 

MARMARA UNIVERSITY FACULTY OF ENGINEERING

ENVIRONMENTAL ENGINEERING DEPARTMENT

ENVE 4197/4198 ENGINEERING PROJECT PROPOSAL FORM (FALL 2024-2025)

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| **Instructor :** Prof. Bilge Alpaslan Kocamemi  **Project Title:** Direct Ammonia Oxidation (Dirammox) Process  **Number of Students : 3** | | | |
| **Scope of the Project :**  The recently discovered Dirammox process, also known as direct ammonia oxidation, oxidizes ammonia to dinitrogen gas (N₂) via hydroxylamine under aerobic conditions. The Dirammox pathway is driven by an enzyme encoded by the dnfT1RT2ABCD gene cluster, which is widely distributed and conserved across various microorganisms, including *Alcaligenes ammonioxydans*, found in diverse natural and anthropogenic environments. The Dirammox process offers significant advantages in terms of energy consumption and carbon emissions. While it requires additional aeration, it consumes less oxygen compared to nitrification.  This study aims to enrich Dirammox species in a lab-scale reactor. Enrichment studies will commence in a lab-scale sequencing batch reactor using seed sludge obtained from diverse natural and anthropogenic environments.  The study will be conducted in a sequencing batch reactor system equipped with dissolved oxygen (DO), pH, and temperature monitoring probes. The reactor will be fed with ammonia, and process efficiency will be monitored through daily measurements of influent and effluent ammonium (NH₄⁺-N), nitrite (NO₂⁻-N), and nitrate (NO₃⁻-N). Enrichment will be evaluated using quantitative real-time polymerase chain reaction (qPCR) measurements. Additionally, Dirammox process kinetics will be examined through batch kinetic experiments. | | | |
| **Hardware/Software/Lab/Equipment Requirements:**   * **Plexiglass reactor ( 2L )** * DO, pH probes, temperature transmitter (Hach, Multi parameter) * Peristaltic pumps (Prodoz PRS-7) * Pressure Transducer (Endress Hauser) * Magnetic stirrer (Heidolph MR Hei standart) * Air pump (Risheng RS-200) * Timers (Timer, Ledx) * Dual injection (cation and anion) ion chromotograph (Schimadzu SIL-10AP) * Thermoreactor | | | |
| **Development Plan:**  The thesis will be managed according to the work schedule below. At the end of this thesis, it is expected to have experience in literature searching, laboratory experiments, and data analysis. time management, thesis writing, presentation, and teamwork.  **Work - Time Table** | | | |
|  | **Work** | **Time period (month)** |  |
|  | Literature search, Training for SBR operation | 2 |  |
|  | Daily measurements, Batch kinetic experiments, Data Analysis | 2-8 |  |
|  | Thesis writing | 8-12 |  |