

# Advanced Biological Processes for Nitrogen Removal from Aqueous Systems

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## Overview

The global nitrogen cycle (N-cycle) has been studied with great interest because nitrogen is the most essential and very important mineral nutrient for plants and microorganisms. Nitrogen is the fourth most common element found in cells and includes the microbially catalysed processes of nitrogen fixation, ammonium oxidation, assimilatory and dissimilatory nitrate reduction, ammonification and ammonium assimilation. For several decades, anthropogenic processes have substantially altered the N-cycle by increasing availability and mobility of nitrogenous compounds in the environment including water systems. Moreover, the wastewater discharges containing excessive nitrogen can be toxic to aquatic life, deplete dissolved oxygen (DO) levels, cause eutrophication in receiving water bodies and affect the suitability of wastewater for reuse and recycle. Therefore, more stringent nutrient discharge standard has been implemented. Conventionally, the biological nitrogen removal has been carried out in two-step aerobic-anoxic process, i.e., nitrification and denitrification, respectively, all over the globe for treating municipal and industrial wastewaters. However, this process is used for treating wastewaters with relatively low total nitrogen (TN) concentration. Whereas, a variety of wastewaters such as anaerobic digester effluents, landfill-leachate, industrial wastewaters and agricultural surface runoffs contain high concentrations of nitrogen. The various advanced biological reactor systems developed based on anaerobic ammonium oxidation (Anammox) and short-cut nitrification-denitrification have been successful in the removal of high nitrogen concentration from the influent. However, proper understanding of the mechanism of various biological nitrogen removal methods and their reactor design could alleviate the issue of nitrogen contamination in the environment.

This course is aimed to address the detailed methodology to be followed for successfully establishing the advanced biological nitrogen removal processes in different reactor configurations and their scale-up for practical application. As a first-step, the mechanism and microbiology of various biological nitrogen removal methods, and their merits and demerits will be introduced. Subsequently, the development of suitable biological nitrogen removal process based on influent characteristics, reactor requirements and reactor design approaches will be discussed. Finally, the successful field-scale reactors developed (i.e., case studies) for nitrogen removal around the globe based on various advanced biological reactor systems will be discussed.

<b>Course Information</b>	<b>Dates – 8<sup>th</sup> to 13<sup>th</sup> May, 2023</b> <b>Advanced Biological Processes for Nitrogen Removal from Aqueous Systems</b>
<b>You Should Attend If...</b>	<ul style="list-style-type: none"><li>▪ you are an environmental/chemical engineer or research scientist interested in understanding the conceptual design of biological systems especially for biosystems for nitrogen removal from different wastewaters.</li><li>▪ you are an engineer interested in learning the different ways for recovery of nitrogen from wastewater and develop (bio)energy systems in wastewater treatment.</li><li>▪ you are a student or faculty member of an academic institution and are interested in learning how to pursue fundamental research on biological nutrient removal from wastewater.</li></ul> <b>Number of participants for the course will be limited to fifty.</b>
<b>Fees</b>	The participation fee for taking the course is as follows:

	<p><b>Participants from abroad</b> : US \$ 500  <b>Students</b> : INR 1000  <b>Faculty</b> : INR 2500  <b>Industry / Research Organizations</b> : INR 10000  <b>Government Organizations</b> : INR 5000</p> <p>The above fee includes all instructional materials including lecture notes, tutorials and assignments.</p> <p><b>Modes of payment:</b>  Online transfer: Click here to pay: <a href="https://elearn.nptel.ac.in/gian/">https://elearn.nptel.ac.in/gian/</a></p>
<b>Accommodation</b>	<p>The participants may be provided with hostel accommodation, depending on availability, on payment basis. Request for hostel accommodation may be submitted through the link: <a href="http://hosteldine.iitm.ac.in/iitmhostel/">http://hosteldine.iitm.ac.in/iitmhostel/</a></p>
<b>Registration Procedure</b>	<p>Please follow the following steps for the registration:</p> <ol style="list-style-type: none"> <li>1. Go to GIAN website (<a href="http://www.gian.iitkgp.ac.in/GREGN/index">http://www.gian.iitkgp.ac.in/GREGN/index</a>) First time users need to register and pay a one-time fee of INR 500 /</li> <li>2. Enroll for the course: <b>Advanced Biological Processes for Nitrogen Removal from Aqueous Systems</b>. Once you enrol for the course, an Enrolment/Application number will be generated, and the course coordinators will be notified.</li> </ol>

## The Faculty



Prof. Jih-Gaw Lin is an Emeritus Professor in the Institute of Environmental Engineering, National Chiao Tung University (NCTU), Taiwan (renamed as “National Yang Ming Chiao Tung University (NYCU)” in 2021). His research interest includes anaerobic secondary treatment, nitrate/nitrite-dependent anaerobic methane oxidation (NdAMO), biological nitrogen removal technologies including ANAMMOX, heavy metal removal by anaerobic or aerobic bioleaching, etc. Prof. J-G. Lin has more than three-decades of teaching, research and consulting experience in Taiwan, China and overseas, and holds 12 patents (domestic as well as overseas) in his research area including ANAMMOX.



Dr. S. Mathava Kumar is an Associate Professor in the Department of Civil Engineering, IIT Madras. Dr. Mathava Kumar's research interest includes water and wastewater treatment using membrane reactors, emerging pollutants removal by advanced oxidation processes, trace organics and nutrients removal for reuse and materials from solid waste.

## Course Co-ordinator

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