

**Sustainable Water Management
Doctoral Programme (Water4All)**



METU

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Title of the PhD Project	Development of DNA biosensor for virus detection in domestic wastewater
Acronym	SENSEVIRO
Research Fields of the Project	Environmental Biotechnology, Environmental Microbiology
Keywords	DNA biosensor, virus detection, wastewater
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 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 types of equipment for microbiological studies, including several shake incubators, autoclaves, laminar hood cabinet, small and large-scale centrifuges, electrophoresis equipments and PCR machine. Two potentiostats and a three-electrode system for biosensor studies are also available in the laboratory.
Scientific Context of the Project	Biosensors are analytical devices that convert a biological response into an electrical signal. In the last two decades, remarkable number of studies have been performed on DNA based biosensors (genosensors) to detect environmental pollutants or pathogenic microorganisms. Continuous monitoring of water sources is essential to decrease potential public health risks. Biosensors are regarded as fast and sensitive devices for on-site monitoring of environmental water



	<p>sources. The presence of pathogenic viruses in water sources endangers not only human health but also the health of animals and plants. Reducing the effects of viral infections necessitates efficient technologies capable of providing accurate viral detection in a variety of environments. Because of their superior biocompatibility and thermal stability DNA is becoming a fascinating biological material for biosensor development. DNA biosensors have been developed for detection of various pathogenic viruses including enterogenic and respiratory ones. In this project, Adenovirus capsid protein gene will be used as a model target DNA for development of an amperometric DNA biosensor for virus detection in domestic wastewater. Adenoviruses are regarded as one of the most persistent enteric pathogens that can penetrate entire aquifer matrices. Synthetic oligonucleotides representing the specific sites of the virus DNA will be used for experimentation and electrode development, no pathogenic virus will be handled for the safe of the students.</p>
<p>Brief Workplan</p>	<p>The amino group ended single-strand DNA oligonucleotides complementary to the gene for the capsid protein of adenovirus 40 will be immobilized on a GC electrode using gold nanoparticles or multiwalled carbon nanotubes. Polypyrrole polygluteraldehyde or chitosan based conduction polymers will also be tested for their efficiency to immobilize probe DNA on electrode surface. The electrode will be tested for the detection of synthetic Adenoviral DNA strands. The optimum concentration of oligonucleotide on the electrode surface, suitable immobilization matrices, and optimum conditions for high sensitivity, selectivity and low limit of detection will be determined.</p>
<p>Innovative Aspects of the Project</p>	<p>Electrochemical DNA biosensors have been developed for the detection of different viruses including Zika virus, Ebola virus, influenza virus etc. However, there is not much information on the application of DNA biosensors for adenovirus detection in the literature. In this research, a DNA-based biosensor will be developed for adenovirus detection. It is important to monitor viruses by fast and selective tools since their detection is difficult by cultural methods and PCR based detection requires complex steps.</p>
<p>Training Opportunities of the Project</p>	<p>The student will be supported in joining symposia and workshops on biosensors and pathogen monitoring. The student also can join the lectures and seminars on microbiological and biotechnological developments for sensor technologies.</p>
<p>Interdisciplinary Aspects</p>	<p>The project involves knowledge and methods of both environmental engineering and microbiology.</p>

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Intersectoral Mobility <input type="checkbox"/> Short Visit <input type="checkbox"/> Secondment	TBD
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International Academic Secondment	UMONS (Universite de Mons, Belgium)

Main Supervisor										
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Brief CV	<p>Assoc. Prof. Dr. Hatice Eser ÖKTEN</p> <p>Email: haticeokten@iyte.edu.tr</p> <p>Academic Degrees:</p> <table><tr><td>Ph.D.</td><td>University of Wisconsin-Madison, Madison, Wisconsin, USA</td><td>2008</td></tr><tr><td>M.Sc.</td><td>İstanbul Technical University, Türkiye</td><td>2002</td></tr><tr><td>B.Sc.</td><td>İstanbul University, Türkiye</td><td>1999</td></tr></table> <p>Professional Networks</p> <p>Google Scholar: https://scholar.google.com.tr/citations?user=GLVckPMAAAAJ&hl=en</p> <p>ResearchGate: https://www.researchgate.net/profile/Hatice-Eser-Oekten</p> <p>Scopus: https://www.scopus.com/authid/detail.uri?authorId=12776514500&origin=recordpage</p> <p>ORCID: https://orcid.org/0000-0001-7511-940X</p>	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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