

BOOK SERIES - 50th Year of Hacettepe University
Series Editor: Adil Denizli

ADVANCES IN ENVIRONMENTAL SCIENCES

***Müge Andaç
Editor***



**HACETTEPE
UNIVERSITY
2018**

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HACETTEPE UNIVERSITY PRESS
ANKARA - 2018

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ISBN: 978-975-491-484-9

Yayına Hazırlama: PALME Dizgi Grafik Birimi

Yayınevi Sertifika No: 14142

Baskı: Step Repro Dijital

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PREFACE

We have proudly celebrated the 50th anniversary of the foundation of Hacettepe University. We take pride in being one of the most successful universities in Turkey and being ranked among the leading universities in the World. Since the year 1967, when Hacettepe earned the status of ‘University’, it has never given up on its principle of continuously going ahead and reaching for the very best. Hacettepe, always preserving its values and basic principles, has become a pioneer university that has been intertwined with the society and pursued innovations, achieving many “firsts” ahead of others.

From medicine to biology, philosophy, statistics, physics and chemistry; from history of arts to the English, German and French languages; from sociology to engineering, fine arts and conservatory, Hacettepe University started almost 50 years ago developing interdisciplinary collaborations across a wide range of scientific fields, a research trend which has achieved a status of global recognition in the 21st century.

Hacettepe University, which was recognized as “Research University” by the decision of Council of Higher Education, dated September 26, 2017, has built a strong “brand” image over these 50 years with its qualified and unique contributions to science in Turkey and has been the country’s gateway to global scientific advances. It has graduated tens of thousands of students, each of whom has been our source of pride with their contributions to science, society and humanity as well as with their worldwide achievements. So have its graduates always been proud of Hacettepe.

Hacettepe University owes its success to its people who have always aimed to move forward by promoting interdisciplinarity and without giving up on the understanding “To the leading edge..... Toward being the best.....”

The Turkish and English series of books you are presented have been prepared in memory of the 50th anniversary of Hacettepe University by Prof. Dr. Adil Denizli, a distinguished researcher and faculty member who has heartily devoted himself to his university and science. Among the editors and authors of the book series are respected scientists from Hacettepe University, Turkey and abroad. The series covers the studies from the multi-/interdisciplinary

research areas of sciences, mainly from Medicine, Science and Engineering Sciences, which particularly stand out among the World's and Hacettepe's research interests.

Readers benefiting from these books will certainly appreciate the value of the profound contributions Hacettepe University made to science both in the country and in the World each time they see the name of "Hacettepe University" in the context of the authors, editors, footnotes, citations and bibliographies. This work is an expression of respect for Hacettepe University and for those who have meticulously served in this university for 50 years with an interdisciplinary understanding.

Thank you Adil Denizli... I would like to express my sincere gratitude and thanks to all those who have contributed to this precious work.

I wish many 50 more years to go forward in line with our motto "To the leading edge... Toward being the best..."

Prof. Dr. A. Haluk ÖZEN
Rector

PREFACE

In 1954 “Hacettepe” was founded in two chambers of an old Ankara house as a Chair of Child Health, then in 1967 officially earned “university” status. Hacettepe University celebrated its 50th anniversary in 2017 by proud of rich heritage and the positive, life-changing impact globally through the strength of our research, teaching, innovation and enterprise. In just 50 years Hacettepe University has managed to forge a powerful global reputation as a strong research-led university. To celebrate 50th anniversary numerous standout events were planned and performed by proud of past and dreaming of the future.

The Hacettepe Book Series are published to honor the five decades of work not only for the field but also for society at large and to leave the scientific mark of Hacettepe University to the history.

Prof. Dr. Adil DENİZLİ
Series Editor

PREFACE

This book specifically focused on the environmental science and technology applications. Environmental science and technology concerns the environmental problems in the removal of environmental pollutants, refers to the application of environmental sciences in the development of new technologies which aim to conserve, monitor or reduce the harm humans regularly cause the environment while consuming its resources. In a technological approach, environmental biotechnology is a system of scientific and engineering knowledge related to the use of microorganisms and their products in the removal of environmental pollution through biotreatment of solid, liquid, and gaseous wastes, bioremediation of polluted environments, and biomonitoring of environment and treatment processes, renewable energy generation or biomass production, by exploiting biological processes

This book serves a wide aspect of environmental science and technology applications. The chapters, which are included in this book, are anaerobic digestion in biogas production from wastes, recent trends in environmental monitoring of pollutants, heavy metal removal for water purification, microbial remediation of environmental pollutants, quantum dot fate and transport in the aqueous medium, spr sensors for environmental analysis, biotechnological methods for heavy metal removal, microbial disinfection cartridges, general aspects of ion imprinted polymers. I would like to give my special gratitude to Prof.Dr. Adil Denizli for giving me the opportunity of editing and publishing of this book. The scientists from different universities and research centers who are specialized in their own fields contributes this international book by sharing their experiences. I would like to express my special thanks to all scientists and researchers around the world. I hope this book meets with researchers and graduate student in the multidisciplinary area of environmental science and technology, chemistry, biotechnology and nanotechnology.

Müge ANDAÇ, Ph.D
Editor

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Müge Andac is an Associate Professor at the University of Hacettepe in the Department of Environmental Engineering at Environmental Technology Division. She carried out a part of her research on cryogels at Lund University in 2007 and gained her Ph.D. degree in 2009 from the University of Hacettepe on application of cryogels to affinity and molecular recognition based chromatographic separation methods. Her current research interests are the synthesis and characterization of molecular imprinted based polymers, micro/nano-materials, super-macroporous hydrogels, composite materials, and their applications to bioassays, sensors, and chromatographic systems in the field of affinity recognition of biomolecules and environmental pollutants.