced. In case of small private wells in the rural areas or small garden systems, if any ambiguities are present, the evaluation of the health department may be useful. If a poor quality of water is stated, the bottled water is to be used rather than a water filter.
- **awareness.** If one ends up with the decision to use water filter, he should check, basing on the results of our test, which one will suit ones needs best (e.g. in terms of water softening)
- **carrying for hygiene:** recommendations included in the user manual are to be observed at all times and contamination is to be avoided. As for protection against bacteria, after each prolonged pause in filter utilization (for example after holidays trip), you should not drink filtered water directly, but rather use it to water plants or boil it to make tea. Replacement of filter cartridges earlier as required would be reasonable as well.
- **cooling.** Low temperatures block development of bacteria. Thus keeping filter in a refrigerator seems to be reasonable. Moreover, cooled water often tastes better. But be cautious: cooling is useless if the filter is used only for treating water that would be used for preparing coffee or tea. In such a case boiling is a sufficient protection against bacteria and secondly, previous cooling would be simply a waste of energy.
- **Environmental threats.** While using most of water filters, the regularly replaced cartridges create wastes that have to be disposed in some way. Paradoxically – on one hand the user wishes to protect himself against harmful environmental substances, and on the other hand he pollutes the environment with the same substances. The Brita company offers the possibility of collecting and recycling the used cartridges. It is worth using such an option.

Some water filters (such as Filopur) can be connected directly to water tap.

Yet Brita and other manufacturers recommend in their operating instruction to use only water, which "is supplied by the pipeline system companies". One should expect the appropriate designation on the packing itself.

Constant secretion of silver into drinking water is contradictory with customers' expectations, being that the filter captures all artificial substances from water and does not add anything. Nevertheless in case of silver it is about

Common sense: relatively small table filters can be stored in refrigerator doors.

ANALYSIS

Drinking water testing

You are not sure of the quality of drinking water in your house? There are old, lead made pipes still being used? Greenish settlements on the sanitary ceramics indicate the existence of corrosion? Or brownish colourings indicate you are facing the problem of zinc-plated steel pipes corrosion? The test readers' action enables examination of water for the price of 25 Euro, for the presence of lead, copper, cadmium and zinc. Information as well as the action voucher may be obtained by fax on 0 180 5/88 76 83 02, in the internet on www.stiftung-warentest.de or by calling 0 180 5/00 24 67 (0,05 Euro per minute, providing the voucher number M 9606 will be required).

Permanently installed filters

	Everpure S - 100	**Filopur HU-ST Household device**	**Provitec Proaqua 4200**
Average price in Euro ca.	**140,00**	**120,00**	**840,00**
Price for one litre of water ca.[1])	0,09	0,32	0,24
Commentary of the authors	The drinking water filter Proaqua, manufactured by the Provitec company is **the most suitable** for filtering water that does not conform to requirements defined in Regulation concerning drinking water. This definitely most expensive device out of those taking part in the test reliably eliminates harmful substances. On the other hand is secretes sodium and chloride into water. Everpure and Filopur are **adequate for application under certain conditions**. The reduction of particular harmful substances is possible. However their **main cause of application** is to improve the taste of drinking water (for example by eliminating chlorine).		
Principle of operation	The filters are designed to be connected to the pipeline system. Water passes through them; they are also equipped with their own fittings. Everpure and Filopur contain active carbon as well as tiny filtering materials. Provitec Proaqua may be equipped with different cartridges, depending on the water composition (for example active carbon, ion exchangers, bacteria filters).		
Eliminating harmful substances and bacteria	**lead and copper:** both elements are being eliminated most sufficiently by the Provitec Proaqua ("very good" mark) Everpure and Filopur are not designed for such applications (however they do capture some compounds of these elements). **Nitrates** – the Provitec filter significantly reduces their quantity, "very good" mark. Both other filters are not appropriate for such applications. **Biocides** –All filters eliminates them "very well" **Suspensions** – are being "very well" or "well" (Everpure) **Germs** – can be captured to a great extent by all three filters. The risk of infection by germs is neglectable.		
Secreting of unwanted substances	The ion exchanger manufactured by the Provitec company secretes **sodium and chlorine** into water. Water treated with Filopur filter operation is subjected to addition of **silver** ("sufficient" mark)		
Maintenance	**Installation** of filters is slightly complicated. **Usage indicators** are missing. Thus the threat of missing the filter replacement or regeneration dates is present. Regeneration of the Provitec filter necessary to be performed each 3 months is problematic. The flow rate equals to approximately 1 to 2 litres per minute ("good" mark).		

Table filters

	Aqua Select System Glas	**Brita Aluna**	**Brita Fjord**	**Kenwood/ WF 95**	**Waterboy**
Average price in Euro ca.	**40,00**	**30,00**	**50,00**	**39,00**	**13,50**
Price for one litre of water ca.[1])	0,14	0,14	0,15	0,16	0,11
Design similarity	**Mabeco Filtering Ssytem** (25 Euro) is similar in terms of construction to the **Aqua Select** filter.				
Commentary of the authors	**Improper** for filtering water that does not conform to the Regulation concerning drinking water. Many harmful organic substances, nitrates and bacteria are being eliminated to an unsatisfactory extent only. Most of the filters are yet capable of limiting the heavy metals content in water, but they also secrete other substances into water. **The main application** of such products should be softening and improving taste of drinking water (for example by means of removing chlorine).				
Principle of operation	Water passes through the replaceable cartridges filled with active carbon and ion exchangers. Chlorine and organic substances that negatively influence the taste of water may be eliminated with active carbon. Ions exchange softens water. The Kenwood and Waterboy offer special cartridges for eliminating nitrates.				
Eliminating harmful substances and bacteria	**Lead and copper:** can be eliminated with a "good" efficiency as a side effect of water softening (the Waterboy with the used nitrates filter scores the "unsatisfactory" result being an exception). Everpure and Filopur are designed for such an application (however they do capture some molecules of these elements) **Nitrates** – special cartridges for eliminating nitrates, manufactured by Kenwood and Waterboy were tested. Their operation capabilities turned out to be not satisfactory. Result: "satisfactory". The other filters are no appropriate for nitrates elimination. **Biocides** –The Brita filters managed to eliminate Biocides with the "satisfactory" mark, the other filters did not perform so good **Suspensions** – the table filters are improper for eliminating suspensions. **Germs** – all table filters are improper for filtering bacteria from contaminated water. On the other hand the risk of infection when operating according to its destination with drinking water is low, in case of the Waterboy filter it is moderate ("satisfactory").				
Secreting of unwanted substances	All table filters (apart from the Waterboy filter) adds the filtrate with **silver** ("sufficient" mark) The filters for eliminating nitrates manufactured by Kenwood and Waterboy increase the content of **chlorides**.				
Maintenance	**Operating faults** of all testes filters are impossible. **Usage indicators** of the Kenwood filter are marked as "satisfactory" and "sufficient" in case of the Brita products and "insufficient" in case of all other filters. **Flow rate** equals to approximately 0.2 litres per minute: "sufficient". **Filter cartridge replacement** is simple. **Real life operation** of the filters is a little bit troublesome and was marked as "sufficient" or – if they can be stored in refrigerators – "satisfactory" (Brita Fjord and Kenwood).				

[1]) Provided prices are to be treated as appropriate under assumption, that during one day 2 (table filters) or 4 litres (filters installed permanently) of water will be needed. The investment pay-off takes place within 2 or 5 years. The cartridges replacement takes place every 4 weeks (all table filters) or according to manufacturer instructions. Cartridges are partially adapted to higher water amounts.

Travel filters

	Katadyn Combi	**Sweetwater Guardian Microfilter**
Average price in Euro ca.	**300**	**140**
Commentary of the authors	Travel filters provide a good solution for travellers, who are for example forced to use ground waters of not always flawless fineness. For this target group of customers, the Katadyn Combi filter is **especially worth being recommended**, and the Sweetwater Guardian Microfilter will **suit their needs** as well.	
Principle of operation	The travel filters contain the micro filtering element, which is to capture tiny elements and bacteria. Free organic substances can be reduced by active carbon. Water is being sucked by a hand operated pump and forced through the filter.	
Eliminating harmful substances and bacteria	**Germs:** Bacteria can be separated from the contaminated water with both test travel filters. Katadyn ("very good") turns out to be more effective with respect to that than Sweetwater ("good"). The risk of infection of filtering materials is very low for the Katadyn filter, and moderate in case of Sweetwater filter ("satisfactory"). **Suspensions** – both travel filters eliminate them "very well" **Biocides** – the filters eliminate them „well" (Katadyn with active carbon filter) or "satisfactory" (Sweetwater). **Lead, copper and nitrates** – the travel filters do not remove them	
Secreting of unwanted substances	The Katadyn filter add **silver** to the filtrate ("sufficient" mark), and the Sweetwater filter does not.	
Maintenance	**Risk of operating faults** for both filters is low, but the usage indicators were evaluated only as "sufficient". **Filtering rate** equals to about 0.5 litre per minute: „satisfactory". **Filter cartridge replacement** is simple. **Real life operation** of the filters we evaluate as "satisfactory" (Katadyn) or "sufficient" (Sweetwater). The Katadyn is however slightly heavier.	

Travel filters: designed for filtering water of questionable hygiene properties

Bacteria, enzymaticaly affecting poison, whose possible side effects for humans at low concentrations have not been properly examined yet.

Apart from silver, also the active carbon dust can be flashed out of a filter. Because of that, some manufacturers recommend the first portions of filtered water to be used for watering plants only. Also the Provitec Proaqua filter in not miraculous in this case, but it does a kind of exchange. As it captures calcium, copper, nitrates and other ions, in return it adds sodium and chloride. Also in case of small table filters they are not to be overvalued. Slightly acidic water is generally not be boiled in old kettles, because it can extract significant quantities of nickel out of it.

The state of proper operation of the pipeline system water provider is being controlled by technicians, chemists and microbiologists, with respect to strict criteria. If one utilizes a miniature drinking water supply installation, one must on his own pay attention to the water quality not to deteriorate. It may be the case for example when the filter cartridges are being used for too long time. The fact that the usage indicators of the tested filters are either not available, or are extremely primitive in terms of aiding while servicing, is very annoying. Even, as the commercial of the Brita Fjord states „the exceptional electronic cartridge replacement indicator", turns out to be a simple indicator of using time left, without taking into consideration the real filtering load.

The examination of water samples, collected from the household of Anita K., indicated real increase of lead content. However we would not recommend using water filter to Mrs. Anita. Instead we would suggest informing the house owner about the results of examination. The obsolete pipelines should be replaced as soon as possible. For the time being Mrs. Anita will have to manage on her own – in case of any doubts, water remaining in pipelines should be flushed, before water for cooking or drinking will be collected.

Selected – Examined – Evaluated

Testing: of elven water filters of different construction design. Six table (kettle like filters) water filters were evaluated including their alikeness, three water filters being permanently installed on water supply inlet as well as two travel filters. Depending on available offer, different cartridges were examined. The control reference was purchased in March/April 2000.

Prices: survey carried out among manufacturers in October 2000

Removing harmful substances and germs:

The efficiency of filter operation was tested with different types of test water (with the operation conditions typical for households, seven samples within 14 days). Test water contained nitrites, copper, lead and biocides (chlorophenol, simazine, dezethelatrazine). The other test water was infected with test Escherichia Coli and Pseudomonas aeruginosa germs, at concentration equaled to at least 1 000 colony building units per millimeter (examination for presence of test germs and their total quantity). With muddy surface water we have examined the rate of reducing suspensions in water. The filter infection has been controlled by single injection of infected test water. After an idle week, the filters were used for two weeks with uncontaminated water (examination for presence of test germs and their total quantity).

Secretion of undesirable substances

We have examined whether the filter secrete silver, sodium or chlorides into water

Maintenance

We have checked the operation manuals of a product, instruction for connecting the filter to water tap (if it was necessary), conditions for filtering medium replacement, preventing actions against faulty product application, cartridge usage indicators, possibility of disposing, flow rate and real life application.

Many water filters do not offer any bacteria protection at all.