Sustainable Water Management

Doctoral Programme (Water4All)

Title of the PhD Project	Development of high-performance water treatment membranes using bacterial aquaporins
Acronym	AQUAMEM
Research Fields of the Project	Environmental Biotechnology, Environmental Microbiology
Keywords	Aquaporin, composite membrane, desalination, wastewater treatment
Host Institution, Department and Campus Location	Gebze Technical University (GTU) Environmental Engineering Department
PhD Awarding Institution and Graduate Programme	Institute of Graduate Studies, GTU.
Name and Affiliation of Main Supervisor	Prof. Dr. Melek Özkan
Name and Affiliation of Co-Supervisors	Assoc. Prof. Dr. Hatice Eser Ökten
Research Environment and Infrastructure	The PhD Project will be held in the Biotechnology Laboratory of the Environmental Engineering Department of GTU. The Department has an adequate number of facilities in terms of types of equipment, expertise, and knowledge. Sophisticated instruments are available for use by department students, including ICP, GC, GC-MS, LC-MS, and HPLC. Also, the students can reach other facilities available at GTU's different departments. Environmental Engineering Department Biotechnology laboratory has all the necessary equipment for microbiological studies, including several shake incubators, autoclaves, laminar hood cabinet, small and large scale centrifuges, electrophoresis equipments, stop flow light scattering spectrometer and a dead-end reactor cell for membrane filtration experiments.
Scientific Context of the Project	Aquaporins are integral membrane proteins facilitating the transport of water across the lipid bilayer of living organisms. The high water transport efficiency of aquaporins while rejecting most solutes attracted a great deal of attention within the last decade. Biomimetic membranes prepared by incorporation of aquaporins (ABM) have been extensively studied for improving the water filtration capacity of forward and reverse osmosis filtration membranes. *Escherichia coli* AqpZ is by far the most commonly used aquaporin in desalination membranes, *Halomonas*

	elongata Aqp cloned and characterized in our laboratory was also used for composite membrane preparation. New usage areas of membranes with biological molecules have been discovered including desalination, dewatering, greywater treatment, or micropollutant removal during the last decade. In this Project, aquaporins from different microbial sources will be used for composite thin film membrane fabrication for wastewater treatment.
Brief Workplan	Aquaporins that are already cloned and characterized will be produced purified and used for aquaporin-based thin film composite membrane preparation. The effect of aquaporin types, aquaporin concentration, the concentration of ingredients of the composite matrix, and the use of different membrane supports on the wastewater treatment efficiency of ABMs will be investigated in the project.
Innovative Aspects of the Project	Commercialization for ABM indicates the utility of this technology for reverse osmosis (RO) and forward osmosis membranes. Since ABMs further strengthen the permeate flux, solute selectivity, and anti-fouling capability of FO membranes use of novel aquaporins and testing ABM for the treatment of different wastewaters will increase their usage area and utilization potential
Training Opportunities of the Project	The student will be supported in joining symposia and workshops on membrane technologies. The student also can join the lectures and seminars on wastewater treatment and membrane processes available at GTU Environmental Engineering Department.
Interdisciplinary Aspects	The project involves knowledge and methods of both environmental engineering and microbiology.
Intersectoral Mobility ☐ **Short Visit** ☐ **Secondment**	TBD
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International Academic Secondment	Consignlio Nazionaledelle Ricerche Instituto per la Technologia delle membrane, Italy

Main Supervisor	
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Co-supervisors	
Brief CV	**Assoc. Prof. Dr. Hatice Eser ÖKTEN** **Email:** haticeokten@iyte.edu.tr **Academic Degrees:** Ph.D. University of Wisconsin-Madison, Madison, Wisconsin, USA 2008 M.Sc. İstanbul Technical University, Türkiye 2002 B.Sc. İstanbul University, Türkiye 1999

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