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Monitoring and modeling pathogens in recreational waters

Rapid urbanisation has increased the pressure to meet the water demands of an expanding population for whom drinking water, drainage, waste water and sanitation services have to be provided. However, greater economic growth generally also increases contamination of water resources and impairs water quality. As a result, many waterborne or water-related infectious illness have been reported worldwide. Current water quality monitoring schemes are based on the detection of fecal indicator bacteria (i.e. *E. coli* and *Enterococcus*) but this has been questioned due to the lack of correlation with several pathogens especially in tropical areas. In Singapore, approximately two-thirds of the land surface is used as water catchment: rainwater is collected through a comprehensive network of drains, canals, rivers and stormwater collection ponds before it is channeled to 17 reservoirs for storage. Field data was collected over a period of 5 years from different reservoirs and catchments in Singapore to study the occurrence and distribution of pathogens and microbial indicators. A total of 25 targets were tested, including fecal indicator bacteria, *coliphages* (somatic and male specific *coliphages, FRNA G1-G4*), human specific markers (*Bacteroides thetaiotaomicron, Methanobrevibacter smithii*, *human polyomavirus*), bacterial pathogens (Salmonella spp., Pseudomonas aeruginosa), enteric viruses (*Adenovirus, Norovirus G1 & G2, Rotavirus, Astrovirus, Enterovirus, Hepatitis A virus, Hepatitis E virus, Aichi virus, Sapovirus, Influenza A virus*), parasitic pathogens (*Naegleria fowleri, Microsporidia*) and a plant virus (*Pepper mild mottle virus*). Predictive models for the occurrence of pathogens have been developed through several mathematical approaches, including machine learning (e.g. Bayesian network and decision tree). Quantitative microbial risk assessment (QMRA) offers a framework to assess the possible health risk brought by each pathogen. Through the integration of QMRA with a suitable predictive model for the occurrence of pathogens, a better evaluation of human health risks associated with the usage of surface waters can be made.

Biography

Karina Gin Yew-Hoong is an Associate Professor with the Department of Civil and Environmental Engineering, National University of Singapore (NUS). She has received her Bachelor's degree in Civil Engineering from the University of Melbourne in 1988 and Doctor of Science (ScD) jointly from the Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution in 1996. Her research specialisation is in the area of water quality and ecosystem processes. She has been a Principle Investigator of research projects totalling more than $16 m and is a Dean's Chair at the Faculty of Engineering, NUS. Her research and professional experience includes member of WHO Expert Working Group on Antimicrobial Resistance and Water Safety and Hygiene and Chairman of National Committee of Future Earth (formerly known as International Geosphere-Biosphere Programme (IGBP)).

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