



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

**ENVE 4197/4198 ENGINEERING PROJECT
PROPOSAL FORM
FALL 2026-2027**

Instructor : Assoc.Prof. Esra ERKEN

Project Title : Phosphorus Removal from Water Using Green-Synthesized Iron Nanoparticles

Proposal No. : 1

Number of Students : (Max 3 students)

Requirements (from students) :

Interest in environmental nanotechnology, water/wastewater treatment, and laboratory experimentation.

Scope of the Project :

This project investigates phosphorus removal from aqueous solutions using green-synthesized iron nanoparticles (FeNPs). Iron nanoparticles will be synthesized using a plant-based reducing agent as an environmentally friendly alternative to conventional chemical synthesis. The study will evaluate the phosphate removal performance of the synthesized material under different operating conditions. Batch experiments will be conducted to investigate the effects of parameters such as initial phosphorus concentration, nanoparticle dosage, pH, and contact time. Phosphorus concentrations before and after treatment will be measured spectrophotometrically. The project aims to assess the feasibility of green-synthesized iron nanoparticles as a sustainable and effective material for phosphorus removal and to identify the operating conditions that provide the highest removal efficiency.

Hardware/Software/Lab/Equipment Requirements :

Synthesis and experimental setup
Magnetic stirrer with stir bars
Orbital shaker
Centrifuge and/or filtration equipment
Analytical balance
pH meter
Drying oven, if required

Analytical tools
UV-Vis spectrophotometer for phosphate analysis

Glassware (volumetric flasks, beakers, Erlenmeyer flasks, cuvettes, pipettes, etc.)

Chemicals and materials

Iron precursor (e.g., FeCl_3 or FeSO_4)

Plant-derived reducing/stabilizing extract for green synthesis

Phosphate stock solution (e.g., KH_2PO_4)

Reagents required for colorimetric phosphate analysis

HCl and NaOH for pH adjustment

Distilled or deionized water

Software

Excel

Development Plan :

Literature Review

Review phosphorus pollution, phosphorus removal technologies, iron-based adsorbents, and green synthesis of iron nanoparticles.

Identify the major parameters affecting phosphate removal and nanoparticle performance.

Green Synthesis of Iron Nanoparticles

Select and prepare a suitable plant extract.

Synthesize iron nanoparticles using an iron precursor and the selected green reducing agent.

Record synthesis conditions such as precursor concentration, extract-to-iron ratio, pH, temperature, and reaction time.

Phosphate Analysis and Calibration

Prepare phosphate standard solutions covering the experimental concentration range.

Establish a UV-Vis calibration curve using an appropriate colorimetric phosphate method.

Determine the working wavelength and verify analytical repeatability.

Preliminary Experiments

Prepare synthetic phosphate-containing water.

Conduct blank/control experiments to distinguish phosphorus removal by the nanoparticles from other losses.

Establish suitable experimental ranges for nanoparticle dosage, pH, initial phosphorus concentration, and contact time.

Batch Phosphorus Removal Experiments

Investigate the effects of:

Initial phosphorus concentration

Green-synthesized iron nanoparticle dosage

pH

Contact time

Measure residual phosphorus concentration after treatment.

Data Analysis



Calculate phosphorus removal efficiency (%) and adsorption capacity (mg P/g material).
Compare performance under different operating conditions.
Where appropriate, evaluate adsorption behavior using simple kinetic and/or equilibrium models.