Water sustainability: a spectrum of innovative technology and remediation methods

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The Daegu–Gyeongbuk region in Korea suffered from water contamination during the modern industrialization period (1960–1990s) of Korean history. This was the result of large industrial complexes having been built along the Nakdong River, which today is the main water source of approximately 10 million people living in the southeastern part of the Korean Peninsula. Local and central governments have undertaken many measures to develop sustainable supplies of clean, safe water while developing appropriate and/or innovative water technologies. Currently, the Korean government is constructing a National Water Industry Cluster (NWIC) center in Daegu to share lessons learned from Korea's many long difficulties in water development and to aid in resolving water issues and crises. The NWIC is addressing these concerns not only for Korea but also for

developing countries and other corners of the globe in need. Under these circumstances, the International Water Industry Conference (IWIC) was launched in 2015 following the 7th World Water Forum in Korea. It has been held annually in Daegu and satellite cities of Korea since its inception. The 3rd IWIC in 2017 was a successful forum for water professionals, scholars, researchers, engineers, and policymakers to meet and discuss intelligent solutions in water sustainability for current and future generations.

More specifically, the theme of the 3rd IWIC covered the following six topics: (1) innovative technologies for the water industry including the water-energy nexus, energy-saving technologies, and nutrient and hazardous substance control; (2) laboratory and field case studies and troubleshooting in water and wastewater management; (3) appropriate water and wastewater technologies for developing countries; (4) green technologies for sustainable water and wastewater management with a focus on renewable and valuable resources recovery and utilization as well as the transformation of wastewater and waste to energy; (5) water resources management and quality; and (6) policy and economic assessment in the water industry. Research articles included in this thematic issue addressed many interesting aspects of the aforementioned topics. New materials for capacitive deionization, arsenic and nitrogen removal, and electrochemical oxidation were demonstrated. Hybrid membrane processes combined with photocatalysis or anaerobic biological treatments were introduced including novel attempts to reduce membrane fouling as well as enhance treatment performance. Recent trends in de-ammonification technology were presented with an in-depth discussion of various topics, including bio-carrier development, anammox bacteria enrichment, etc. Water resource diversification, including rainwater harvesting and water reuse, was discussed and the monitoring of emerging contaminants and improvement of monitoring tools were also presented.

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Appropriate technologies were revisited as viable options for developing countries.

The water industry is among the most important and critical sectors in the world industrial market, so much so that it is considered “blue gold” in contrast to the “black gold” of oil. The world water industrial market is expected to reach nearly US\$800 billion during 2018. Water is also connected to industrial sectors, such as agriculture, energy, chemicals, etc. Thus, water sustainability is a key criterion of many social and economic activities as well as the infrastructure of communities. The rate of world water consumption is growing faster than that of the population. China is one of the most rapidly growing countries in terms of world water demand. Some countries have a strong dependence on neighboring countries for water sources, such as Singapore and some European countries. In addition, populations between countries, regions, or local areas have issues and conflicts regarding the management of water quality and quantity.

Korea also lacks water availability based on the estimation of renewable internal freshwater resources per capita as of 2013 (approximately 2000 m³ per capita per year). These trends have accelerated the growth of the water industry; stimulated technological innovations in water and wastewater infrastructure, equipment, and services including operation and maintenance; and encouraged increased interaction among water professionals. It is believed, therefore, that this thematic issue provides new insights to the water industry, which is recognized as an important topic of the global agenda now and in the future.

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