RECLAIM FROM THE DRAIN – THE IMPORTANCE OF WATER REUSE

WITH AN EVER GROWING POPULATION AND ACCESS TO ONLY 2.5% OF THE WORLD'S FRESH WATER[1], ALTERNATIVE SOURCES MUST BE SOUGHT TO TACKLE SHORTAGES. GLOBAL INTEREST FOR USING RECLAIMED WATER AS A SAFE AND EFFECTIVE SOURCE TO MEET THE INCREASING WATER DEMAND CONTINUES TO EXPAND.

TYPES OF WATER REUSE

POTABLE REUSE
Further purified reclaimed water used to boost water supplies distributed for drinking and other household applications.

Potable reuse systems use advanced processes to remove contaminants from treated wastewater to ensure it meets drinking water quality standards and other appropriate reuse objectives.

NON-POTABLE REUSE
Treated wastewater for non-potable industrial and municipal uses such as landscape and agricultural irrigation.

Non-potable reuse systems generally have lower water quality requirements than potable systems, and the level of treatment varies depending on the end use.

BUT IS IT SAFE?

Stigma exists around reclaimed water, however, water can be purified to the necessary standards for various uses including industrial processes, irrigation, and even drinking water.[2]

RECLAIMED WATER – THE GLOBAL SITUATION

US
- In 2008, at least 36 US states had to address chronic water shortages[3]
- The California Direct Potable Reuse (DPR) Initiative was launched in 2012 to advance DPR as a water supply option in California and to date over $6 million has been allocated to fund 34 DPR research projects[6]
- The first direct potable reuse facilities in the US were opened in 2013 in Texas[4]
- More than 247 water reuse projects are now in various stages of planning[5]

CANADA
- In Canada, British Columbia was the first province to establish a comprehensive wastewater reclamation regulation in 1999, which was revised in 2012[4]

EUROPE
- ~1 billion m^3 of treated urban wastewater is reused annually[10], equivalent to 400,000 Olympic swimming pools
- Cyprus and Malta reuse more than 90% and about 60% of their wastewater, respectively[9]

MEXICO
- Approximately 160 m^3 of water per second was reused in 2009
- Mexico is the second leading country in the world in terms of untreated wastewater reuse for agriculture[7]

CHINA
- The demand for reclaimed water is still low with only 4% of 24.4 billion m^3 of discharged municipal wastewater reclaimed due to lack of public education and acceptance[10]
- In 2012, Beijing built the Qinghe Wastewater Treatment Plant, which has the capacity to serve water to 814,000 people for non-potable uses (e.g., road washing and toilet flushing)[10,11]
- The Wastewater Treatment Industry Report China 2013 stated that 217 new treatment plants were constructed in 2012 bringing the total number to 3,830[12]

JAPAN
- There are 1,718 wastewater treatment plants in Japan[14]
- 8% of the total reclaimed water in Japan is used for urban purposes such as toilet flushing, which uses 4.2 million gallons of reused water per day[14]

BRAZIL
- Brazil's Aquapolo Ambiental project was initiated in 2012 to reduce industrial potable water use in São Paulo and is the largest industrial water reuse project in the Southern Hemisphere[8]. This project will provide water for a petrochemical facility, thereby conserving enough drinking water to continuously supply a population of 300,000 people[8]

SINGAPORE
- Singapore has insufficient water to meet its demand and imports 30% of its annual supply of fresh water from Malaysia[13]
- Currently, Singapore's NEWater project efficiently recycles wastewater with four purification plants producing 430 million liters of NEWater a day. The initiative supplies approximately one third of the country's water, and that number is expected to grow to more than half by the year 2060[13]

HOW ARE AGILENT SOLUTIONS BEING USED FOR TESTING RECLAIMED WATER?

IN VITRO CELL ASSAYS
Exposure research using changes in cell metabolism to identify new chemicals in source water and new disinfection by-products with an effect on biochemical and biological systems.

GC/Q-TOF LC/Q-TOF


High Resolution Accurate Mass Mass Spectrometry used to identify emerging chemicals not currently included in EPA DW target lists; to detect and verify chemical toxicants found through the in vitro cell and expression assays; to identify new transformation and disinfection by-products produced through the purification process, and in final water polishing for microbial removal through chloramination or ozonation treatments.

IN VITRO GENE ASSAYS

Research using in vitro gene expression assays to further characterize chemical effects on intracellular processes. Gene arrays are used as rapid screening tools for influent and effluent water quality from DPR treatment facilities.

GC/MSD SYSTEMS

Gas chromatography with single or triple quadrupole mass spectrometer systems for the analysis of residual volatile and semi-volatile organic contaminants. GC/MSD also used for characterization of disinfection by-product content.

LC/MSD SYSTEMS

Liquid chromatography with single or triple quadrupole mass spectrometer systems used for the analysis of residual polar organics. Characterization of PPCP, antibiotics, and hormone loads in feed waters, plus measurement of removal efficiency. LC-QQQ detection systems coupled to IC used for the determination of disinfection by-products including haloacetic acids and other low molecular weight organic acids.

ICP-MS SYSTEMS

ICP-MS systems used to characterize metal content in finished water. Hyphenation of ICP-MS to GC and LC to characterize inorganic disinfection by-product formation, e.g. bromate, chlorate, fluorate.

1. US Geological Survey; 2. WHO; 3. Municipal World; 4. Water Online; 5. Bluefield Research; 6. WateReuse California; 7. LGA Consulting; 8. Ecomagination; 9. European Commission; 10. International Water Association; 11. United States Environmental Protection Agency; 12. Environmental Performance Index; 13. Deutsche Welle; 14. Decentralized Water Resources Collaborative

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