

# DEPARTMENT OF CIVIL ENGINEERING

#### SEMINAR

# Navigating Emerging Contaminants: Key monitoring in aquatic systems and their removal strategies

Professor C.T. Aravindakumar School of Environmental Sciences, Mahatma Gandhi University, India

Date:April 1, 2025 (Tuesday)Time:3:00 p.m. to 4:30 p.m.Venue:Room 612B, 6/F Haking Wong Building, The University of Hong Kong

## Abstract

Water pollution is a global issue. One of the causes of this pollution is chemical pollutants in water being both inorganic and organic in nature. Synthetic organic compounds, including pesticides, personal care products, pharmaceuticals, and surfactants, are major contributors. Emerging contaminants (ECs) like pharmaceuticals, endocrine disruptors, and industrial additives are also a growing concern due to their environmental and health impacts. These compounds are often found in water bodies at concentrations ranging from ngL<sup>-1</sup> to mgL<sup>-1</sup>, detected using mass spectrometry. Pharmaceuticals, especially antibiotics, are commonly detected, with over 25,000 tons produced annually. Antibiotics are poorly metabolized by humans, leading to high excretion rates, and their persistence in the aquatic environment can cause antibiotic-resistant pathogens and disrupt ecosystems. The non-target analysis using mass spectrometry is an ideal technique to monitor these chemicals in aquatic system. Demonstration of the determination of contaminants from both polar and equatorial water bodies will be presented.

Removing organic contaminants from water is challenging. Traditional water treatment methods like adsorption, flocculation, and filtration are inefficient for many organic pollutants, and biological treatment is often ineffective due to the toxic nature of chemicals. Chlorination can generate more toxic by-products, making it unsuitable for wastewater containing organics. Recent research has focused on Advanced Oxidation Processes (AOPs), which use hydroxyl radicals (•OH) for the complete degradation of organic contaminants. AOPs, such as UV-H2O2, ozonolysis, Fenton, and photocatalysis, have shown promise in mineralizing organic pollutants into CO2 and water. In addition, membrane based treatment technique is yet another procedure. In the presentation, the use of AOPs and multilayer membrane in the removal of various CECs such as pharmaceuticals and personal care products (PPCPs) will be discussed. AOPs are praised for effectively removing CECs from wastewater, particularly in industries like petrochemical, pharmaceutical, and textile. While some AOPs are commercially available for industrial use, challenges such as commercial viability and practical application remain. However, recent innovations offer hope for future developments.

#### <u>References</u>

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### About the Speaker

Dr. C.T. Aravindakumar is currently holding the position of Vice-Chancellor of Mahatma Gandhi University, Kottayam, India. He is a Senior Professor at the School of Environmental Sciences at Mahatma Gandhi University. He also holds honorary positions as the Director of the Inter University Instrumentation Centre, Coordinator of the National Centre, SAIF-DST, and the Director of the International Centre for Polar Studies.

Prof. Aravindakumar is an Environmental Chemist. He received his MSc in Chemistry from the University of Pune and obtained his PhD from the University of Pune in an interdisciplinary topic on DNA radiation damage under an exchange programme with the Max Planck Institute for Radiation Chemistry, Germany, under the ICSC-World Laboratory Fellowship. He conducted post-doctoral research at the Catholic University of Leuven, Belgium (in Biochemistry), the Max Planck Institute, Germany (in Free Radical Chemistry), and the Free University of Amsterdam, the Netherlands (in Biophysics). He has also been a visiting faculty member/visiting professor at several reputed universities and research organisations in nearly 16 countries across Europe, the USA, Australia and Asia. His recent research interests include oxidation technology for water purification, polar environmental research, monitoring of emerging contaminants in water bodies, membrane technology for water purification, air pollution, and proteinpollutant interaction. He has over 400 publications in international journals, conference proceedings, conference presentations, book chapters, reviews and editorials. Thirty students have obtained their PhDs under his guidance. He was the team leader of India's Arctic Expedition in July 2017. He was selected for the LEAP programme of MHRD in 2019 and received an ERASMUS fellowship from the European Union in 2019. He was a Fulbright Fellow from United States-India Educational Foundation (2023). Presently, he is serving as an expert member of many national and international bodies related to environmental research.

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