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Research Article

Hydro-Therapy of Sea Water for its Efficient Reusability

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Abstract

Today's water crisis is widespread, and continuing with current policies for managing water will only widen and deepen that crisis. Water quality may be the biggest emerging water problem in the industrial world, with traces of chemicals and pharmaceuticals not removed by conventional drinking water treatment processes now recognised as carcinogens and endocrine disrupters. During the 20th century the world population tripled, while water use for human purposes multiplied six fold. The most obvious uses of water for people are drinking, cooking, bathing, cleaning, etc. Worldwide, industry uses about twice as much water as households, mostly for cooling in the production of electricity. Far more water is needed to produce food and fibre and maintain the natural environment. An unacceptably large portion of the world population— one person in five—does not have access to safe and affordable drinking water, and half the world's people do not have access to sanitation. Each year at least 3–4 million people die of waterborne diseases, including more than 2 million children who die of diarrhoea, according to World Health Organization statistics (WHO 1996).

Keywords: *Graphene, Blue Water, Green Water, epoxy resin, groundwater, treatment*

1. Introduction

Rapidly declining surface and groundwater quality in almost all major urban centres in the developing world threatens human health and natural values. The world's wetlands were halved in the 20th century, causing a major loss of biodiversity. Users do not value water—and so waste it. There are too few investment funds and revenues to maintain water infrastructure and research and training systems. As a result the sector is conservative and stagnant, not dynamic with a stimulating flow of innovative thinking.

Unregulated access to groundwater, affordable small electric and diesel pumps, and subsidised electricity and diesel oil have led to over pumping of groundwater for irrigation and to rapidly falling groundwater tables in key aquifers.

In most countries water continues to be managed sector by sector by a highly fragmented set of institutions. And it is a major obstacle to integrated water resource management. A key characteristic of the world's freshwater resources is their uneven distribution in time and space. Almost, water resource management should be focused exclusively on redistributing water to when and where people want it for their use, this is a supply-side (engineering) approach. We need to look at what water is used for and to manage these competing claims in an integrated framework.

2. Total amount of water in world

Blue water or renewable water resources is the portion of rainfall that enters into streams and recharges groundwater,

- Blue or renewable, water -- 40,000 km3
- Withdrawals for irrigation -- 2,500 km3
- Withdrawals for industry -- 750 km3
- Withdrawals for municipalities -- 350 km3
- Withdrawals consumed -- 55%
- Drainage and wastewater, much of it polluted -- 45%

Green water or soil water is the portion of rainfall that is stored in the soil and then evaporates or is incorporated in plants and organisms.

- Green, or soil, water -60,000 km3
- Source for rain fed agriculture -- 60% of food production
- Primary source for terrestrial ecosystems

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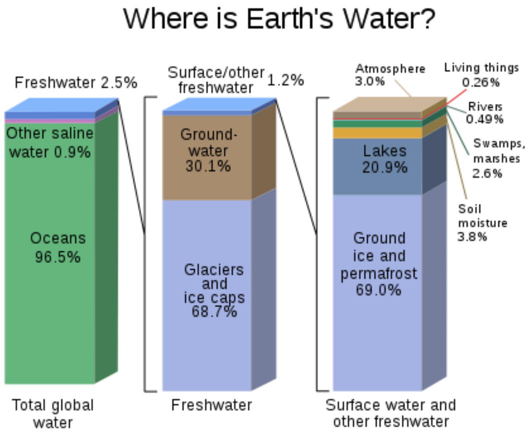


Fig.1 Distribution of Globally Available Water

Usable water resources represent the water that could be used if all economically and technically feasible storage and diversion structures were built. Usable water resources represent the upper limit to consumptive use even with future development.

The primary water supply is the amount of water that can be consumed given the current state of development of the water resource. It represents the first-time diversions of water. Water diverted to a use that is not consumed either flows to a sink or re-enters the river or human made flow network and is recycled. Total deliveries, often reported as withdrawals, comprise primary water plus recycled water. Total water deliveries depend on how much water is recycled.

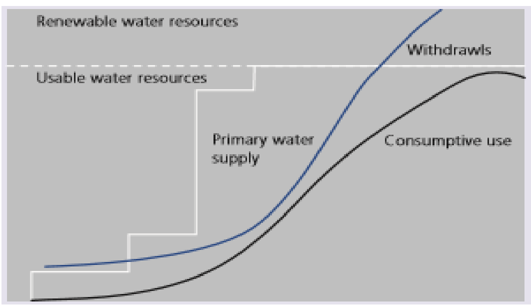


Fig.2 Passing the threshold of what's usable

3. Amount of fresh usable & unusable water in water bodies

Body of Water	Area (10^6 km^2)	Volume (10^6 km^3)	Mean Depth (m)
Atlantic Ocean	82.4	323.6	3,926
Pacific Ocean	165.2	707.6	4,282
Indian Ocean	73.4	291.0	3,963
All oceans and seas	361	1,370	3,796

- Globally, 20% of freshwater fish are vulnerable, endangered, or extinct
- The rich endemic ichthyofauna of Lake Victoria in Africa have been reduced by predatory Nile perch, overfishing, and eutrophication.
- The Thames River, polluted for centuries, is again habitable by fish.
- Groundwaters as deep as 2.8 kilometres may have rich bacterial flora.
- Of 30,000 rivers in Japan, only 2 are not dammed or modified.
- The Ganges and Bramaputra Rivers carry more than 3 billion tonnes of soil to the Bay of Bengal each year, spreading it over 3 million square kilometres of seabed.

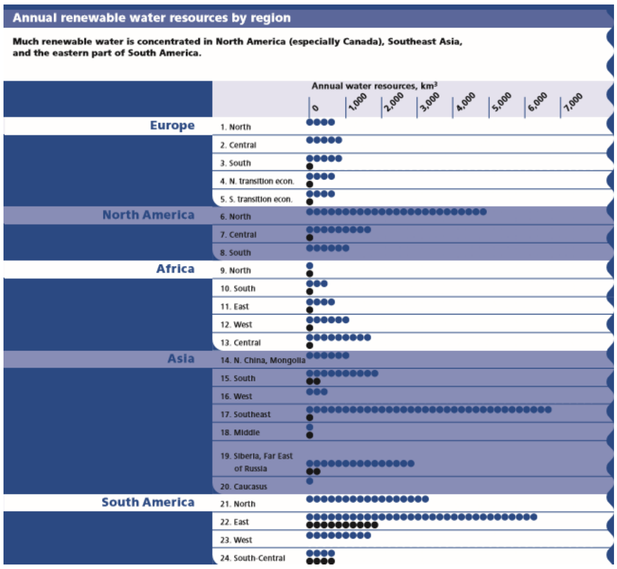


Fig.3 Annual Renewable Water Resources by Region

4. Amount of water consumption in world

An average American uses 100 to 175 gallons of water per day. Globally, we consume around 4 trillion cubic meters of fresh water a year! Agriculture alone consumes 75% to 90% of a region's available freshwater.

Although we are withdrawing only 10% of renewable water resources, and consuming only about 5%, there are still problems for human use. Water is unevenly distributed in space and in time—and we are degrading the quality of much more water than we withdraw and consume.

Cubic kilometres

Use	1900	1950	1995
Agriculture			
Withdrawal	500	1,100	2,500
Consumption	300	700	1,750
Industry			
Withdrawal	40	200	750
Consumption	5	20	80
Municipalities			
Withdrawal	20	90	350
Consumption	5	115	50
Reservoirs (evaporation)	0	10	200
Totals			
Withdrawal	600	1,400	3,800
Consumption	300	750	2,100

Fig.4 Global water use in 20th century

5. Amount of water used per person

Each person uses about 80-100 gallons of water per day. One may be surprised to know that the largest use of household water is to flush the toilet, and after that, to take showers and baths.

Bath	A full tub varies, of course, but 36 gallons is good average amount.
Shower	Old showers used to use up to 5 gallons of water per minute. Water-saving shower heads produce about 2 gallons per minute.
Teeth brushing	1 gallon. Newer bath faucets use about 1 gallon per minute, whereas older models use over 2 gallons.
Hands/face washing	1 gallon
Face / leg shaving	1 gallon
Dishwasher	6-16 gallons. Newer, Energy Star models use 6 gallons or less per wash cycle, whereas older dishwashers might use up to 16 gallons per cycle.
Dish washing by hand	About 8-27 gallons. This all depends on how efficient you are at hand-washing dishes. Newer kitchen faucets use about 1.5-2 gallons per minutes, whereas older faucets use more.
Clothes washer	25 gallons/load for newer washers. Older models might use about 40 gallons per load.
Toilet flush	3 gallons. Most all new toilets use 1.6 gallons per flush, but many older toilets used about 4 gallons.
Glasses of water you drank	8 small glass. Also, note that you will be using water for cooking.
Outdoor watering	2 gallons per min, depending on the force of outdoor faucet. This may not sound like too much but the large size of lawns & yards means outdoor water use can be a significant use of water.

6. How long fresh water will last???

Cheap and seemingly abundant, water is so common that it's hard to believe we could ever run out. All the water on Earth, only about 2.5% is fresh water, two-thirds of that is locked up in glaciers and ice caps. Less than one hundredth of one percent of Earth's water is fresh and renewed each year by the solar-powered hydrologic cycle. In the West, we're growing food and supplying water to our communities by over pumping groundwater. We are meeting some of today's food needs with tomorrow's water. As of 2005, a volume equivalent to two-thirds of the water in Lake Erie (USA) had been pumped out of this water reserve.

In answer to the climate crisis, the economy will need to move away from fossil fuels toward solar, wind, and other non-carbon energy sources. But there is no transitioning away from water. Water has no substitutes. And unlike oil and coal, water is much more than a commodity: It is the basis of life. A human being can only live for five to seven days without water. Deprive any plant or animal of water, and it dies. Our decisions about water—how to use, allocate, and manage it—are deeply ethical ones; they determine the survival of most of the planet's species, including our own. clean drinking Cater is still incredibly hard to come by in many parts of the world - the UN predicts that by 2025, 14 percent of the world's population will encounter water scarcity.

6.1 Shifting Course

In modern times, water management has focused on bringing water under human control. Since 1950, the number of large dams worldwide has climbed from 5000 to 45000. Today, many rivers flow like plumbing works, turned on & off like water from a faucet. Fish, mussels, river birds & other aquatic life no longer get the flows & habitats they need to survive: 40% of all fish species in North America are at risk of extinction. As we face the pressures of climate change & growing water demands, By some estimates the volume of water moved through river transfer schemes could more than double globally by 2020.

7. Water treatment processes

7.1 Surface and groundwater quality

The industrial revolution turned the Thames into a stinking, black health hazard as it ran through London in the late 19th century. Major investments in wastewater treatment and cleaner production have gradually restored its recreational and environmental value. Most large cities in newly industrialising and developing countries have rivers in the same condition as the Thames in the 19th century. They are a health hazard. They threaten downstream irrigation areas. And they destroy ecosystems. Because of inadequate management, water quality is deteriorating.

7.2 Dynamics of Water Withdrawal v/s Water Consumption

Withdrawals for irrigation are nearly 70% of the total withdrawn for human uses, those for industry 20%, and those for municipal use about 10%

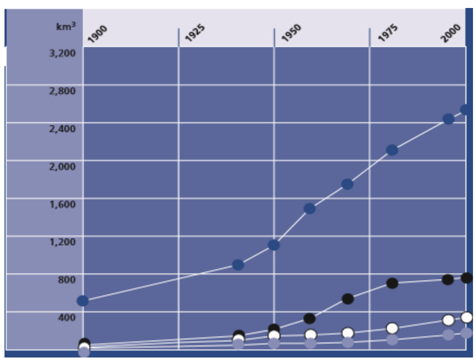


Fig.5 Water withdrawal from earth

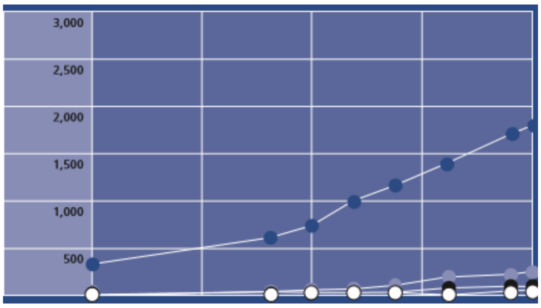
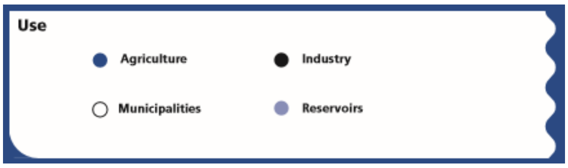


Fig.6 Water Consumption around World



Rapidly growing cities, burgeoning industries, and rapidly rising use of chemicals in agriculture have undermined the quality of many rivers, lakes, and aquifers.

Water treatment is any process that makes water more acceptable for a specific use. Water treatment removes contaminants & undesirable components. Substances that are removed during the process of drinking water treatment include suspended solids, bacteria, algae, viruses, fungi & minerals such as iron & manganese. The processes included removing physical processes such as settling & filtration, chemical processes such as disinfection & coagulation and biological processes such as slow sand filtration.

9. Results

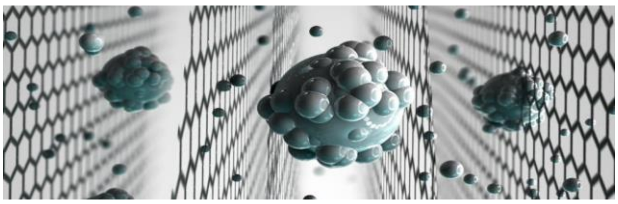


Fig.7 Graphene-oxide membrane that sieves salt right out of seawater

Water is largely used for agricultural purpose. Also considerably a very large amount of water is needed for electricity generation in hydro generated power plant, where the clean water is essentially required for the purpose.

Desalination today is a costlier process & involves large amount of electricity for the purpose. Realisation of scalable membranes with uniform pore size down to atomic scale is a significant step forward and will open new possibilities for improving the efficiency of desalination technology.

Although many teams have developed membranes that could sieve large particles out of water, but getting rid of salt requires even smaller sieves that scientists have struggled to create. The Manchester team (leaded by Mr. Rahul Nair) overcame this by building walls of epoxy resin on either side of the graphene oxide membrane, stopping it from swelling up in water. This allowed them to precisely control the pore size in the membrane, creating holes tiny enough to filter out all salts from seawater. Not only did this leave seawater fresh to drink, it also made the water molecules flow way faster through the membrane barrier. Graphene oxide is also a lot easier and cheaper to make in the lab than single-layers of graphene, which means the technology will be affordable and easy to produce.

Conclusion

A centralised system that provides low-cost water but is not accountable or responsive to users can lead to a vicious cycle in which systems deteriorate and require more than normal rehabilitation. Even though people use only a small fraction of renewable water resources globally, this fraction is much higher in many arid and semiarid river basins where water is scarce. In many temperate zone river basins, adequate water resources are relatively evenly distributed over the year, but they are used so intensively that surface and groundwater resources become polluted and good-quality water becomes scarce. There are already several desalination plants around the world using polymer based membranes to filter out salt, but the process is still largely inefficient & expensive.

Acknowledgement

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Our Institute has always focused on providing us a framework for better future for mankind. Also in shaping us to become effective, skilled professionals in coming future. We are very thankful to the Institute's Management & our Director Sir for his kindness, constant encouragement, influential leadership & for the valuable time which he devoted to us. Also, thanks to our family & friends who directly & indirectly helped, supported & motivated us along the due course of completion of this review paper.

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