High-quality Drinking Water
for the home

by Joseph Országh (adapted and translated by André Leguerrier)

More and more people familiar with our website www.eautarcie.org make further inquiries on water management in the home. What seems to concern a growing number of my correspondents is the quality of drinking water. Their concerns are partly justified considering the current threats on the state of our tap water. Yet the quality of tap water is not as bad as suggested by vendors of domestic water filtration and treatment systems or as rumored by those who have a commercial interest in the sale of bottled water.

Faced with little specific information, the average consumer, lacking a sufficient scientific background, is disabled by the sometimes pseudo-scientific spiel provided by suppliers of home filtration devices. Even doctors are not invulnerable to the influences of incorrect scientific concepts promoted by commercial interests. The goal is to make money by selling devices or bottled water, a purpose which is not wrong in itself. The problem arises when, either by interest or lack of correct information, the consumer is erroneously induced into purchasing products that do not necessarily meet expectations, that is, to have high quality drinking water at home, for food and drink, at a reasonable cost.

The following pages are designed to answer the most frequently asked questions, and guide consumers towards solutions with the best possible quality-price ratio for drinking water. Different households have different needs. Yet there are common elements useful to all. Obviously, water supply solutions are not necessarily the same when you live in a house with garden or when you live on the 10th floor of an apartment building. Some families have «alternative» water sources such as a well, spring, river water or even water infiltrating into the basement. Depending on the family's desires and financial capacity, there is always a solution suited to every situation.

Adapting water quality to its end-uses

A person needs only about 5 litres per day of thoroughly «potable» water. For all other uses in the household, lesser-quality water will suffice. An excess of nitrates or heavy metals, exceeded standards for pesticides or other harmful substances have no effect on one's health when water is used for *non-food purposes*. For years now, the daily practice of tens of thousands of households who have been using the PLUVALOR System [1] (for whole-house reuse of rainwater) has shown for example that for brushing teeth, personal hygiene, washing fruits and vegetables, laundry, dishwashing, etc.., water that is «inoffensive» [2] is perfectly safe. You don't necessarily need thoroughly «potable» water. The latter, which will be used for drinking, preparation of tea, herbal infusions, coffee and for cooking must be high quality. Here «we set the bar very high».

[1] Link : http://www.eautarcie.org/en/03a.html#c
[2] Link : http://www.eautarcie.org/en/03c.html

In the household, drinking water quality that I would call «biocompatible» rather than «potable» will be as good as the best bottled mineral water on the market, but at a cost of only a few euro-cents per litre. For other household uses, other water sources such as mains water, water from springs, wells, rivers, canals, etc. – whatever is available – will do fine, without any danger to one's health. Such water requires only a basic and inexpensive treatment or filtration. When you have virtually free water from a well, spring, river or canal, these should be prioritized over mains water distribution (growingly more expensive), provided that the water from these sources is considered «inoffensive», upon analysis.

Such water may therefore contain a small excess of nitrates, heavy metals, pesticide residues, drug residues, and even a small amount of what are considered «pathogens» [3]. In addition to non-food uses in the household, such water will be used in the preparation of biocompatible water, by means of reverse osmosis or microfiltration.

Biocompatible water in the household

In a house or an apartment, all taps will deliver water that will qualify as «inoffensive», except for a selected faucet, reserved exclusively for biocompatible water [4], placed for example in the kitchen or in a technical room harbouring the filtration devices. It is from this faucet that you will fill jugs and water bottles meant for making drinks and cooking.

Wherever one only has access to city water (i.e. mains water), it is best to protect the family from a slow deterioration of health associated with chlorine disinfection or chlorine substitutes (e.g. ozone) [5] in the treatment of water. It is also best to avoid the use of cleaning products containing chemical disinfectants for the bathroom, kitchen and even the W-C (i.e. washroom). Such toxic and oxidizing products are hyped on how they «eliminate 99.99% of germs». Yet the overwhelming majority of bacteria are definitely not pathogenic: even the presence of a small amount of pathogens is useful in upkeeping our immune system. If you so need, keep bleach on hand only for quite exceptional situations and in small quantities. A bottle dispenser containing a germ-killing disinfectant for hand washing is especially not recommended for children whose immune system is not yet mature. A good standard soap is quite sufficient to ensure cleanliness and hygiene. Disinfectants are biocidal, meaning they «kill life» ... including yours, bit by bit.

Beware of water treatment systems intended to energise and improve mains water!

With the deteriorating quality of our water supply and the rising cost of bottled water, the market for domestic water treatment systems has exploded, some claiming their system is «miraculous». Consumers' gullibility and the public's lack of information are abusively exploited. In most cases, the main goal is to make money even when selling a system that has questionable utility.

It's important to know that the quality of drinking water is primarily determined by its chemical and electrochemical composition. Systems that do not affect these two criteria provide small improvement (if any) and are rarely worth the asking price. We're looking here at an issue of quality-price ratio.

[3] Link : http://www.eautarcie.org/en/03e.html
[4] Link : http://www.eautarcie.org/images/ivovizcsap.jpg
[5] Link : http://www.eautarcie.org/en/03e.html

Mains water is a standardized product, regularly monitored on its compliance with specific standards. Obviously, this ensures a certain quality: the elimination of pathogens and the control of heavy metals, nitrates and even pesticide residues. Short of being biocompatible, this water has intrinsic qualities that need not necessarily be improved upon by spending a lot of money. *Unfortunately, domestic water filtration system dealers heavily emphasize how their device is able to eliminate substances, which in fact are not present in dangerous quantities in mains water*.

Systems that eliminate heavy metals, bacteria and nitrates from water improve the water quality somewhat, short of producing truly biocompatible water. Such impurities are well controlled in tap water. If you don't change the water's chemical composition (excess mineral salts, excessive hardness, electrochemical character altered by chlorine), it's unrealistic to expect an improvement of the water's quality that is consistent with the cost for the majority of these systems on the market.

Many dealers claim that their filtering systems contain elements that introduce trace minerals (silica, and others) in water and «revitalize» the water. I think we should, once and for all «wring the neck» of such scientifically incorrect information by which it is said that «our body needs minerals from the water that we drink». Practically the sole source of trace elements and ions (minerals) is found in the food we eat. Elements that may be present in our drinking water are generally not absorbed by the body.

You often hear of systems that claim to «dynamise», «energize» or «revitalize» drinking water. Yet it's useless to «energize» water whose chemical and electrochemical composition does not already comply with the guideline values for biocompatible water [6]. You'd better read the EAUTARCIE website section dedicated to the dynamisation of drinking water [7].

When the only water that is available to you comes from a well, spring, river or mains city water, the only technique capable of providing biocompatible water at a reasonable cost is reverse osmosis. One can easily show that the quality-price ratio of many domestic water treatment devices available on the market is lower than that of a good reverse osmosis system. In recent years, reverse osmosis systems have benefited from manufacturing improvements that have helped lower their cost substantially.

Reverse osmosis

Reverse osmosis is currently the only technique that corrects the chemical and electrochemical composition of water at an affordable price. But beware, the market for reverse osmosis does not escape the commercialism that encourages buyer overspending to acquire equipment of questionable utility.

Generally, the quality of water obtained from reverse osmosis systems available on the market is inversely proportional to the price of the devices. Upon examination of systems available, the essential components (osmosis membrane, primary filter and activated carbon filter: more than sufficient) are included in the system, but at a price that can vary between fifty euros up to more than a thousand euros. The problem with some systems is that they include other (expensive) embedded devices, such as a UV light for sterilization, and a cartridge to «remineralize» water, such

[6] Link : http://www.eautarcie.org/en/03d.html#tableau
[7] Link : http://www.eautarcie.org/en/03d.html#e

devices that actually deteriorate the quality of water obtained by reverse osmosis. You must read the section devoted to the purchase of a reverse osmosis unit [8] on the EAUTARCIE website.

Useful information to help choose a system

The www.eautarcie.org website has no commercial pretence and is not associated with any commercial activity. The recommendations made on the site (for example, towards the purchase of a domestic water treatment system) may vary from time to time, based on the testimony of our readers. Hundreds of them inform us of their satisfaction (or dissatisfaction) with the purchase and use of a water treatment system. The devices having a more interesting quality-price ratio are very often reported to us.

Currently (*December 2012*), it is clear that the best purchases can be found in reverse osmosis systems designed for aquariums. The usual elements of a reverse osmosis unit are the 5-micron sediment filter (to remove coarse impurities from the water) followed by a reverse osmosis membrane (the core component) and an activated carbon filter (to improve the water's taste). In aquarium-type units, the activated carbon filter is typically located upstream from the membrane, to protect it against the harmful effects of the chlorine found in mains tap water. In such a situation, some will prefer placing a second activated carbon filter downstream from the membrane (to improve the taste). Yet when you filter water that hasn't been disinfected with chlorine (rainwater for example), an activated carbon filter is not required upstream from the membrane. In such a case, when ordering a less expensive aquarium-type reverse osmosis unit, it is best to ask that the single activated carbon filter provided with the unit be placed downstream from the membrane.

Any other component within the system that is claimed to «correct» the water's quality is needless and will even diminish the water's quality.

Here are the extra elements of which you must beware:

- The UV lamp, for «disinfection»:
  No bacteria, not even a virus, can pass through a reverse osmosis membrane, which also removes very small ions as well as radioactive elements. Thus, nothing needs to be «disinfected» in water that has been filtered by a reverse osmosis membrane. The UV lamp is pretexted as a means to sterilize the bacteria that appears in the pressure tank that is provided with certain systems. Yet these mundane bacteria are absolutely harmless. In fact, a biofilm develops within the tank and stabilizes the water's quality from a microbiological standpoint. Irradiating the water with high-energy radiation such as ultraviolet light profoundly alters the biological properties of water [9], and not in a good way.
- Cartridges, to «rectify» the mineral content:
  Such cartridges are meant to introduce a certain amount of minerals in the filtered water, which contains less minerals than tap water. The pretext is based on the claim that «we need minerals in the water that we drink»: an abusive distortion of the truth. In reality, we do not absorb the minerals found in drinking water. In fact, these minerals leave the body with the urine, about 20 minutes after drinking the water. «Bio-available» minerals are actually absorbed in the food we eat and drink. A good vegetable broth or fruit juice contains more bio-available minerals than several litres of mineral water. Please read the

[8] Link : http://www.eautarcie.org/en/03h.html#e
[9] Link : http://www.eautarcie.org/en/03e.html#c

section on «minerals in water« [10] on the EAUTARCIE website. The main role in the drinking of water is to eliminate our metabolic residues. For this purpose, water must be lightly loaded in minerals.

- Filters with resins, for water «deionization».
  These filters remove the last traces of minerals (i.e. ions) that will have passed through the reverse osmosis membrane. Then comes the claim that it becomes necessary to introduce other minerals using the cartridge mentioned previously. Minerals re-introduced in this way are virtually identical to those removed by the reverse osmosis membrane: calcium carbonate, magnesium carbonate, chlorides, sulfates, etc. It is worth repeating: heavy metals, nitrates, and excess calcium are removed by the reverse osmosis membrane. Minerals introduced after «deionization» are completely useless. They will only overload the body's renal function (i.e. kidneys).

Here are elements that may come in useful:

- A booster pump: to boost the system's water pressure:
  This is especially useful in residential areas where mains water pressure is less than 3 bars (or 43.5 psi). This is usually recommended for installations supplying aquariums, where lots of water is needed. This pump accelerates filtration. For those who are afraid of the totally harmless bacteria previously mentioned, you may want a direct-flow system [11], without a pressure tank. The automated rinsing mechanism included extends the membrane's lifespan.
- A pressure storage tank for the filtered water.
  With a ±12-litre tank, the filtered water is stored under pressure, and is thus available at a tap with a reasonably fast flow. Compare to the units sold for aquariums, which are not equipped with a storage tank, and thus deliver filtered water at a low flowrate. To fill a one-litre bottle with an aquarium-type system takes about 7 to 10 minutes. Therefore, either you opt for a unit with a pressure tank, either you opt for the cheaper aquarium-type alternative, whereby you accumulate filtered water in a large capacity carboy or jug (25 litres for example). A disadvantage of this solution is the risk of overflow when the carboy or the jug is filled. The cheapest carboys are sold in supermarkets where bottled drinks are sold. You can find 4- to 6-litre capacity bottles with a spigot, containing spring or mineral water.

Image: a carboy comes with 8 litres of spring or mineral water in a supermarket. It is equipped with a practical push button valve or spigot. To fill, with the help of a wide screwdriver, you can easily remove the valve, which can be put back in place by simply pressing down on it.

[10] Link : http://www.eautarcie.org/en/03e.html#c
[11] Link : http://www.purepro.net/super380_direct_flow.htm

What to do with the membrane rinse water ?

For each litre of filtered water, the reverse osmosis unit rejects between 2.5 and 4 litres of rinse water (depending on the model), which contains minerals and impurities removed from the original water. The rinse water is still clean enough for non-food uses: general cleaning, watering flowers, washing the dishes, washing your hands, etc. The plumber who will install your device will typically connect the rinse water drain to a sewer drainpipe. You can ask him to provide a bypass valve for this water so that it can drain where you want it, either to the sewer or to an alternative container for another usage.

When using rainwater to make biocompatible water, the rinse water is simply returned to the cistern. In this way, there is absolutely no waste.

Systems currently recommended by EAUTARCIE

The cheapest devices are those sold for aquariums. They contain the essential elements needed to produce biocompatible water. As mentioned previously, the main disadvantages are the low water flow delivered at the faucet and the need to accumulate the filtered water in a jug or carboy. This solution is ideal for low-income families and for those who «are afraid of bacteria» (harmless as these may be) that are likely to develop in the 12-litre pressure tank supplied with most systems.

Take the case of the AQUASCAPE system, currently sold (*December 2012*) for 58.90 € + shipping (www.aquascape-boutique.fr). Compare prices on the website be.cherchons.com. A membrane replacement costs 30 €; an activated carbon filter cartridge and sediment filter cartridge each cost 9 €. It is best to replace the two latter cartridges every 2 years, or annually if the water supply is of poor quality. When filtering mains tap water, the membrane will last 2.5 to 3 years. It will last 8 to 10 years if your water source is a rainwater cistern. For ease of use, you can also opt for a device with a pressure tank [12] or a direct-flow system [13]. Sold for 220 € or 300 € + shipping. The installation of these devices is accessible to all. A good plumber can correctly install these in less than an hour. The filter's inlet pipe can be screwed onto a double-service tap (e.g. hose bib) or even a kitchen faucet. The rinse water can be conveyed to any sewer drainpipe connection (e.g. servicing a sink, lavatory, bath, shower, clothes washer or dishwasher). To avoid cluttering the kitchen's work surfaces, a good plumber will install all these devices undersink, in less than an hour.

When should you change the reverse osmosis membrane?

When filtering water from a spring, well, river or from city mains, the membrane has an average limited lifespan of 3 years. This depends a lot on the how much chlorine is in the water, but also on its mineral content. The more water is loaded with minerals, the less time the membrane will last.

Unless the water consumer is a fine «water taster» in the presence of an activated carbon filter, he will not detect when it's time to change the membrane. At this point, the more the system is utilized, the greater the quantity of impurities that will pass through the membrane. Sometimes it gets to a point where the system clogs up. To check when the membrane needs replacing, it is best to buy a TDS tester (for Total Dissolved Solids). This device is commercially available [14] for a price ranging

[12] Link : http://www.aquatechnics.fr/osmoseur-clara100a.html
[13] Link : http://www.aquatechnics.fr/osmoseur-400gpd-a-flux-direct-sans-reservoir.html
[14] Link : http://www.priceminister.com/offer/buy/162067190/testeur-digital-de-tds-metre-eau-aquarium-0-9990-ppm.html

between 20 and 50 €. With it, you monitor the dissolved solids at the unit's inlet (water prior to treatment) and at the unit's outlet (filtered water after reverse osmosis). When the TDS value for the filtered water is greater than 20 to 25% of the incoming water, than it's time to change the membrane.

And what about rain water ?

When your source of water is a rainwater cistern (preferably built of concrete, and buried, of course), water obtained from reverse osmosis filtration is better than that obtained through reverse osmosis from a well, spring or mains city water. As mentioned previously, the lifespan of the reverse osmosis membrane extends up to 8 to 10 years using rainwater. Also be reminded that with an aquarium-type reverse osmosis unit, make sure to order and install the activated carbon filter downstream from the reverse osmosis treatment.

Rainwater users have indicated to me that even the activated carbon filter can last many years. I witnessed a set-up that had worked 8 years, without the least bit of maintenance! The water quality at the unit's outlet met all the highest standards. This obviously is only possible with a correctly designed rainwater harvesting system [15]. As for the 5-micron sediment filter, its replacement is recommended annually, although with rainwater, it too can benefit from an extended lifetime of several years. Most users of the PLUVALOR System [16] forget to replace it as well as the other components. They are actually not at risk. At worst, the 5-micron filter will clog (after about 5 to 8 years) and the system will not provide enough water. This is definitely the time to replace the 5-micron filter and the activated carbon filter.

Drinking water

The installation of a rainwater harvesting system is a major expense. Before undertaking such an expense, it is best to know that from a financial standpoint, the most efficient use for rainwater is to produce one's own drinking water. In this way, one can limit the use of rainwater to what is essential (and is by far the most important usage for the safeguard of a family's health): cooking, food and drink. Using rainwater for the flushing of toilets is irrational and a real wastage.

To cover the drinking and cooking needs of a family, a small 1000- to 1500-litre tank is sufficient. Preferably, it should be built of concrete or cement masonry parged with cement, and buried underground. Concrete or cement mortar is used to neutralize the natural acidity of rainwater and introduce a small amount of minerals in the water. For this purpose, you can also recommission an old disused cistern. Just empty it, clean it and check for leaks. Burying it will help ensure a constant stable temperature, for optimal water conservation.

Thus, this small cistern will be reserved for drinking water production. A small well pump pressure tank system will ensure adequate pressure. Downstream from the pressure tank system, you need to place a 25- to 30-micron primary filter, followed by a 10-micron filter. This water will feed the reverse osmosis system that could be installed in a technical room, for example. The filtered water can be either drawn within this technical room, or can be conveyed to the kitchen by means of a fine plastic pipe to a tap placed at the sink.

[15] Link : http://www.eautarcie.org/en/03e.html
[16] Link : http://www.eautarcie.org/en/03a.html#c

Beauty water

Nothing can match the quality of filtered rainwater for beauty care. An aquarium-type reverse osmosis system can easily provide 150 to 300 litres of water per day. Besides being used for drinking and cooking, this water will be used for beauty care and for washing your hair. Given the harmful nature of chlorine on health, such filtered water should also be used for infants' bath water.

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Mons, December 8, 2012.