



## MINERAL WATER AS A TRUST, QUALITY, TASTE AND WORTH FOR THE ELIXIR OF LIFE

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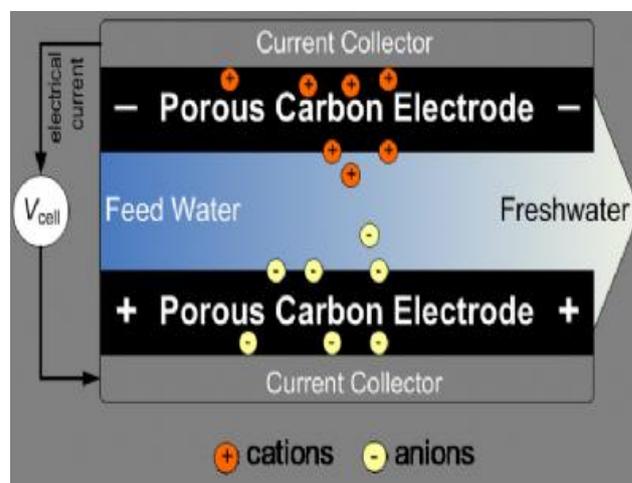
### ABSTRACT

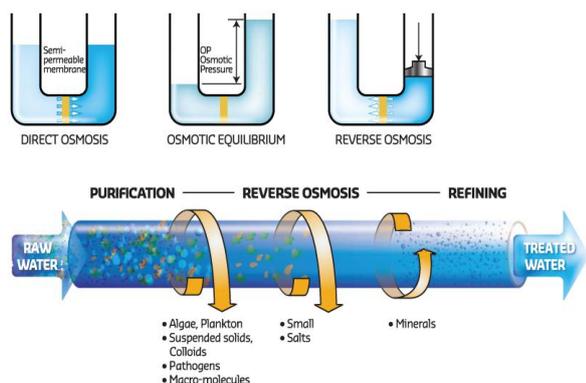
*Bottled water is drinking water (e.g., well water, distilled water, mineral water, or spring water) packaged in plastic or glass water bottles. Bottled water may be carbonated or not. Sizes range from small single serving bottles to large carboys for water coolers. Purified water is water that has been mechanically filtered or processed to remove impurities and make it suitable for use. Distilled water has been the most common form of purified water, but, in recent years, water is more frequently purified by other processes including capacitive deionization, reverse osmosis, carbon filtering, microfiltration, ultra filtration, ultraviolet oxidation, or electro deionization. Combinations of a number of these processes have come into use to produce water of such high purity that its trace contaminants are measured in parts per billion (ppb) or parts per trillion (ppt). Purified water has many uses, largely in the production of medications, in science and engineering laboratories and industries and is produced in a range of purities. It can be produced on site for immediate use or purchased in containers. Purified water in colloquial English can also refer to water which has been treated (rendered potable) to neutralize, but not necessarily remove contaminants considered harmful to humans or animals.*

**KEYWORDS:** Deionization, Reverse Osmosis, Carbon Filtering, Microfiltration, Ultra Filtration, Ultraviolet Oxidation, Electro Deionization, Ozonation, Magnesium Sulphate, Potassium Bicarbonate, Polyethylene Terephthalate.

### INTRODUCTION

One of the most important needs for every individual in their everyday life is water. Drinking pure water plays a vital role in keeping one healthy. It's impossible to carry our own water bottles every time. Hence, we go for packaged mineral water bottles. Earlier, there is only one brand available in the market i.e. Bisleri, which is pure, hygienic and tastes good. In present market, there are a lot number of brands of mineral water available namely, Bisleri, Kinley, Aquafina, Himalayan, Bailey, Kingfisher, Oxyrich, Tata Water Plus, Aava etc. Some brands are good in supplying tasty pure mineral water but some brands are going in a commercial way, thereby failing to supply tasty pure mineral water. They are not meeting the needs of the customers. Customers, even by paying the good amount on mineral water are not satisfied with the taste and quality of water available in the markets these days. Lets check out which brand is best in terms of trust, quality, taste and worth.<sup>[1]</sup>





**Figure-1: Capacitive Deionization and Reverse Osmosis mechanism**

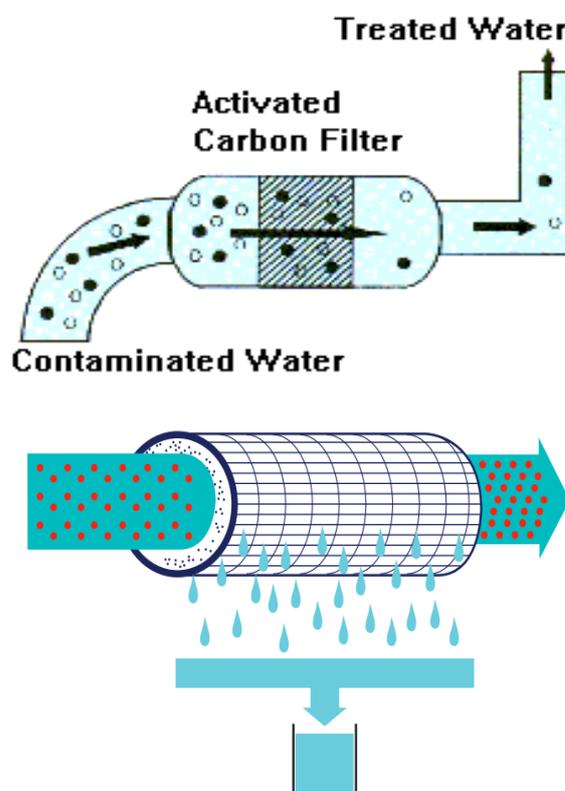
### Capacitive Deionization

It is a technology to deionize water by applying an electrical potential difference over two porous carbon electrodes. Anions, ions with a negative charge, are removed from the water and are stored in the positively polarized electrode. Likewise, cations (positive charge) are stored in the cathode, which is the negatively polarized electrode. Today, CDI is mainly used for the desalination of brackish water, which is water with a low or moderate salt concentration (below 10g/L). Other technologies for the deionization of water are, amongst others, distillation, reverse osmosis and electro dialysis. Compared to reverse osmosis and distillation, CDI is considered to be an energy-efficient technology for brackish water desalination. This is mainly because CDI removes the salt ions from the water, while the other technologies extract the water from the salt solution. Historically, CDI has been referred to as electrochemical demineralization, electrosorb process for desalination of water, or electro sorption of salt ions. It also goes by the names of capacitive desalination, or in the commercial literature as CapDI.

### Reverse Osmosis

It is a water purification technology that uses a semi permeable membrane to remove ions, molecules and larger particles from drinking water. In reverse osmosis, an applied pressure is used to overcome osmotic pressure, a colligative property that is driven by chemical potential differences of the solvent, a thermodynamic parameter. Reverse osmosis can remove many types of dissolved and suspended species from water, including bacteria and is used in both industrial processes and the production of potable water. The result is that the solute is retained on the pressurized side of the membrane and the pure solvent is allowed to pass to the other side. To be selective, this membrane should not allow large molecules or ions through the pores (holes), but should allow smaller components of the solution (such as solvent molecules) to pass freely. In the normal osmosis process, the solvent naturally moves from an area of low solute concentration (high water potential), through a membrane, to an area of high solute concentration (low water potential). The driving force for the movement of

the solvent is the reduction in the free energy of the system when the difference in solvent concentration on either side of a membrane is reduced, generating osmotic pressure due to the solvent moving into the more concentrated solution. Applying an external pressure to reverse the natural flow of pure solvent, thus, is reverse osmosis. The process is similar to other membrane technology applications. However, key differences are found between reverse osmosis and filtration. The predominant removal mechanism in membrane filtration is straining, or size exclusion, so the process can theoretically achieve perfect efficiency regardless of parameters such as the solution's pressure and concentration. Reverse osmosis also involves diffusion, making the process dependent on pressure, flow rate and other conditions. Reverse osmosis is most commonly known for its use in drinking water purification from sea water, removing the salt and other effluent materials from the water molecules. Minerals are then added to the water to bring back the taste and goodness.



**Figure-2: Carbon Filtering and Microfiltration mechanism**

### Carbon Filtering

It is a method of filtering that uses a bed of activated carbon to remove contaminants and impurities, using chemical adsorption. Each particle/granule of carbon provides a large surface area/pore structure, allowing contaminants the maximum possible exposure to the active sites within the filter media. One pound (454g) of activated carbon contains a surface area of approximately 100acres (40Hectares). Activated carbon works via a process called adsorption, whereby pollutant molecules in the fluid to be treated are trapped inside the pore

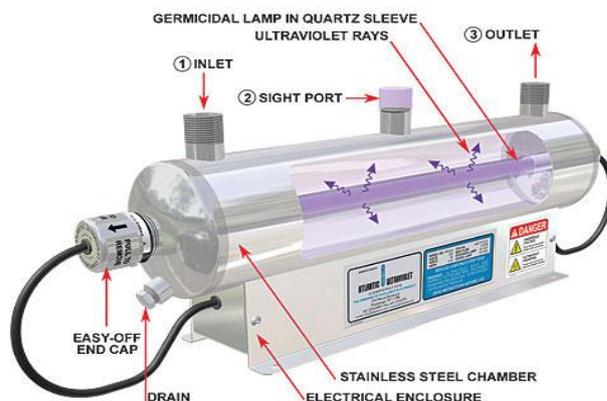
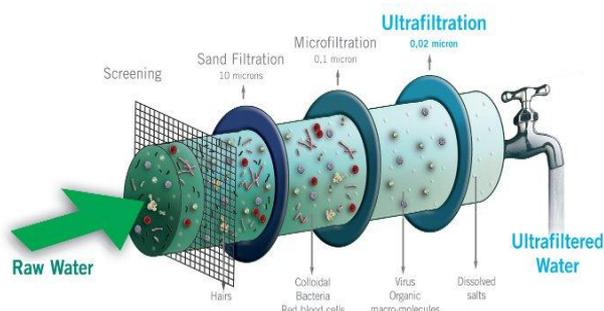
structure of the carbon substrate. Carbon filtering is commonly used for water purification, in air purifiers and industrial gas processing, for example the removal of siloxanes and hydrogen sulfide from biogas. It is also used in a number of other applications, including respirator masks, the purification of sugarcane and in the recovery of precious metals, especially gold. It is also used in cigarette filters. Active charcoal carbon filters are most effective at removing chlorine, sediment, volatile organic compounds (VOCs), taste and odor from water. They are not effective at removing minerals, salts and dissolved inorganic compounds. Typical particle sizes that can be removed by carbon filters range from 0.5-50µmetres. The particle size will be used as part of the filter description. The efficacy of a carbon filter is also based upon the flow rate regulation. When the water is allowed to flow through the filter at a slower rate, the contaminants are exposed to the filter media for a longer amount of time.

### Microfiltration

It is commonly abbreviated to MF which is a type of physical filtration process where a contaminated fluid is passed through a special pore-sized membrane to separate microorganisms and suspended particles from process liquid. It is commonly used in conjunction with various other separation processes such as ultra filtration and reverse osmosis to provide a product stream which is free of undesired contaminants.

### Ultra Filtration

It is a variety of membrane filtration in which forces like pressure or concentration gradients lead to a separation through a semi permeable membrane. Suspended solids and solutes of high molecular weight are retained in the so-called retentate, while water and low molecular weight solutes pass through the membrane in the permeate (filtrate). This separation process is used in industry and research for purifying and concentrating macromolecular (103-106Da) solutions, especially protein solutions. Ultra filtration (UF) is not fundamentally different from microfiltration. Both of these separate based on size exclusion or particle capture. It is fundamentally different from membrane gas separation, which separate based on different amounts of absorption and different rates of diffusion. Ultra filtration membranes are defined by the molecular weight cut-off (MWCO) of the membrane used. Ultra filtration is applied in cross-flow or dead-end mode.



**Figure-3: Ultra filtration and Ultraviolet Oxidation mechanism**

### Ultraviolet Oxidation or Advanced Oxidation Processes

These are efficient methods to remove organic contamination not degradable by means of biological processes. AOPs are a set of processes involving the production of very reactive oxygen species able to destroy a wide range of organic compounds. AOPs are driven by external energy sources such as electric power, ultraviolet radiation (UV) or solar light, so these processes are often more expensive than conventional biological wastewater treatment. Moreover, AOPs can be applied for the disinfection of water, air and for remediation of contaminated soils. Advanced Oxidation Processes (AOPs) refer to a set of oxidative water treatments that can be used to treat toxic effluents at industrial level, hospitals and wastewater treatment plants. AOPs are successful to transform toxic organic compounds (e.g. drugs, pesticides, endocrine disruptors etc.) into biodegradable substances. AOPs in general are cheap to install but involve high operating costs due to the input of chemicals and energy required. To limit the costs, AOPs are often used as pre-treatment combined with biologic treatment. Advanced oxidation was recently also used as quaternary treatment or a polishing step to remove micro-pollutants from the effluents of municipal waste water treatment plants and for the disinfection of water. The combination of several AOPs is an efficient way to increase pollutant removal and reduce costs.

### Examples of AOPs

Many methods are classified under the broad definition of AOPs. Advanced oxidation generally uses strong oxidizing agents like hydrogen peroxide ( $H_2O_2$ ) or ozone ( $O_3$ ), catalysts (iron ions, electrodes, metal oxides) and irradiation (UV light, solar light, ultrasounds) separately or in combination under mild conditions (low temperature and pressure). Among different available AOPs, those driven by light seem to be the most popular technologies for wastewater treatment as shown by the large amount of data available in the literature. Solar AOPs are particularly attractive due to the abundance of solar light in regions where water scarcity is high and due to their relatively low costs and high efficiencies.



**Figure-4: Electrode ionization and Ozonation Process mechanism**

#### Electrode ionization

It is a water treatment technology that utilizes electricity, ion exchange membranes and resin to deionize water and separate dissolved ions (impurities) from water. It differs from other water purification technologies in that it is done without the use of chemical treatments and is usually a polishing treatment to reverse osmosis (RO). There are also EDI units that are often referred to as continuous electrode ionization (CEDI) since the electric current regenerates the resin mass continuously. CEDI technique can achieve very high purity, with conductivity below  $0.1 \mu\text{S}/\text{cm}$ .

#### Ozonation Process

Ozone ( $\text{O}_3$ ) is an unstable gas comprising of three oxygen atoms, the gas will readily degrade back to oxygen and during this transition a free oxygen atom, or free radical form. The free oxygen radical is highly reactive and short lived; under normal conditions it will only survive for milliseconds. Ozone is a colorless gas that has an odor similar to the smell of the air after a major thunderstorm. The entire process involves zero human intervention giving no chance for external contamination. Ozone has greater disinfection effectiveness against bacteria and viruses compared to chlorination. In addition, the oxidizing properties can

also reduce the concentration of iron, manganese, sulfur and reduce or eliminate taste and odor problems. Ozone oxidizes the iron, manganese and sulfur in the water to form insoluble metal oxides or elemental sulfur. These insoluble particles are then removed by post-filtration. Organic particles and chemicals will be eliminated through either coagulation or chemical oxidation. Ozone is unstable and it will degrade over a time frame ranging from a few seconds to 30 minutes. The rate of degradation is a function of water chemistry, pH and water temperature. The formation of oxygen into ozone occurs with the use of energy. This process is carried out by an electric discharge field as in the CD-type ozone generators (corona discharge simulation of the lightning), or by ultraviolet radiation as in UV-type ozone generators (simulation of the ultraviolet rays from the sun). In addition to these commercial methods, ozone may also be made through electrolytic and chemical reactions. In general, an ozonation system includes passing dry, clean air through a high voltage electric discharge, i.e., corona discharge, which creates and ozone concentration of approximately 1% or  $10,000 \text{mg}/\text{L}$ . In treating small quantities of waste, the UV ozonation is the most common while large-scale systems use either corona discharge or other bulk ozone-producing methods. The raw water is then passed through a venturi throat which creates a vacuum and pulls the ozone gas into the water or the air is then bubbled up through the water being treated. Since the ozone will react with metals to create insoluble metal oxides, post filtration is required.

#### Advantages and Disadvantages of different water purification technologies

##### 1. Distillation

Distillation is probably the oldest method of water purification. Water is first heated to boiling. The water vapor rises to a condenser where cooling water lowers the temperature so the vapor is condensed, collected and stored. Most contaminants remain behind in the liquid phase vessel. However, organics with boiling points lower than  $100^\circ\text{C}$  cannot be removed efficiently and can actually become concentrated in the product water. Another disadvantage is cost. Distillation requires large amounts of energy and water.

##### 2. Deionization

The ion-exchange resins capture dissolved ions in the feed water at the top of the cell. Electric current applied across the module pulls those ions through the ion-selective membrane towards the electrodes. Cations are pulled through the cation-permeable membrane towards the cathode and anions through the anion-selective membrane towards the anode. These ions, however, are unable to travel all the way to their respective electrodes since they come to the adjacent ion-selective membrane which is of the opposite charge. This prevents further migrations of ions, which are then forced to concentrate in the space between the cells. This space is known as

the "concentrate" channel, and the ions concentrated in this area are flushed out of the system to the drain.

The channel running through the resin bed in the center of the cell is known as the "dilute" channel. As water passes down this channel, it is progressively deionized. At the lower end of the dilute channel, where water is free of ions, splitting of H<sub>2</sub>O occurs in the electric field. This generates H<sup>+</sup> and OH<sup>-</sup> which regenerate the ion exchange resins, effectively eliminating chemical regeneration.

### 3. Reverse Osmosis

Reverse osmosis (RO) is the most economical method of removing 95% to 99% of all contaminants. The pore structure of RO membranes is much tighter than UF membranes. RO membranes are capable of rejecting practically all particles, bacteria and organics >300 daltons molecular weight (including pyrogens). Natural osmosis occurs when solutions with two different concentrations are separated by a semi-permeable membrane. Osmotic pressure drives water through the membrane; the water dilutes the more concentrated solution; and the end result is equilibrium. In water purification systems, hydraulic pressure is applied to the concentrated solution to counteract the osmotic pressure. Pure water is driven from the concentrated solution and collected downstream of the membrane. Because RO membranes are very restrictive, they yield very slow flow rates. Storage tanks are required to produce an adequate volume in a reasonable amount of time. RO also involves an ionic exclusion process. Only solvent is allowed to pass through the semi-permeable RO membrane, while virtually all ions and dissolved molecules are retained (including salts and sugars). The semi-permeable membrane rejects salts (ions) by a charge phenomena action: the greater the charge, the greater the rejection. Therefore, the membrane rejects nearly all (>99%) strongly ionized polyvalent ions but only 95% of the weakly ionized monovalent ions like sodium. Different feed water may require different types of RO membranes. Membranes are manufactured from cellulose acetate or thin-film composites of polyamide on a polysulfone substrate. RO is the most economical and efficient method for purifying tap water if the system is properly designed for the feed water conditions and the intended use of the product water. RO is also the optimum pretreatment for reagent-grade water polishing systems.

### 4. Carbon Adsorption

The carbon adsorption process is controlled by the diameter of the pores in the carbon filter and by the diffusion rate of organic molecules through the pores. The rate of adsorption is a function of the molecular weight and the molecular size of the organics. Certain granular carbons effectively remove chloramines. Carbon also removes free chlorine and protects other purification media in the system that may be sensitive to an oxidant such as chlorine. Carbon is usually used in

combination with other treatment processes. The placement of carbon in relation to other components is an important consideration in the design of a water purification system. The distinction between filters is important because the three serve very different functions. Depth filters are usually used as pre filters because they are an economical way to remove 98% of suspended solids and protect elements downstream from fouling or clogging. Surface filters remove 99.99% of suspended solids and may be used as either pre filters or clarifying filters. Micro porous membrane (screen) filters are placed at the last possible point in a system to remove the last remaining traces of resin fragments, carbon fines, colloidal particles and microorganisms. For example, 0.22µm Millipore membrane filters, which retain all bacteria, are routinely used to sterilize intravenous solutions, serums and antibiotics.

### 5. Ultra filtration

Ultra filtration (UF) membrane functions as a molecular sieve. It separates dissolved molecules on the basis of size by passing a solution through an infinitesimally fine filter. The ultra filter is a tough, thin, selectively permeable membrane that retains most macromolecules above a certain size including colloids, microorganisms and pyrogens. Smaller molecules, such as solvents and ionized contaminants, are allowed to pass into the filtrate. Thus, UF provides a retained fraction (retentate) that is rich in large molecules and a filtrate that contains few, if any, of these molecules. Ultra filters are available in several selective ranges. In all cases, the membranes will retain most, but not necessarily all, molecules above their rated size.

### 6. Ultraviolet Treatment

Recent advances in UV lamp technology have resulted in the production of special lamps which generate both 185nm and 254nm UV light. This combination of wavelengths is necessary for the photo-oxidation of organic compounds. With these special lamps, Total Organic Carbon (TOC) levels in high purity water can be reduced to 5ppb.

### 7. Ion-Exchange

The ion-exchange process percolates water through bead-like spherical resin materials (ion-exchange resins). Ions in the water are exchanged for other ions fixed to the beads. The two most common ion-exchange methods are softening and deionization. Softening is used primarily as a pretreatment method to reduce water hardness prior to reverse osmosis (RO) processing. The softeners contain beads that exchange two sodium ions for every calcium or magnesium ion removed from the softened water.

Deionization (DI) beads exchange either hydrogen ions for cations or hydroxyl ions for anions. The cation exchange resins, made of styrene and divinylbenzene containing sulfonic acid groups, will exchange a hydrogen ion for any cations they encounter (e.g., Na<sup>+</sup>,

Ca<sup>++</sup>, Al<sup>+++</sup>). Similarly, the anion exchange resins, made of styrene and containing quaternary ammonium groups, will exchange a hydroxyl ion for any anions (e.g., Cl<sup>-</sup>). The hydrogen ion from the cation exchanger unites with the hydroxyl ion of the anion exchanger to form pure water. These resins may be packaged in separate bed exchangers with separate units for the cation and anion exchange beds. Or, they may be packed in mixed bed exchangers containing a mixture of both types of resins. In either case, the resin must be "regenerated" once it has exchanged all its hydrogen and/or hydroxyl ions for charged contaminants in the water. This regeneration reverses the purification process, replacing the contaminants bound to the DI resins with hydrogen and hydroxyl ions.

Deionization can be an important component of a total water purification system when used in combination with other methods discussed in this primer such as RO, filtration and carbon adsorption. DI systems effectively remove ions, but they do not effectively remove most organics or microorganisms. Microorganisms can attach to the resins, providing a culture media for rapid bacterial growth and subsequent pyrogen generation.

8. Ozone has greater disinfection effectiveness against bacteria and viruses compared to chlorination. In addition, the oxidizing properties can also reduce the concentration of iron, manganese, sulfur and reduce or eliminate taste and odor problems. Ozone oxidizes the iron, manganese and sulfur in the water to form insoluble metal oxides or elemental sulfur. These insoluble particles are then removed by post-filtration. Organic particles and chemicals will be eliminated through either coagulation or chemical oxidation. Ozone is unstable and it will degrade over a time frame ranging from a few seconds to 30minutes. The rate of degradation is a function of water chemistry, pH and water temperature. The formation of oxygen into ozone occurs with the use of energy. This process is carried out by an electric discharge field as in the CD-type ozone generators (corona discharge simulation of the lightning), or by ultraviolet radiation as in UV-type ozone generators (simulation of the ultraviolet rays from the sun). In addition to these commercial methods, ozone may also be made through electrolytic and chemical reactions. In general, an ozonation system includes passing dry, clean air through a high voltage electric discharge, i.e., corona discharge, which creates and ozone concentration of approximately 1% or 10,000 mg/L. In treating small quantities of waste, the UV ozonation is the most common while large-scale systems use either corona discharge or other bulk ozone-producing methods. The raw water is then passed through a venturi throat which creates a vacuum and pulls the ozone gas into the water or the air is then bubbled up through the water being treated. Since the ozone will react with metals to create insoluble metal oxides, post filtration is required.

#### **Advantages to Ozone**

Ozone is effect over a wide pH range and rapidly reacts with bacteria, viruses and protozoans and has stronger germicidal properties than chlorination. Has a very strong oxidizing power with a short reaction time. The treatment process does not add chemicals to the water. Ozone can eliminate a wide variety of inorganic, organic and microbiological problems and taste and odor problems. The microbiological agents include bacteria, viruses and protozoans (such as Giardia and Cryptosporidium).

#### **Disadvantages to Ozone**

There are higher equipment and operational costs and it may be more difficult to find professional proficient in ozone treatment and system maintenance. Ozonation provides no germicidal or disinfection residual to inhibit or prevent regrowth. Ozonation by-products are still being evaluated and it is possible that some by-products may be carcinogenic. These may include brominated by-products, aldehydes, ketones and carboxylic acids. This is one reason that the post-filtration system may include an activate carbon filter. The system may require pretreatment for hardness reduction or the additional of polyphosphate to prevent the formation of carbonate scale. Ozone is less soluble in water, compared to chlorine and therefore, special mixing techniques are needed. Potential fire hazards and toxicity issues associated with ozone generation.

#### **Bisleri**

Bisleri, the popular brand that has explored the concept of mineral water and today exists in every household need. Quality is what, makes Bisleri the largest brand of mineral water in India. Every drop of Bisleri undergoes rigorous 6-step purification process, giving clean and germfree water to every person at ₹ 20 per litre.

Bisleri International Pvt. Ltd is an Indian beverages company best known for its eponymous Bisleri brand of bottled water. Bisleri holds 60% market share in the Indian packaged drinking water industry. It is available in 7 pack sizes: 250ml, 300ml, 500ml, 1litre, 2litres, 5litres and 20litres jars. Its operations run throughout the subcontinent of India and are one of the leading bottled water supplying companies. As of 19 September 2015, Bisleri has 80 bottling plants Pan India, amongst which 12 are their own and 68 are licensed. The composition of Bisleri Water in milligrams per litre (mg/litre): 80-150ppm TDS, 6.5-7.5-pH factor, 75ppm-Calcium, 200ppm-Chlorides and 30ppm-Magnesium.



**Figure-5: Bisleri and Kinley mineral water bottles with logos**

The Parle Group, founded by Jayantilal Chauhan, began manufacturing soft drinks in 1949. Bisleri, an Italian mineral water company, was launched in Mumbai in the year 1965. The Parle Group purchased Bisleri from the Italian entrepreneur Signor Felice Bisleri in 1969. They merely used the name and launched Bisleri soda with two variants—carbonated and non-carbonated mineral water. Bisleri soda, though doing well, had to be discontinued, as Parle sold their soft drink brands to Coca-Cola in 1993. After the sale to Coca-Cola, Ramesh Chauhan dedicated himself to develop Bisleri as a brand and bring safe drinking water into the public domain.<sup>[2]</sup>

The multiple stages of the Bisleri purification process is claimed to ensure that the water is free from all forms of bacteria. Bisleri does not use the process of chlorination as it may create harmful residues in water. The journey of a Bisleri bottle begins from the source which is ground water. This sourced water is treated with ozone, which helps to destroy all the bacteria and viruses within seconds.



**2litres**



**5litres**



20litres

**Figure-6: Various Bisleri bottles**

The water then goes through a sand filter which removes the coarse particles up to  $30\mu$  in size. The next filter is the carbon filter which helps get rid of any pesticides, color and odor from the water. This water then goes through a process called reverse osmosis (RO) which removes the excess quantity of salts and minerals from the water making it soft and drinkable. Bisleri mineral water contains minerals such as magnesium sulphate ( $MgSO_4$ ) and potassium bicarbonate ( $KHCO_3$ ), which the company claims to maintain the body's pH balance and to keep the body fit and energetic. At Bisleri this purified mineral water is made to go through a double ozonisation process before the filling to ensure no environment contamination happens during the filling and the product can enjoy a long life. In case of SKU's such as the 20-litre jar, where the container is re-used, there is an additional process followed. This process involves getting back the containers, conducting a human check. The bottles used at Bisleri are manufactured at the Bisleri plant itself to avoid any possible contamination. Bisleri uses only Grade 1 polyethylene terephthalate bottles for its products. PET is safe for storing water and can be 100% recycled after use. The bottles are made using preforms, which go through a blowing process where the bottles attain the desired shapes and sizes. These bottles are then used for filling the purified water and are then mechanically sealed and packaged.<sup>[3]</sup>

### Kinley

Kinley mineral water gives the assurance of safety from The Coca-Cola Company. Kinley which is manufactured under reverse-osmosis process (RO), along with the latest technology of purification safeguard the purity of the product, as their motto is providing pure and safe drinking water. Kinley comes at ₹ 15 per litre. Composition per 100ml: Energy-0kcal, Carbohydrate-0g, Sugar-0g, Protein-0g, Fat-0g, Sodium-0.3mg, Magnesium-0.1mg. Kinley is a brand of still or carbonated water owned by The Coca-Cola and sold in many large European and Asian countries. Its carbonated forms are used for mixers and also available in a variety of fruit flavors. The Kinley brand is used by Coca-Cola for two types of drinks: Packaged water bottle and a carbonated water with a wide array of

variants: tonic, bitter lemon, ginger ale, club soda and fruit flavored. Available in Austria, Belgium, Bulgaria, Czech Republic, Denmark, ElSalvador, Germany, Hungary, India, Israel, Italy, Lithuania, Luxembourg, Maldives, Moldova, Nepal, Netherlands, Norway, Poland, Romania, Slovakia, Sweden and Zambia. Kinley Lemon was one of eight international soda flavors featured and available for tasting at Club Cool in Epcot, but was retired in October 2013.<sup>[4]</sup>

### Oxyrich

Oxyrich is enriched with 300% more oxygen. This outstanding feat is achieved through first-of-its-kind revolutionary patented oxygenation process. Of the various nutrients needed by the human body, oxygen is the one we at all times. It is the element that sustains us. It is what we use to digest food and to break down toxins in our bodies so that they can be removed. And yet, Oxygen is the one nutrient most people don't associate with deficiency problems. Nothing could be further from the truth. When oxygen levels are low in our body, our bodies accumulate toxins, develop disease and possibly cause yearly cell death. Oxyrich cares not just about health but also the planet's eco-health. Plastic water bottles are 100% recyclable — even the cap, label and multipack outer wrap — can be put safely into the recycling bin.

**Figure-7: Kinley and Oxyrich mineral water bottles**

As all bottles and closures are produced in-house, this can be cut down on the gallons of fuel and carbon

emissions that would have otherwise been incurred in transportation. The vast network of bottled water production sites across the country reduces the distance of Oxyrich products travel from the plants to retail stores. A glass of pure water is nothing short of a breath of life. It is the source of all life forms. Just the fact that 70% of our bodies are made up of water tells us about the importance of water and the oxygen dissolved in water is what makes all the difference. Oxygen is a natural energizer and body purifier. Providing sufficient levels of oxygen to every part of the body promotes optimum health. Oxygen provides the energy for immune system, growth, maintenance, repair and all the other functions of the body. It also allows detoxifying chemical pollutants. Needless to say, more the amount of oxygen, better it becomes for a pure, healthy living.

At Manikchand, we know the importance of healthy drinking water. This elixir that makes up 70% of our bodies is the most vital for life. It had always been our effort to provide water not just in its purest but also its healthiest form. Thus, was born Oxyrich – Dhariwal Industries' own brand of packaged drinking water. In 2002, another set up one of India's most modern and comprehensive packaged drinking water plants near Pune. It has been later established more plants at Hyderabad, Bangalore, Ahmedabad and Haridwar. Manikchand now boasts of revolutionary packaged drinking water plants across the country.



**Figure-8: Aquafina and Himalayan mineral water bottles with logos**

To ensure strict quality control, the Manikchand Group has companies that manufacture and supply pre-forms, caps, labels and cartons to Dhariwal Industries Ltd. The Pet Preform division and the Closure manufacturing division also provide services to other packaged drinking

water units across the country. Oxyrich is the only packaged drinking water in India to have 300% more oxygen. Adding more oxygen to water is achieved by our one and only path-breaking patented technology in the world. Oxyrich is also one of the few bottled drinking water from India to be ISO 22000:2005 certified; world standard for food safety management system. World-class processes and superior equipment ensure highest levels of purity and quality of packaged drinking water.

### Aquafina

Aquafina is a purified mineral packaged drinking water brand produced by PepsiCo. Aquafina undergoes through 5 steps of state of the art filtration process comprising sand filtration, activated carbon filtration, UV treatment, reverse osmosis (RO) and ozonation process. Aquafina packaged drinking water market price is ₹ 18 per litre. Aquafina is a brand of purified bottled water products produced by PepsiCo, consisting of both unflavored and flavored water. The Aquafina brand name is also licensed for use on multiple skin care products, including lip balm and wrinkle cream. It was first distributed in Wichita, Kansas in 1994, before becoming more widely sold across the United States, Spain, Canada, Lebanon, Turkey, the GCC, Iran, Egypt, Vietnam, Pakistan and India to compete with The Coca-Cola Company's Dasani and Dr. Pepper Snapple's Deja Blue. As of 2009, Aquafina represented 13.4% of domestic bottled water sales in the United States, making it the number 1 bottled water brand as measured by retail sales. Its primary competition includes Aqua (Indonesia), Aqua Minerale (Greece), Dasani (USA), Aqua Pura (UK) and Aquasource (Australia). Aquafina Pure Water, the primary unflavored product produced under the Aquafina brand, is derived from local municipal tap water sources and goes through a purification process that incorporates reverse osmosis (RO), ultraviolet (UV) and ozone sterilization. Beginning on July 27, 2007, a disclaimer was added to each bottle of Aquafina, stating the water comes from a public source. Aquafina uses the term Purified Drinking Water in reference to the product on its labeling in the United States. In Canada, the current 1.5litres (51US fl oz) bottle of water displays Demineralized Treated Water. In response to concerns amongst environmental advocates who raised questions over the disclosure of water sources, a PepsiCo spokeswoman stated, if this helps clarify the fact that the water originates from public sources and then it's a reasonable thing to do.<sup>[5]</sup>

Flavored variations are also produced under the Aquafina brand name—all of which are labeled as containing no calories and no carbohydrates. *Aquafina FlavorSplash*, first introduced in 2005, is a flavored water product line which is non-carbonated and artificially sweetened with sucralose. As of 2011, it is produced in six flavors: Grape, Strawberry Kiwi, Wild Berry, Raspberry, Lemon and Peach Mango. *Aquafina Sparkling* is a carbonated line of flavored water; however its production was discontinued in the U.S. in late

2010. Other former products included *Aquafina Alive* (a low calorie, vitamin-enhanced water beverage introduced in 2007 and discontinued in 2009) and *Aquafina plus+* (a low calorie flavored water labeled as a vitamin supplement)—both of which have been discontinued in the U.S. As of 2011, the Sparkling and plus+ lines were still in production in other markets such as Canada. Aquafina is distributed in 12US fluid ounces (0.35l), 500millilitres (17US fl oz), 20US fluid ounces (0.59litre), 24US fluid ounces (0.71litre), 1litre (34US fl oz), 1.5litres (51US fl oz) bottles. The bottled water industry has drawn criticism for the production and distribution of plastic product packaging, which consumes additional petrochemicals. The packaging has evolved from its original iteration for the purpose of partially offsetting environmental impacts of production and shipment. This has primarily involved packaging weight reduction. The weight of Aquafina bottles was reduced by approximately 50%, to 10.9grams (0.38oz), with a packaging redesign in 2009 which, according to the company, resulted in the use of 75million fewer pounds of plastic during the production process.<sup>[6]</sup>

### Himalayan

Sparkling Himalayan natural mineral water is a premium brand with wellness of natural minerals comes at ₹ 50 per litre. As pure as winter snow, every sip of Himalayan is pristine and comes straight from the Himalayan Mountains. Untouched by civilization, the source has no human activity, remaining completely pollution free allowing for the water to retain its natural and pristine state. Himalayan is marketed by NourishCo, a joint venture between Tata Global Beverages and PepsiCo India. The water is bottled at source from a pure and pristine underground moving stream aquifer, which is about 400feet below the surface, located at the foothills of the Shivalik range in the Himalayas. This aquifer is one of the largest and purest sources in the world, providing a perennial source of natural mineral water. The catchment area has no human activity and is pollution-free. Every drop travels through layers of rock, sand and silt for over 20years. These layers act as natural filters and keep the water naturally pure and bacteria-free. During this journey, the pure water picks up essential minerals and acquires its fine, unique taste before reaching an underground reservoir. The aquifer is naturally protected from pollutants by a thick impervious layer of clay that acts as a barrier and prevents any contaminants from passing through it. Himalayan is bottled in Dhaula Kuan, Himachal Pradesh and available in 200ml, 500ml, 750ml, 1litre and 1.5litre bottles. Himalayan is the only natural mineral water in India to be awarded international certification by Institut De Fresenius, Germany — the world leader in the treatment of environment pollution and production technology of natural mineral water. It has granted Himalayan the highest grade for a water company. The product has also been certified as Genuine Natural Mineral Water, as per EU Regional Codex Standard. The Himalayan plant and product is also certified for ISO 9001-2008, OSHAS

18001-2007. The NSF International has certified the Product Quality, tested as per US FDA norms. Himalayan has also been approved by the US FDA.<sup>[7]</sup>

### Bailley

Bailley bottled drinking water, since 1993 has been the ideogram of purity under Parle Agro. It is extensively preferred as a source of safe drinking water. Bailley is packaged and manufactured in state-of-the-art bottling plants all over India. The motto is proving the customers full satisfaction and safe drinking water at ₹ 18 per litre. Parle Agro have always held the consumers in the highest regard, satisfying their refreshment needs at every level and the testimony of this commitment is Bailley, bottled drinking water. Launched in 1993, Bailley has been the symbol of purity for years now.



**Figure-9: Bailley and Kingfisher mineral water bottles and logos**

### Kingfisher

Kingfisher packaged drinking water is being manufactured under parameters as by BIS as well as that of United Breweries Ltd. It holds expertise in providing packaged drinking water, which is highly approved for its purity and safe to consume. It is available in 1litre packaged bottles which costs ₹ 20 per litre.

Kingfisher is one of the oldest and widely respected brands of India. The best in class Kingfisher's premium packaged drinking water is prepared by removing undesirable dissolved solids, suspended solids, biological

contaminants and gases from water. Kingfisher best on its purity uses reverse osmosis, ozonation and ultraviolet rays, a unique and rapid method of water purification which is an ideal solution for an ever growing range of water treatment applications. Kingfisher provides natural purity with the use of most innovative and advanced techniques which makes it the leading and one of the most trusted brands in India. It has ozonated water with UV treated and Reverse Osmosis (RO). Bottle comes with sealed package ensuring zero tampering and 100% quality and can be stored and consumed for 30days duration from the date of manufacture.



India's first nutrient water which was launched by NourishCo a joint venture between Tata Global Beverages Limited and PepsiCo has normal taste of water with the goodness of minerals and nutrients like Zinc and Copper. The brown label on the water bottle is the symbol of Indian tradition which insights that people used copper vessels to store water because of its health benefits. Tata Water Plus is available in 1litre bottle which prices ₹ 20. It is developed in collaboration with international scientists and Indian nutrition experts; Tata Water Plus represents the larger mission of NourishCo Beverages — to mitigate nutritional gaps in the average Indian consumer. NourishCo, the joint venture with PepsiCo India, seeks to deliver Healthy Beverages for a Healthier India and intends to enhance the hydration category in the country. An affordable *on-the-go* re-hydration solution, Tata Gluco Plus comes packed with great taste and instant energy. Tata Gluco Plus has been brought to the Indian market through NourishCo Beverages, the joint venture with PepsiCo India. NourishCo focuses on delivering Healthy Beverages for a Healthier India and intends to enhance the hydration category in the country.<sup>[8]</sup>



**Figure-10: TATA water plus and AAVA mineral water bottle with logo  
Tata Water Plus**

**Table-1: Comparison chart of Mineral water vs Purified water**

Contents	Mineral water	Purified water	Maximum permissible limit	Remarks
pH value	7.96	7.03	6.5-8.5	Neutral water-safe from causing stomach ulcers
TDS	305 ppm	85	500 ppm	A good proportion is needed to avoid intravascular and cardiac diseases
Calcium	20.8mg/litre	4.008mg/litre	75mg/litre	Good for bones, teeth and nervous system activity
Magnesium	7.6 mg/litre	1.46mg/litre	30mg/litre	Good tonic for brain and heart
Sodium	9.9mg/litre	NA	150mg/litre	In this safe proportion, it is good for heart and high blood pressure patient
Fluorides	<0.2mg/litre	NA	1mg/litre	Trace level good for gums and teeth
Chlorides	45.2mg/litre	26.9mg/litre	200mg/litre	Due to its low composition it is good for health if taken regularly
Nitrite	NA	Nil	0.02	Safe for babies and pregnant women

**Aava**

Aava is Natural Mineral Water originating from the holy hills of Taranga, a part of the world's oldest mountain range, the Aravallis. Every drop of Aava is naturally purified with great patience: Drop by drop, for 20 years Aava trickles down from the catchment area to our deep underground reservoirs. Along the way, it is purified as it passes through layers of alluvium and clay that act as natural filters. In a world where every alternate food item claims to be fortified, nothing about Aava is artificial. Nature has endowed Aava with a unique mineral composition that is beneficial to the health. Aava Natural Mineral Water Cup Cap originates from the holy hills of Taranga. This mineral water is packed in a hygiene quality-tested 1 liter PET bottle with an in-built cup, which makes it convenient to carry and use. Every bottle of Aava has the same natural purity and unaltered mineral composition. Every drop of Aava is naturally purified to give a taste that is relishing and thirst quenching.

**Benefits**

Some studies have shown that the healthiest kind of bottled water is mineral water and drinking this water each day can help to enhance overall health and well-being. Mineral water is able to do so much good because it contains essential minerals such as iron, calcium and magnesium. Even better, mineral water, unlike tap water, will be free of added chemicals as well as preservative-free and completely natural. Here we will discuss some of the benefits of mineral water.<sup>[9]</sup>

**1. Lose Weight:** Any type of water including mineral water contains no calories and is fat free. When trying to lose weight, many people forget to consider the calories found in the most popular drinks such as soda and juice and these calories can make it difficult to achieve weight loss or even maintain a goal weight. The Mayo Clinic actually reports that cutting out calories from the beverages can lead to greater weight loss than simply cutting calories from meals. When you opt for mineral water you will be able to stay at your target calorie intake while staying hydrated and feeling healthy.

**2. Improve Bone Health:** After menopause women suffer from a gradual bone loss but this can be controlled by simply having mineral water on a regular basis. A study in one of the popular scientific journals suggested that the calcium found in mineral water may be crucial to maintaining a normal bone density and therefore preventing the development of bone related illnesses such as osteoporosis.

**3. Lower Blood Pressure:** The magnesium found in mineral water can also play an important role in maintaining a normal blood pressure level. One study found that patients with hypertension who consumed one liter of bottled mineral water showed a decrease in blood pressure over time. The researchers propose that these patients had poor magnesium levels so consuming

mineral water rich in magnesium was able to lower their blood pressure.

**4. Lower LDL Cholesterol:** LDL cholesterol is the bad cholesterol and is one of the largest factors for developing heart problems. People who drink mineral water regularly will notice a large reduction in their risk of developing heart disease due to its ability to lower levels of LDL cholesterol. In addition, some of the minerals found in mineral water such as potassium and magnesium support heart function.

**5. Aid Digestion:** Mineral water is also a great source of sulphates which help promote digestion. That is because sulphates stimulate the pancreas so it releases enzymes such as amylases, proteases and lipases that help digest food properly. Low sulphate levels can cause poor digestive health or even bloating, constipation or diarrhoea.

**6. Maintain Muscle Performance:** Mineral water that is rich in magnesium may also help play a key role in the function of muscles. That is because magnesium is an essential mineral for our bodies as it allows muscles to relax and contract properly. That is why muscle aches and cramps are one of the signs of magnesium deficiency.

**7. Maintain Electrolyte Balance:** Electrolytes are salts (bicarbonate, chloride, potassium and sodium) which prevent dehydration by helping the cells of the body absorb water. Because mineral water can be a great source of electrolytes, those who experience an electrolyte imbalance are frequently asked to consume mineral water in order to replenish their electrolyte loss.

**8. Reduce Kidney Stone Risk:** Doctors recommend increasing the intake of fluids in order to help prevent kidney stones and the best choice is mineral water. Usually kidney problems take place because of calcium oxalate kidney stones but when you consume mineral water that has adequate amounts of calcium and magnesium it can help decrease the concentration of calcium oxalate. Studies have also shown that drinking mineral water can significantly reduce a person's risk of suffering uric acid kidney stones.

**9. Better Your Skin:** Mineral water can help better your skin because of its high quantities of silica which can strengthen the spongy cells that are found between elastin and collagen fibers as well as slow down wrinkle formation. Simply drinking mineral water will help your skin but you can also use it in your beauty regime. One great way is to cleanse your face, then wipe your face using a cotton ball soaked in mineral water and finish with your moisturizer. You can also put mineral water on your toner pad before adding the toner. If you use homemade beauty products or wet your makeup before using it, always opt for mineral water instead of tap

water. You can even gently spray your face with mineral water throughout the day or use it for hair spray.

**10. Other Benefits:** Mineral water can help breakdown waste materials in the body as well as cleanse it of toxins. Many of the mineral waters available have therapeutic effects that can ease or cure multiple chronic diseases and conditions. Mineral water can also help relieve the pains and aches associated with rheumatism and arthritis by reducing inflammation and swelling of the muscles and joints.

### Precautions

**1. Mind the Sodium Content:** Some of the brands of bottled mineral water will contain high quantities of sodium so in these cases, if you only use mineral water for your daily fluid intake you may be consuming excess amounts of salt. Drinking too much mineral water can also be detrimental to the health of people who suffer from high blood pressure. Because of this, you should either limit your intake of mineral water or opt for ones with low levels of sodium.

**2. Limit Mineral Water during Pregnancy:** When you are pregnant, you must drink water to ensure the body stays hydrated. When pregnant you should restrict your consumption of mineral water to only occasional use that is because bottled mineral water can contain high levels of salt which could raise your blood pressure or cause other health complications when pregnant.

**3. Consider Sparkling Mineral Water:** Sparkling mineral water is mineral water that has been carbonated but it can also be found in some springs naturally. Sparkling mineral water can be as good for the body as normal mineral water. Usually to make the sparkling variety, man-made processes will add carbon dioxide to the natural mineral water. This type of mineral water has the added benefit of helping destroy germs which are a source of various bacterial and viral infections.<sup>[10]</sup>

### CONCLUSION

The use of mineral water has increased exponentially through a couple of decades; however, we have no idea whether or not it is good for our health. Luckily, mineral water happens to be good for our body than tap water and so on. Here are seven health benefits of mineral water. Unlike tap water, mineral water is free of chemicals added for purification. They also contain magnesium, calcium and iron, the minerals essential for our body. Mineral water also helps in improving bone health in women. Calcium found in the mineral water helps improve bone health in women after menopause. One of the scientific researches has reported that having mineral water can help maintain bone density as well as prevent bone related defects like osteoporosis in women. Mineral water helps in keeping blood pressure under check. Magnesium found in mineral water helps in maintaining blood pressure as normal as possible. Studies have proved that when blood pressure patients

had a bottle of mineral water a day their blood pressure decreased over time. Mineral water is also a great source of sulfates which help promote digestion. That is because sulfates stimulate the pancreas so it releases enzymes such as amylases, proteases and lipases that help digest food properly. Low sulfate levels can cause poor digestive health or even bloating, constipation or diarrhea. Electrolytes like sodium, potassium, bicarbonate and chloride are necessary for cells in our body for various purposes. When we drink mineral water it helps in maintaining electrolyte levels in the body and prevents cells from dehydration. Potassium and magnesium in mineral water help in maintaining good heart health. People with heart-related problem can benefit to an extent from drinking mineral water which is a good source of the above minerals. Mineral water is also reported to lower LDL levels in the body, paving the way for heart help. Mineral water can help better your skin because of its high quantities of silica which can strengthen the spongy cells that are found between elastin and collagen fibers as well as slow down wrinkle formation. Simply drinking mineral water will help your skin but you can also use it in your beauty regime. Formation of kidney stones could be prevented by drinking mineral water since calcium and magnesium decrease the calcium oxalate levels in kidney, which is responsible for the kidney stone.

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