



**MARMARA UNIVERSITY
FACULTY OF ENGINEERING
ENVIRONMENTAL ENGINEERING DEPARTMENT**

**ENVE 4197/4198 ENGINEERING PROJECT
PROPOSAL FORM
FALL 2020-2021**

Instructor: Prof. Dr. Barış ÇALLI, Özlem KAPLAN (PhD Student)

Project Title: ENHANCED BIOMETHANE RECOVERY FROM WASTE ACTIVATED SLUDGE

Proposal No.: *BarişÇalli-1*

Number of Students: Max 4 students

Requirements (from students): Application to TÜBİTAK 2209a Program

Scope of the Project: The aim of this project is to develop a vacuum assisted low-temperature sludge treatment process to increase the amount of biomethane produced from waste activated sludge by anaerobic digestion. The low-temperature vacuum process will be applied in a chamber on the internal recycling line of anaerobic sludge digester (AD) to remove the dissolved CO₂, H₂S and NH₃ gases from the digestate. After vacuum application, the digestate free of dissolved gases will be recycled back to AD and there it will re-absorb CO₂, H₂S and NH₃ from the headspace. In this way, a biogas with a higher methane content will be produced. In addition to methane enrichment, it is supposed that vacuum application will to some extent disintegrate the WAS and thus will increase the methane yield and daily biomethane production. In this project, different vacuum-assisted digestate treatment parameters such as vacuum level, temperature, recycling flowrate, pH adjustment, hydraulic retention time, liquid depth and liquid surface area in the vacuum chamber and etc. will be tested to find the optimum conditions for gas separation and bacterial cell disintegration.

Hardware/Software/Lab/Equipment Requirements: Spectrometer, Magnetic stirrer, Incubator, pH meter, Vacuum Pump, Manometer, HPLC (UV detector), GC-FID, GC-TCD.

Development Plan:

- 1) Installation and starting-up of two bench-scale ADs
- 2) Operation of ADs by feeding with WAS to obtain digestate (effluent)
- 3) Optimization of vacuum-assisted digestate treatment parameters
- 4) Evaluation of the effectiveness of disintegration with BMP tests