

Future Sri Lanka – Water based economy

1. Miracle water

Water is ubiquitous! The deceptively simplest structure of water cannot fully encode its bizarre behavior. At any given moment water occurs in all three states, *liquid, solid, and gas*. Pressure can melt ice. Heat shrinks the water (not the other way). Water is a universal solvent or no pure water does exist in nature. The water forms directional H-bonds creating caged structures that partially decode its bulk properties on a molecular basis. Water plays a critical role in protein folding that requires body messenger services. If water does not behave in this way, life on Earth cannot exist! The astronauts who look for extra-terrestrial life indeed quest for water.

Basic water research into exceptional solvation, H bond directionality and dynamisms, anomalies in caged water molecules, or solutes water interactions will pave new insights in resolving scientific controversies, thus opening up new research in understanding perturbed behavior of water in confined environments, and also offer new directions in water sustainability, climate change issues, and plethora of industrial applications. For example, Stanford University researchers¹ have built a synchronous computer that operates using the unique physics of moving water droplets. Because of its universal nature, the water computer can theoretically perform any operation that a conventional electronic computer can crunch numbers, although at significantly slower rates.

2. Water Abundance

The clean water supply on the Earth is finite. The precious water resource is under stress by pollution. Do not take clean water for granted. Clean water is vital in all aspects of life. We count on clean water to divine our souls. The Water belongs to the entire world, from streams to oceans, creeks and waterfalls, rivers and lakes. The wetlands are filled with vegetation and the pure waters running from glaciers and deep waters—springs and groundwater often invisible. Water knows no political boundaries and, whether we like it or not, water crosses them freely. Water covers over 70% of the earth, however, only 2.5% is freshwater; By the year 2030, over 6 trillion cubic meters annually required for the thirst world, and about half of the world's population will be under water stress which often results in conflict among countries, communities, etc. over access to water resources.

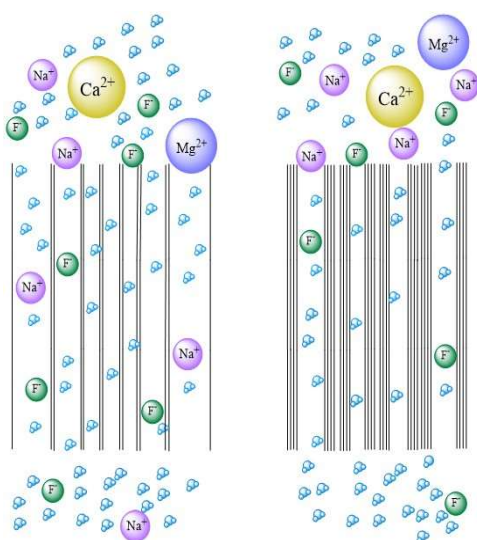
3. Water in Sri Lanka

Sri Lanka is not a water-scarce nation. Sri Lankan water has many facets. It ranges from boisterous waterfalls in the highlands to quiescent lowland rivers that meander into the sea, creating unique aquatic environments with enhanced biological activity. The mountainous and highland areas covered by the forest act as a sponge to capture rainwater and release it downstream. However, as in other parts of the world, water distribution in Sri Lanka is uneven, which results in water stress in the community. According to UN Norms, about 85% of the Sri Lankan population have access to safe water, and about 45% have access to piped water. About 3% have access to hand-pump tube wells, 37% of the rural population has access to safe drinking water through protected dug wells, and 1% uses rainwater harvesting systems. The remaining 15% of the population (~4 million) have no access to a safe water source within 200 m periphery to their residences. Most of the aquifers in the dry zone (Sri Lanka) are saline due to the intense weathering of silicate rocks which renders water unpalatable. Inappropriate treatment methods excessively desalinate water resulting in palatability issues due to solutes deficiency. The giant cool drink industries attempt replacing drinking water by their products. However, our lives autonomously quest for clean natural water! We envisioned to replace cool drink products by value adding the nations clean natural water. Our water flavor research direct towards this way!

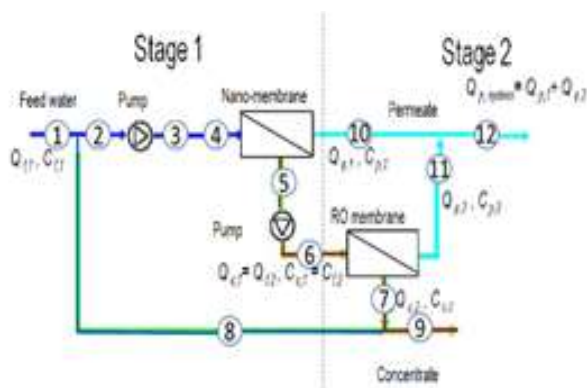
In compliance with “*Water for All by 2025, Govt. of Sri Lanka*” and the “*UNSDG 6: Clean Water and Sanitation*” aimed at developing a sustainable solution for drinking water problems that prevail in the dry zone (Sri Lanka).

4. Water desalination – a new paradigm

The essential basic research question we addressed to elucidate ion-pair/ solute pair formation in water when natural particulates are not present, and use this data to selectively remove excess solutes thus attaining pseudo-tunability of membranes since this technology offers a promise in water desalination when used no external chemicals (Figure B). Tunable membranes are required to sieve solutes in saline water for its enhanced palatability. However, such products are not available yet globally (Figure A). We drive research toward developing tunable membranes for water desalination using Sri Lanka graphite through the support from the National Research Council of Sri Lanka. In the meantime, we attained pseudo-tunability in membrane for water desalination by a unique reverse osmosis and nanomembrane topology network without adding external chemicals.



A. Proposed tunable graphite membranes



B. Pseudo-tunable membranes

Only the water used for consumption is treated. The wastewater generated during initial flushing were blended for other water requirements, e.g., recreation, washing, gardening and wash rooms. The method is robust that can withstand nearly 100% TDS fluctuations while delivering predefined treated water quality. To our knowledge this is the only method where we conceptualize using treated water for consumption while using water with appropriate quality for other needs. According to our method, over 95% of the feed water was utilized for community use in compliance with the UNESCO Water, Sanitation and Hygiene (WASH) program. The water purification plants are commonly used by the village community, where technical expertise is lacking among them. The routine maintenance and operation of the water treatment are achieved via a new controller fabricated using mobile phones. The operation of the water treatment plant occurs via a 4G signal transmit that can be added to the cloud system to ensure versatility. In the future, the database poses big data will optimize operation processing using the data mining algorithm. However, as in other parts of the world, water distribution in Sri Lanka is heterogeneous and uneven, which results in water stress in the community.

5. Last word

The behavior of water in the presence of other substances is largely unknown at molecular level. If so, can we de-pollute water using a treatment technology? Unfortunately, it is not possible. The best method to treat water is its protection.

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References

1. <http://www.nature.com/nphys/journal/vaop/ncurrent/full/nphys3341.html>