

## Efficiency of Solutions to Reduce Water Impurity and Pollutants

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### ABSTRACT

Water is considered as primary source of life. It is also the primary requirement of everyone in the world. 5,02,000 deaths are caused worldwide due to contaminated water. Several policies like National Lake Conservation Plan, National Water Mission, etc. and many technological processes have been implemented by the Government of India to reduce impurity levels in water. Pollutants are the substances which pollute water, we drink, air, we breathe, food, we eat, land, we live. 1.2 million deaths in India in last year are caused due to pollutants. Several pollution boards like Green Tribunal, Central Pollution Control Board have been formed and many technological processes have been implemented by Government of India. This paper explores, do the efficiency of these policies and technological processes are enough to reduce water impurity and pollutants? What policies have to be taken by the government to reduce these problems. As one of the largest populous countries in the world, these problems have a lot of impact on the growth and development of our country. By finding a better solutions and implementing them effectively can make our country's people to lead a better life.

### 1. Introduction

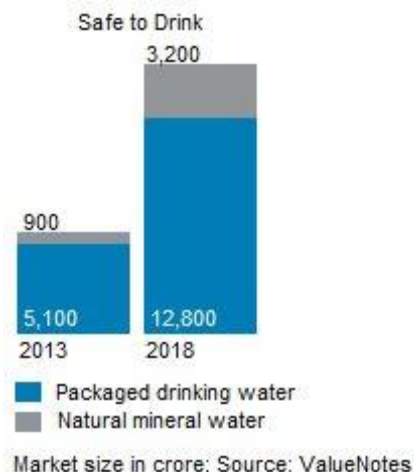
The growing distrust in purity of water has fuelled the packaged drinking water and water purifier businesses.

Unknown just three decades ago, 'mineral water' is today ubiquitous in India . Packaged drinking water is a `6,000-crore industry with brands like Bisleri, Kinley and Aquafina becoming household names. Even in the early 1990s, the per capita annual consumption of bottled water was a mere four to five litres. It has since risen to more than 20 litres. The industry is growing at a compound annual growth rate of 22 per cent and expected to touch `16,000 crore by 2018, according to market intelligence firm, ValueNotes.

"The public perception that bottled water is pure and safe, fuelled by intense advertising, led to the sales explosion," says ArunJethmalani, Managing Director, ValueNotes. "The increase in the number of tourists, both foreign and domestic, gave it a further fillip." The demand is all-weather, with seasons making only marginal difference. "There is a peak in summer no doubt, but sales are high during the monsoons, too, due to fear of diseases from unsafe water, as well as in winter because it is the festive season," says Ramesh Chauhan, Chairman, Bisleri International, the pioneer and still the lead player in this sector.

A 2013 study by ValueNotes shows that 35 per cent of packaged water consumption takes place in Western India, 30 per cent in the South, 25 per cent in the North and the remaining in the East. While the southern states have the maximum number of registered players – 3,300, or 48 per cent of the total – the big boys like Bisleri, PepsiCo, Coca-Cola and Parle Agro are all headquartered in Mumbai. The profusion of marginal players is not necessarily healthy. "Many of them have little concern for quality standards and procedures ," says Jethmalani. The bigger players are strengthening their

distribution networks to improve sales as well as innovating with the size of their bottles and jars. "We keep innovating with concepts like the 'Rocking Jar' which makes it is easier to carry five litres of water," says Chauhan.



Alongside bottled drinking water, water purifiers for home use are also spreading rapidly. ValueNotes estimated this segment at `3,400 crore in 2014, having grown at a CAGR of 20 per cent in the three previous years. It is expected to reach `91,900 crore by 2019. "With the water table falling, groundwater is being drawn from much deeper in the earth than before, thus carrying more impurities, the importance of water purifiers has increased," says Marzin R. Shroff, CEO, Eureka Forbes.

Marginal players are fewer in this segment than in bottled water, with 75 per cent of the market held by well-known brands like Eureka Forbes, Kent RO, Hindustan Unilever, Tata Chemicals and Ion Exchange. Water purifiers are broadly of

three kinds: those using reverse osmosis (RO), those employing ultraviolet radiation (UV) and those using a bed of sediment (offline). RO purifiers contribute the most – 39 per cent by value – to the market, being the most expensive.

Numerous innovations have been introduced, such as a combination of UV and RO technologies, which are available at prices of `17,000-18,000, while the average UV purifier costs less than `10,000. “Water purification needs in India vary widely according to regions,” says Shenoy of Dow India. “We are working with our partners to provide different cost effective solutions for different markets.

**Highways made out of plastic:** Plastic forms one of the toughest pollution challenges. India is producing around 60% of the total plastic waste in the world. Plastic is not biodegradable. Dr. Rajagopalan Vasudevan, Professor of Chemistry, Thiagarajar College of Engineering, Madurai, has invented a technique that uses excess plastic waste for road laying. In this process, plastic is added to stones used for building roads at around 170 degree Celsius. Around one tonne of plastic waste is utilised for covering one kilometre. It is a cheaper and stronger replacement for cement blocks. This has been used for building roads in over 11 Indian states.

As the country grapples with poor water management, polluted water bodies, shortage of drinking water and water-borne diseases, businesses and entrepreneurs are coming up with unique solutions to quench the thirst of the people. *Business Today* profiles a few promising initiatives that could prove to be game-changers.

## 2. PIRAMAL SARVAJAL

In a country where 125 million people do not have access to drinking water, Sarvajal's ATMs cater to 300,000 people every day at 30 paisa per litre of potable water. Since its launch in 2009, the company has installed over 180 water units across 13 states. “All one has to do is swipe the prepaid card and key in the amount required, and the machine dispenses the water. The Sarvajal server keeps a record of user transactions and deducts the amount used on the card,” says Vasu Padmanabhan, CEO, Piramal Sarvajal. The company has got into partnerships with local entrepreneurs, panchayats and community-based organisations to run the water treatment plants. “Local community members are selected and trained to manage the purification units. The projects are also monitored remotely on a daily basis to ensure production and purity, and understand the consumption pattern for remedial action,” he adds. The ATM units cost `5 lakh to `10 lakh, and the local partners can also earn up to `35,000 per month. The plant works on reverse osmosis and UV-based filtration technology.

## 3. WATERLIFE INDIA

Sudesh Menon, who was tipped to take over as the South East Asia head of GE, quit the company to later launch Waterlife India in partnership with two former colleagues – Mohan Ranbaore and Indranil Das – in 2009. So far, the Hyderabad-based company has installed over 4,000 water purification plants to quench the thirst of over 12 million people across 15 states. Waterlife focuses on community water systems in villages and urban slums, and works in

collaboration with governments, local bodies and corporate houses. Menon says that sustainability is key while providing high quality water over the long-term (five to 15 years), compared to systems that go defunct after the first year “due to poor maintenance or apathy”. A Waterlife team first visits the village to map its drinking water requirements, analyses the viability and tests sources of water for contamination. Based on the findings, a customised plant is built. It costs anything between `5 lakh and `25 lakh. Operators are hired to operate and maintain the plant after rigorous training. “We expect to maintain revenue growth of 30-40 per cent per annum over the next five years,” says Menon, adding that the World Bank's recognition of Waterlife as one of the pioneers in the provision of safe water in the bottom-of-the-pyramid market was a rewarding experience.

## 4. KENT RO

When Mahesh Gupta failed to get a quality water purifier for his children diagnosed with jaundice, he decided to make one himself. “Purifiers primarily work on the Ultra Violet principle, wherein the water passes through UV rays and the bacteria are killed in the process. For me, that was not enough because industrial activity has resulted in contaminated ground water, and impurities such as arsenic, rust, pesticides and fluorides,” says Gupta, Chairman, KENT RO Systems. After several trials, he zeroed in on the reverse osmosis (RO) technology and the first KENT purifier was launched in March 1999 from his garage in South Delhi. In the first year he sold around 100 units for `20,000 a piece, compared to the `5,000 price tag of other available water purifiers in the market. Gupta claims, KENT RO now enjoys 40 per cent share of the RO market and is looking at `1,000-crore turnover in 2016/17.

## 5. VISHVARAJ INFRASTRUCTURE

Nagpur was no different from the rest of India when it came to water mismanagement. “These inefficiencies clubbed with low tariff made the urban water distribution unsustainable,” says Arun Lakhani, Chairman, Vishvaraj Infrastructure. So, when Nagpur Municipal Corporation issued tenders for 24x7 water supply in the city and another project at Bhandewadi for water reuse, Lakhani bid for both projects. For the `550-crore 24x7 water supply project the company is supposed to provide continuous water supply to every household, improve the technical and commercial efficiency of the system, lay 2,100 km of pipelines, set up a water treatment facility and storage reservoirs, apart from providing 325,000 new house service connections. It is also responsible for metering, billing and collection of charges. “We carried out our hydraulic modelling of the city and, now, all households in Nagpur are getting at least three to four hours of daily water supply.”

According to the widely accepted estimates, there are 8.7 million species on Earth; with 6.5 million having chosen land and sky as their living space and 2.2 million with oceans as their home. We humans are only one of them. And yet, God knows by what logic, we have assumed the ownership of this planet. We have seized the ship, but apparently have no navigation charts.

The present age of our Earth is an estimated 4.6 billion years and our ancestors appeared here about six million years

ago. Our species established rather recently around 2,00,000 years back. What we call civilisation is barely a 6,000-year-old phenomenon and industrialisation does not even go as far back as a quarter of a millennium. Yet, the negative impact of man on Earth's environment has been far greater than that of any other form of life on this planet. A look at the world forest cover is enough to show how fast we are eating away our own lungs. From 5.9 billion hectares at the time of the pre-industrial era, the forest cover of the world is now down to less than four billion hectares.

On a global scale humans are probably the only species whose numbers have consistently increased in the last hundred years. Available data shows that from about three billion in 1960 we've exploded to 7.4 billion today. Humans are also perhaps the most widely distributed species on Earth. We're just about everywhere. But that does not mean we have the numbers and the weight to claim any supremacy on this planet. And just one statistic is enough to prove that. The combined weight of ants on Earth is equal to that of humans! And we know, on an average, a human weighs a million times more than an average ant.

In less than the last 200 years, we have chopped down forests for timber and fuel, ripped mountains for minerals and metals, driven wildlife into smaller and smaller areas; at times hunting and pushing them over the edge into extinction. We have turned grasslands into fields, dried wetlands, hampered the natural flow of rivers and overdrawn ground water. By burning fossil fuels, within a century we have released into our atmosphere an inestimable quantity of carbon dioxide that nature had stowed away into the Earth as coal, oil and gas for millions of years. We have certainly earned ourselves the dubious distinction of the only species on this Earth capable of wreaking disaster all around.

Marshall McLuhan had said, "There are no passengers on Spaceship Earth. We are all crew." The big question today is: "Are we running it or ruining it?"

### **It's time to be alarmed**

It is now clearer than ever before that we are fast heading towards the limits of the Earth's capacity to tolerate us. Not only the pressure of a galloping human population, but also that of our lifestyle, is certainly becoming too heavy a burden for this planet to bear. Just imagine this one figure, according to a World Wide Fund for Nature (WWF) estimate, globally we are flushing down the drain an equivalent of 2,70,000 trees as toilet and tissue paper every day, a product that none of our grandparents probably ever used!

Air pollution is a significant health risk factor, particularly in the urban areas. According to a 2014 WHO estimate, air pollution is responsible for some seven million premature deaths worldwide every year. India is already paying the price of a rapid development with high levels of air pollution. With 13 of the world's most polluted 20 cities here in our country we certainly have reason to be alarmed.

Global warming is no more an environmentalist's flight of fancy. It is a reality staring in our face with polar ice caps

melting faster than ever before. Sea levels have started rising more than their usual average. Rising sea levels coupled with encroachment of flood plains and the loss of traditional wetlands that worked as sponges to absorb excess water—it is a recipe for disastrous floods in coastal areas. A recent demonstration of which were the Chennai floods.

Extinction as a natural phenomenon occurs at a "background" rate of one to five species every year. The present estimates are that we are now losing species 1,000 to 10,000 times the background rate, which means virtually dozens every day. It is a scary future because species' extinction is a delicately linked chain reaction.

Earth has been through five waves of mass extinctions of plants and animals in the past half-billion years and they were all caused by natural phenomenon like asteroid strikes, volcanic eruptions, and natural climate shifts. The bad news is that the next one may be entirely a result of human activity. As it happens, behind 99 percent of currently threatened species the causes are loss of habitat, irresponsible introduction of species (getting species from other countries and introducing them in India) and global warming.

It is beyond any doubt now that the way we are going we won't reach far. We have already displayed our capacity to inflict irreversible damage on the life-sustaining resources and systems of nature. Air, water and soil, the three key components of the environment that support our climate, plants and all other forms of life, are critically stressed. Our present rate of disregard for the environment cannot be allowed to continue... not without drastically altering the world as we have known it.

Jared Diamond said in his best-selling book, Collapse, that Easter Island is the "clearest example of a society that destroyed itself by over exploiting its own resources." Diamond called this self-destructive behaviour "ecocide" and warned that Easter Island's fate could one day be our own.

**Diesel exhaust to ink:** A study conducted by World Health Organisation (WHO) has concluded that 14 of the 20 most air polluted cities in the world are in India. Graviky Labs, a Bengaluru-based company, has invented a device, which captures carbon emission before it is released from vehicles or generators. The device is fitted in tailpipes of vehicles or generators and conveniently converts the emission into ink. The invention has been named Air Ink.

**Nasal filters:** A team of former IIT students and their professors have invented a nasal filter that filters the air we breathe. Prateek Sharma, Tushar Vyas, and JatinKevlan along with their professors, ManjeetJassal and Ashwini K. Agrawal came up with this solution. Known as nasofilters, the filter is about two centimetres in size and can be placed within the nose and doesn't restrict breathing. The filters are for one time use and are economically priced. The innovation received the 'Startup National Award 2017'. The filters can be bought from the official website of the company and are priced at ₹98.2, for a pack of 10.

**Robot for water pollution:** Ro-Boat, a device invented by Omnipresent Robot Tech Pvt. Ltd., is designed to collect sludge and pollutants in rivers and water bodies. It floats through water and with the help of its robotic arms it can collect sludge and other pollutants. The device operates on solar energy, has a pan-tilt zoom camera and fog lights. The light allows the device to work underwater and in adverse weather conditions. It can submerge in water and pull out pollutants from the riverbed. It can segregate around 600 kgs of waste from water in a time span of 12 hours.

**Water filter for arsenic and iron contamination:** The groundwater in various districts of Assam, Arunachal Pradesh, and Nagaland is highly contaminated with arsenic. The high level of arsenic contamination is becoming a persistent problem for the Brahmaputra River. To deal with this, researchers Robin Kumar Dutta, S. Bordoloi, A.J. Bora, S. Nath, and SweetYGogoi invented a low cost technology to eliminate arsenic and iron from contaminated water sources. This can be done for less than one paisa per litre. More than 75 schools and various households in Assam have started using this technology for filtering water from various source

## 6. Conclusion

Does all this mean that man should stop all progress and development projects? The obvious answer is no. But at the same time it is also obvious that the present level of pressure on the environment has to reduce.

The pattern of consumption has to be rationalised. The population growth rate has to be checked, industrial and auto emissions have to be reduced and deforestation has to stop. Reforestation has to be adopted as a national policy and new plantations should be taken up on a long-term farming pattern to fulfil the timber requirement. Effluent treatment has to be made a priority to ensure that rivers stay clean and availability of safe drinking water increases.

The environment has a great capacity to heal itself. Rivers flush themselves clean every year during floods. They don't need 'cleaning'; we have to just stop polluting them. This simple fact seems to have eluded successive governments in India. Year after year thousands of crores of tax-payers' money has been spent on 'cleaning' the rivers while the process of polluting them with sewage, industrial discharge and religious activity has continued.

It is interesting to note that while the Ganga and Yamuna, the holiest of India's rivers, are among the most polluted in the world, the cleanest Indian river is the Chambal, traditionally termed as unholy and unclean. The Chambal is associated with stories of animal sacrifice in the past and its ancient name is said to be Chamarivati, implying a place where hides and leather were processed and dried. Its 900-km path runs across Madhya Pradesh, Rajasthan and Uttar Pradesh. This longest tributary of the Yamuna is mercifully a clean and safe sanctuary for crocodiles, gharials, Gangetic river dolphins, turtles and many species of birds.

A few of us may have noticed that, on its part, nature is always working full-time to maintain the cycle and balance.

Trees are constantly ingesting our carbon emissions and supplying oxygen for us to breathe. Birds are transporting seeds in their droppings to plant new fruit trees. Bees and other pollinators are constantly engaged in ensuring fertility of crops.

In fact, insects are the real unsung heroes of our environment. Take a small example of ants and other insects emerging from their sub-terrestrial homes before the onset of the rainy season. It is time for them to move to higher ground before the rain waters flood their homes. Those trillions of capillaries that they leave behind act as aqua channels to transport rain water to sub-soil levels and help recharge ground water. And that is not all. It also breaks the flow of water as it rushes over sieve-like earth riddled with holes, preventing soil erosion. In nature such incredible mechanisms are at work at every step and when we wipe a species off the face of Earth, we also lose on some incredible service that it is providing.

The environment is not somewhere out there. It is the very space we live in. And it is the resources of this space that support our life. Everything that we consume comes from our environment. The air we breathe, the water we drink, the food that we eat, the clothes that we wear, the house that we live in and the fuels that run our lives come from nowhere other than our Earth.

It is true that each one of us who is a part of the problem also has the potential to become a part of the solution. Let us consider ourselves fortunate that we are so many and small efforts at the individual level can add up to massive totals. Let each one of us start with looking at our consumption pattern. Before we buy anything new, can we just pause and ask ourselves in all honesty: "Do I really need that?" Every time you take your car out to go to the neighbourhood gym or the grocery store, can you consider walking or cycling as an option? Could you carry a bag from home to carry back things when you go shopping, rather than bringing things in new plastic bags only to be trashed the moment you reach home? Ask yourself while leaving the room: "Do empty rooms really need so many lights on?" Do you need more than one refrigerator in the house? Do you really need the air-conditioner or is it just a habit to keep it on? Soon you'll see that once you are on the path of environment consciousness a lot more wisdom may dawn on you!

While thinking of water scarcity I also wish that some innovator would bless this world with a water faucet for the washbasin that is foot-operated. So that we draw water only when we need it and do not waste 10 times the quantity while shaving, washing our face, or brushing our teeth.

Over the past few decades, as the juggernaut of development started trampling over all other concerns, a small section of society started making noises of concern. This new breed of thinkers, the 'environmentalists,' were termed 'friends of nature' by some and 'road-blocks of development' by others. Battle-lines were drawn. But with the industry, economy and a political class sympathetic to both of them on one side; and a bunch of rational minds that advocated a sustainable utilisation of resources and right to life for all forms of life that we share

this Earth with, on the other. It was an unequal match right from the beginning. But the latter are in no mood to give up.

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