

drinking water

Unique electrochemical technology for drinking water purification

Enviolyte® units: residential and commercial water purifiers

- Many countries of the world today are facing problems of shorter life expectancy and higher mortality rates, especially among children. To a great extent it is caused by use of low quality drinking water. It is extremely difficult to solve this problem for a whole country, as it requires huge investments and takes a long time.
- Really pure water is obtained from either very deep artesian wells and then bottled and sold, or you can process sub-standard tap water with residential or commercial water purifiers.
- Of all tap water delivered to the consumer only less than one per cent is used for drinking and cooking, the rest just goes down the drain. As natural water sources today are contaminated with a wide variety of chemicals and micro-organisms, many of them difficult to remove (heavy metals, dioxins, bacteria, spores, etc), smaller water treatment units for offices and homes seem much more practical.
- A lot of people already use water purification units at home to process tap water. Those are usually different kinds of filters, which capture and retain the impurities. As time passes, a crust is formed on the filter surface, which becomes a source of water contamination itself. Besides, a lot of filters capture hazardous and useful admixtures indiscriminately.

Some disturbing facts

- Every day 25,000 people die through drinking contaminated water
- 80% of all diseases in the world are water related
- 1.8 billion people are exposed to disease by drinking contaminated water... daily
- To meet WHO standards, an extra 768 million people in the 3rd world need to be served contaminant free water
- The lack of safe drinking water is the cause of 900 million cases of diarrhoeal disease every year, which causes the deaths of more than 3 million children
- At any 900 million people have hookworm, cholera, typhoid or paratyphoid and 200 million people have schistosomiasis or bilharzia
- 90 million people in Latin America have no access to safe water
- 23,000 villages in India have no consistently safe drinking water

ENVIOLYTE INDUSTRIES INTERNATIONAL LTD. HAS DEVELOPED AND IS PRODUCING THE NEW GENERATION OF WATER PURIFIERS BASED ON THE ELECTROCHEMICAL ACTIVATION PRINCIPLE - ECA

ECA - technology of the future

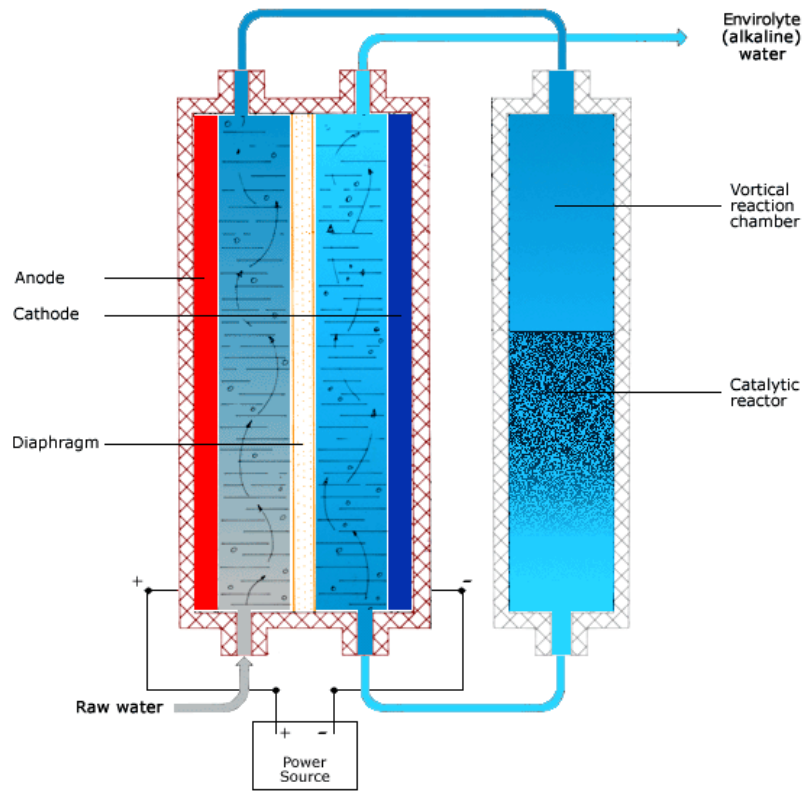
- ECA technology allows changing acid-alkali and oxidation-reduction properties of tap water with different degree of mineralisation. Ecologically, this technology is the safest among all water purification methods existing today.
- ECA technology makes it possible both to rid tap water of different hazardous admixtures as well as turn plain water into something useful in different spheres of human activity.
- ECA technology is implemented in unique Enviolyte ECO[®] units. They are highly efficient, economical,

do not require use of expensive and harmful chemicals. They are also dependable, durable and easy to use.

- Enviolyte ECO[®] units use technology based on a diaphragmatic electrochemical reactor. This is a small flow-type highly efficient device that only needs power supply (no more than 1W/h per 1 L of water). Enviolyte ECO[®] units do not include cartridges that require periodical replacement and must be safely disposed of. This is an important advantage over filter-type units, as filters or sorbents usually accumulate micro-organisms which reproduce quickly on the filter or sorbents surfaces, feeding on admixtures from the water flow and produce their own toxins, becoming the source of secondary contamination themselves.
- Enviolyte ECO[®] units have been created to purify sub-standard tap water. They guarantee effective destruction of all kinds and forms of micro-organisms, as well as their toxins; neutralisation of all hazardous organic substances (herbicides, pesticides, phenols, chlororganic compounds, including dioxins, etc) and removal of all heavy metals.
- ECA reactors have been world-wide patented by Enviolyte Industries International Ltd.

Enviolyte ECO[®] units operational principle

- Water purification process in Enviolyte ECO[®] units includes anodic electrolytic oxidation with simultaneous removal of cations; electrocatalytic and chemical additional oxidation in intermediate vortical reaction tank and catalytic purification in catalytic reactor. Processes of water treatment in the Enviolyte ECO[®] units consist of several stages (different kind of influence on the water and its impurities) separated in time and space. This guarantees higher effectiveness and environmental safety of the water treatment processes in the Enviolyte ECO[®] units, as compared to other known techniques. The unit consists of a diaphragmatic electrochemical flow-through type reactor, a catalytic reactor, a vortical reaction chamber and a VDC power source. The electrodes in the reactor have a special coating, which includes oxide ruthenium, iridium, platinum and titanium. The ultrafiltrating ceramic diaphragm made of zirconium, yttrium and aluminium oxides is located between the anode and cathode chambers and prevents the water in the anode and cathode chambers from mixing, thereby providing ion migration in electric field between anode and cathode. The design of a electrochemical reactors ensures the contact of all microvolumes of water flowing through the anode or cathode electrode chamber with an electrode surface, in the vicinity of which (in so-called Double Electric Layer - DEL) the electric intensity reaches 100,000 to 10,000,000 V/cm. This ensures a high quality of electrolytic and electrocatalytic water purification.
- Water purified by Enviolyte ECO[®] units acquires biocidal properties, stimulates biological oxidation, can provide indirect electrochemical detoxification of the human body through oxidation hydrolysis of uremic and other toxins.
- In the course of anode unipolar electrochemical treatment the water within fractions of a second becomes saturated with highly active oxidants: HClO, ClO₂, ClO₂⁻, O₃, O₂, H₂O₂, OH[·], HO[·]₂. Depending on mineralisation and the speed of the water flow their concentration may vary between 1,5-2 to 15 mg/L.



Drawing of Enviolyte operational principle

- Processes of direct electrolytic oxidation (on the electrode surface) and electro-catalytic oxidation ensure the destruction of organic impurities and the demolition of micro-organisms. End products of the total oxidation of all organic matter (including phenols) are generally harmless, mostly carbon dioxide and water.
- Extremely high oxidation-reduction potential of the water directly in the anode chamber and meta-stable compounds of active chlorine and active oxygen participating in the reactions prevent the formation of toxic chlorine-organic substances and ensure total destruction of dioxins.
- In the catalytic reactor, hetero-phase catalytic destruction of active chlorine compounds and heterophase catalytic oxidation of organic substances is carried out on the surface of granules of a replacement-free and regeneration-free catalyst, where active chlorine compounds (HClO , ClO_2 , HClO^- , ClO^-) decay to form highly active short-lived particles: O^\cdot , O , Cl^\cdot , OH^\cdot . When leaving the catalytic chamber, the water is saturated with oxygen and practically does not contain active chlorine compounds.

Reduction of heavy metal toxicity of water through unipolar electrochemical cathode treatment

- It has been proved that ions of heavy metals are much more harmful for human body than their atoms or compounds. Ions are usually absorbed in the upper part of small intestine and deposited in the liver. But as neutral particles or insoluble hydroxides these metals are absolutely harmless. In the stomach they are easily bonded by enterosorbents (proteins, polysaccharides) which prevent them from being dissolved in the acid of gastric juice. Therefore, they do not dissolve in the stomach and are excreted from the body naturally.
- In unipolar electrochemical cathode treatment in the cathode chamber, also within fractions of a second, water becomes saturated with highly active deoxidants (reducers): OH^- , H_2O_2 , HO_2^- , O_2 . It leads to the formation of insoluble heavy metal hydroxides $[\text{Me}_n + n\text{OH} \rightarrow \text{Me}(\text{OH})_n]$. At the same time, direct electrolytic reduction (on the electrode surface) and electrocatalytic reduction of multiplex charged cations of heavy metals also take place: $\text{Me}_n^+ + e \rightarrow \text{Me}^0$. These processes reduce the toxicity of water caused by the presence of heavy metal ions, through their conversion into natural, biologically inactive form. $\text{Me}_n^+(\text{OH})_n$, $\text{Me}^0(\text{OH})_n$, Me^0 are not dissolved by water and are absolutely harmless for humans and animals.
- The degree of water purification generally depends on the speed of the water flow, that is the amount of electricity per litre.

Comparative effectiveness of different methods for drinking water purification

Methods of purification	Bacteria	Viruses	Microbial toxins	Phenols	Chlororganic substances	Other organic substances	Heavy metal ions	Mineral salt surplus	Total points
Micro-filtering	3	2	2	2	2	2	2	2	17
Ultra-filtering	5	4	2	2	2	2	2	2	21
Sorption	3	3	3	4	4	4	3	2	26
Ion exchange	2	2	2	2	2	2	5	5	22
E7F8FFing	5	5	3	2	2	2	2	2	23
Iodation	5	5	3	3	2	2	2	2	24
Ozonization	5	5	3	4	4	4	2	2	29
Ultraviolet irradiation	4	4	2	2	2	2	2	2	20
Boiling	5	5	4	2	2	2	2	2	24
Electro- Dialysis	3	2	2	2	2	2	2	5	20
Coagulation	3	2	3	3	3	3	4	2	23
Electrolysis without a	5	5	4	4	3	3	2	2	28
Envirolyte ECO® units	5	5	5	5	5	5	3	2	35

Points: 5 - excellent, 4 - good, 3 - satisfactory, 2 - unsatisfactory

Effectiveness of drinking water purification with Envirolyte ECO® units

Effectiveness points (5 - excellent, 4 - good, 3 - satisfactory)

- Destruction of all kinds of micro-organisms - 5
- Neutralisation of all hazardous organic substances - 5
- Neutralisation of heavy metal ions - 5
- Removal of heavy metal ions - none
- Removal of nitrates and nitrites - 3
- Removal of deactivated and destructed organic compounds molecules - none
- Saturation of water with oxygen - 3
- Active chlorine compounds destruction - 4
- Loosening of hydrogen bonds (higher biocidic properties) - 5
- Decreasing mineralisation - none

Unique qualities of Envirolyte ECO® units water

- Water processed in Envirolyte ECO® units tastes similar to spring water and should be used for drinking and cooking. Its biological properties are comparable with those of high-mountain glacier melting water. The unique property of Envirolyte ECO® units-processed water is its low parameters of oxidation- reduction potential (ORP, redox potential) which are the same as inside a human body (+50...-300 mV), as compared to the usual untreated tap water parameters (+200...+400), measured on a platinum electrode in respect to a silver chloride (AgCl) reference electrode. There are a few natural water sources in the world with such redox potential, and those have been proven to possess medicinal properties without any additional changes of water chemical composition. This turns water into a natural antioxidant, capable of normalising cell membranes functions in humans and animals.
- After 10-15 hours redox potential parameters of Envirolyte ECO® units-processed water return to the usual fresh water ones and it loses its medicinal properties, although its other parameters (including the purity) does not degrade in time.
- It should be reiterated that Envirolyte ECO® units-processed water retains all the necessary microelements, among them sodium calcium, magnesium and especially fluorine, important to keep your teeth healthy. That is why Envirolyte ECO® units-processed water should not be boiled before drinking.

Enviolyte ECO® units - for those, who take care of their health

- Medical research has shown that regular use of freshly processed Enviolyte ECO® units water becomes more digestible for body cells and has positive effect on metabolism, i.e., accelerates the removal of residue, and promotes the fullest digestion of nutrients. Enviolyte ECO® units water inhibits excessive fermentation in digestive tract by reducing indirectly metabolites such as hydrogen sulphide, ammonia, histamines, indoles, phenols and scatoles, facilitates normalisation of the microbe flora in the gastroenteric tract. It stimulates liver functions and reduces allergic reactions.
- Enviolyte ECO® units water strengthens the body anti-oxidant protection, improves efficiency of vitamins A and B group, vitamins C, E, lecithin, enhances immunity. The water coming into the body with food and drink has properties compatible with those of the internal environment, so oxidative attack on body biostructures (cellular membranes, cell organoids, nucleic acids, etc) are decelerated, ageing processes stopped or even reversed.
- The concept of Enviolyte ECO® units water may be summarised as follows: everything that is harmful and alien to a human body (i.e., xenobiotics) has been removed and all that is useful and harmless is retained.
- **You can successfully use Enviolyte ECO® units water for almost anything:**
 - food and drink made with it is much tastier;
 - it leaves negligible amount of scaling when boiled;
 - it easily washes away stubborn film of pesticides and herbicides off fresh fruit and vegetables;
 - a woman who uses it to wash herself and as a basis for herbal cosmetics will always look young;
 - you can use it to wash babies without boiling or adding anything;
 - it makes plants grow faster;
 - even pets prefer it to tap water.
- **ENVIOLYTE ECO® UNITS - PROCESSED WATER MEETS WORLD HEALTH ORGANISATION DRINKING WATER HEALTH STANDARDS**

Comparative analysis of prices for home drinking water treatment units

Unit Name	Processing method	Working hours without cartridge replacement	Cartridge price	Capacity (L per Hr)	Price per liter (\$US)
NSA (Great Britain)	adsorption filter	1000 - 3000	-	25	0.1
Brita (Germany)	adsorption filter with replaceable cartridge	60 - 100	\$5	10	0.06
Kenwood Electronic (Great Britain)	ditto	300	\$9	20	0.06
Elgastat Option 1A (Sweden)	reverse osmosis	6000	\$87	4	0.3
Elgastat Option 2A (Sweden)	ditto	10.000	\$87	30	0.3
Nimbus mini (USA)	ditto	400	\$40	1.0	0.35
Nimbus III (USA)	ditto	450	\$60	2.0	0.35
Enviolyte (Estonia)	electrochemical activation	1.000.000	-	120	0.001