MEDRC

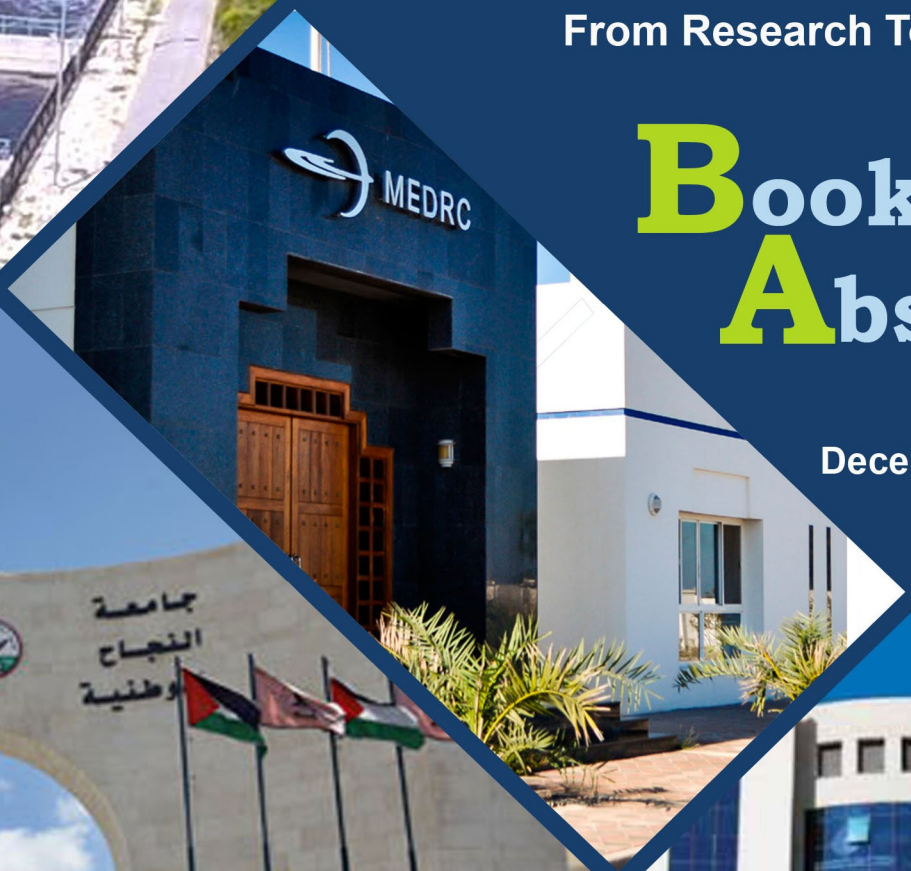
سلطة المياه الفلسطينية
PALESTINIAN WATER AUTHORITY

# The Second MEDRC Palestinian Water Research Alumni Forum

## From Research To Application

# Book of Abstracts

December 16th, 2019





# Book of Abstracts

## The Second MEDRC Palestinian Water Research Alumni Forum (2nd MPWR)

## " From Research To Application "

**Monday - December 16th , 2019**

### Organized by

**Chemistry Department at An-Najah National University,**

**in partnership with Palestinian Water Authority (PWA)**

**and with support of Middle East Desalination Research Center (MEDRC).**

**2019**

Designed by: Eng. Nisreen Hamadneh

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# Messages

On the behalf of An-Najah National University, let me welcome all of you to the 2nd Middle East Desalination Research Center (MEDRC) Palestinian Water Research Alumni Forum.

I would like to formally thank and welcome the distinguished delegate of the Ministry of Palestinian Water Authority, Eng. Mazen Ghuneim; the MEDRC Center Director, Ciarán Ó Cuinn; the MEDRC Development Cooperation Program Manager in Oman, Mr. Brendin Smith; the distinguished delegates of the Palestine Water Authority (PWA) Eng. Hazem Kittaneh and Dr. Subhi Samhan. I would also like to welcome all the postgraduate students from An-Najah National University and other universities who have received MEDRC scholarships.

The cooperation between An-Najah National University and PWA began more than 10 years ago through the Scientific Centers at An-Najah National University. We have supported the PWA with their water pollution analysis as well as multiple projects and conferences related to access to water.

In the last 10 years, MEDRC in collaboration with PWA, have consistently encouraged scientific research in Palestine. One of the many strategies to increase scientific research has included the creation of a scholarship program for graduate students. This program has provided more than 210 scholarships to graduates of Universities across Palestine, with graduates of An-Najah National University obtaining more than 60% of them.

This scholarship program has greatly supported An-Najah's ability to have far more outstanding students within the chemistry and other engineering graduate programs. Prior to the creation of this scholarship program, only ten students were enrolled in the related graduate programs. Currently, we host over 55 graduate students (15 of whom are PhD candidates). MEDRC has also provided training to our graduate students, including travel to Oman for expert trainings. Additionally, the number of published papers and the quality of research increased dramatically since the start of the scholarship fund, which has had a huge impact on the ranking of our university in such prestigious international ranking publications such as the QS World University Rankings.

# Messages

Last year, MEDRC began supporting Ph.D. students and An-Najah received three superb scholars through this opportunity, which has greatly helped with the scholars' efforts to create high quality research both locally and abroad.

We are looking forward to continuing what has proven to be a very fruitful cooperation and effective support from MEDRC Center and to continue to evolve and elevate the quality of research both within our institution and nationally.

An-Najah National University has been working diligently to increase cooperation with colleagues in the Palestinian Water Authority and MEDRC Foundation within the field of scientific research, and that is clearly proven through the above mentioned accomplishments. We believe that the furthering of our collaboration and crucial research will support our shared efforts to benefit the country in practical ways based on the results of such research, such as the development of smart irrigation, water purification, and other environmental and sustainability initiatives.

We envision only further developing our relationships with PWA and MEDRC with the goal of launching an incubator and research center, serving as a local and regional research and incubation hub for innovation in the field. I hope that following the results of today's event, effective and practical steps will be developed to implement the international goals and objectives in the field of water treatment and resources.

Lastly, I must extend my sincere gratitude to the Forum's Organizing Committee and everyone who had a part in putting this whole event together. I hope you enjoy and benefit from today's event.

Sincerely,

**Prof. Maher Natsheh**
**President of An-Najah National University**

# Messages

**Dear Professors, researchers and students,**

I deem it a great honor and unique privilege to express my sincere gratitude to the organizers of the second Palestinian MEDRC Water Research Alumni Forum which is taking place at An-Najah National University in partnership with Palestinian Water Authority (PWA) and Middle East Desalination Research Center (MEDRC).

Dear participating scholars and researchers,

The issue of water resources, and actions related to sustainable development are in the focus of attention of all countries around the world including Palestine.

I would like to mention that the lessons learned during the long collaboration between An-Najah University, the PWA and MEDRC became the basis for the implementation of new projects and programs on water supply and the setting of new goals related to water resources.

The main objectives of this event include conducting comprehensive review of the progress achieved, as well as recommendations for the further actions that will be taken to support Master and Ph.D. students who that conduct applied research and projects in the field of water treatment.

In my humble opinion, I think many of you, distinguished participants, will contribute to the achievement of the goals and objectives of this important international event.

I hope that following today's results, practical steps will be taken to enhance and implement the goals of this event, held in collaboration with PWA, MEDRC and other partners, in the field of water treatment and resources.

Today's forum will open the doors for tangible recommendations on the topics that will be discussed.

Allow me to take this opportunity to acknowledge the efforts of MEDRC, sponsor of the forum, so I thank Dr. Brendan Smith from MEDRC. Special thanks are also

due to Eng. Hazem Kitani and Dr. Subhi Samhan from PWA. Thank you for your time and efforts in organizing the forum.

I am positive that your active participation in this forum, and other forums and conferences will be a valuable contribution to the promotion of joint efforts to achieve sustainable development and use of water resources for the benefit of the future generation.

We at An-Najah University have an ambition to increase collaboration with our colleagues in the Palestinian Water Authority and the MEDRC Foundation in the field of scientific research related to water purification. We hope that An-Najah University will be an incubator and research center at the local and regional levels. This ambition cannot be achieved without the support of our colleagues in the Palestinian Water Authority and MEDRIC Foundation. The incubator will support scientists to develop their innovative technological ideas and set up new businesses in order to commercialize them. The center will act to promote R&D projects in collaboration with academic/research institutes and industry partners. In addition, the center will offer research services and act as development and test sites for industrial companies. This research center can actually succeed if established at An-Najah University as it has the elements of scientific research study and a broad experience in establishing, managing and utilizing specialized centers. An-Najah University has acquired an excellent reputation in the field of providing services to the Palestinian community in collaboration with other private and public local and international sectors. It has strong collaboration with the Palestinian Standards Institution in the field of Accreditation of Palestinian Standards, and has many collaborative studies and projects with most of the Palestinian municipalities.

I thank you all for your attention and wish you successful and fruitful deliberations.

**Thank You**
**Dr. Maen Ishtaiwi**
**Chairman of MPWR**
**Dean of Faculty of science**
**An-Najah National University**

# Messages

Dear All,

His Excellency Minister of water authority Head of Water Authority, Eng. Mazen Ghuneim, Excellency Distinguished President of An-Najah National University Prof. Maher Natsheh, H.E. Ciarán Ó Cuinn- Center Director, MEDRC, Ms. Kirsten Winterman - Head of Development Cooperation, MEDRC, Mr. Brendan Smith - Development Cooperation Program Manager, MEDRC, Mr. Martien Huisman - Development Cooperation Program Manager, MEDRC Distinguished delegates of Palestinian Water Authority, Dear Postgraduates who have received M.Sc. and Ph. D. grants from MEDRC Foundation, Distinguished representatives of national and international organizations.

It is a great honour for me to express my gratitude to the organizers of the second 2nd MEDRC Palestinian Water Research Alumni Forum that is held at An-Najah National University in association with Palestinian Water Authority (PWA) and Middle East Desalination Research Center (MEDRC).
Dear participants of the Conference, as we approach the year 2020, one of the most important sectors to watch is the development of water infrastructure. During the recent times, all countries including Palestine expected to face severe water shortages unless measures and actions are taken to address this.

Over a billion people in the world do not have access to fresh water today and this number is expected to increase as a result of water pollution, depletion of reserves, climate change, and population growth. Providing a reliable source of clean water for tomorrow requires the adoption of more efficient methods to use, and treat water.

I would like to mention that the experiences and lessons learned during the long collaboration between An-Najah University, the Palestinian Water Authority and MEDRC becomes the basis for implementation of new projects and programmes on water supply, and formulation of new goals related to water resources.

Today's forum will provide an opportunity to prepare concrete recommendations on the topic that will be discussed.

# Messages

We at An-Najah National University have an ambition to increase cooperation with our colleagues in the Palestinian Water Authority and the MEDRC Foundation in the field of scientific research related to water purification. An important objective of this forum is to review progress, challenges, and gaps identified during the forum, and formulate recommendations to guide us all as we embark on the implementation of the post-2019 development agenda.

There are both successes to build on and big challenges to address. I am hopeful that, with the support of Palestinian Water Authority and MEDRC Foundation we will succeed in setting good start for advanced research in the field of water purification. It is time to move from the scientific research stage to the practical application of our researches. We in the Department of Chemistry expect further support from MEDRC to establish water research laboratories in order to conduct advance research and the establishment of an incubator at An-Najah University in order to start transforming the research achievements of graduate students into economically viable projects.

I thank you all for participation and wish you a fruitful deliberations, health and success.

**Thank You**
**Dr. Nidal Zaatar**
**Head of Chemistry Department**
**An-Najah National University**

# Messages

I would like to thank the Middle East Desalination Center for its support to the water sector in Palestine by upgrading scientific research from theory to practice towards sustainable and environmentally friendly development. Thanks are due to the research team at the Palestinian Water Authority who worked hard to promote scientific research in the Palestinian universities and to participate in the utilization of this research in achieving the strategy of the Water Authority by pushing its results towards field application. We also thank An-Najah National University for hosting this forum for the second time and congratulate it for its outstanding excellence in obtaining the majority of the grants provided and this reflects the excellence of students and their supervisors and seriousness in providing creative solutions. Finally, we thank the management team of the Forum for this outstanding success, which reflects a lot of commitment and team work spirit and the desire to succeed and build a country with knowledge based econmy.

The cooperation program between the Middle East Desalination Center, the Water Authority and the Palestinian universities has evolved over the past ten years by offering scholarships to master students in local universities in the West Bank and Gaza Strip through a transparent process that goes through official announcements, in-person applications and interviews by specialized and impartial technical committees. This program has been upgraded to cover doctoral students in the West Bank. A specialized doctoral program has been introduced in the Gaza Strip to serve this purpose. In addition to granting masters and doctorates, a special program has been developed to support applied research, which is usually a post-master completion used by the student to do more applied experiments on research as a first step towards getting out of scientific research to the market where the challenges are greater. During this period, the scientific research team at the Water Authority exerted its utmost efforts to build a diverse network of local and international experts working in universities, non-governmental organizations, various associations, government institutions, forums and international conferences. This great effort has been done to consolidate the concept and importance of scientific research in achieving

the objectives of sustainable development, most importantly water security and food security through Networking with various programs and projects dealing with research, excellence and innovation to provide material, technical and moral support to creative students with entrepreneurial ideas through incubators and accelerators specialized in the field of Water, environment and agriculture. We strive to strengthen the components of national sustainable development and localize entrepreneurship and innovation on all levels, as well as maintain leadership in all facets so as to fulfill its duty as a place where innovation and entrepreneurship flourish. We also endeavor to provide empowerment and foster partnerships with centers of innovation and excellence at Palestinian universities and private sector institutions by creating an atmosphere that encourages innovation and inspires academics and professors to develop research methodologies and practices that can be found more relevant to practical life and the surrounding community.

Before concluding, I would like recommend and urge the Middle East Desalination Center to build on this success we achieved during the previous years by focusing and spotting the light on creative ideas through a n entrepreneurship program in partnership with partners in the creation of incubators and accelerators. We also submit our recommendations to the departments of our universities to review curricula, materials and educational programs and upgrade it in response to unprecedented era of development in all fields, especially IT and the IOT and adapt them to serve sustainable development in various sectors in coordination and cooperation with government institutions.

The last recommendation goes to our dear students specially those who are granted scholarship from these programs to upgrade their scientific and practical aspirations through finding creative ideas leading them to establish their startup companies to benefit themselves, benefit their country and the world as well and employ others instead of graduating from the university looking for jobs.

**Eng. Hazem Kittani**
**General Director of Technical Affairs**
**Palestinian Water Authority**

# Messages


In recent years MEDRC and the PWA have backed more than 270 water research projects in Palestine through our Fellowship program and Innovation Initiative. The projects we support focus on the urgent water issues facing the country today. Our approach is to support Palestinian researchers in Palestinian universities, to focus on the priority areas set by the Palestinian Water Authority. This approach addresses fresh water scarcity while building Palestine's national capacity, supporting the next generation of Palestinian water experts and supporting local universities.

This year alone the PWA and MEDRC will support 39 projects on diverse topics from using graphene technology, to treating the effects pharmaceutical compounds in wastewater, to improving the efficiency of filtration basins in the northern Gaza Strip. These projects work to develop local talent to find local solutions in innovative ways.

In MEDRC, we work with universities, governments and agencies all over the world, and I can tell you this: Palestinian water researchers are second to none. We are proud and honored to work alongside them.

Thank you. Kind regards,

**Ciarán Ó Cuinn**
**Center Director**
**MEDRC Water Research**

# Organizers

**An-Najah National University** is a fully independent, non-governmental university, run by the Board of Trustees and the University President. The structure of the administration is composed of the University President, Assistant and Vice Presidents, University and Deans Council, Administrative Departments and the University Comptroller. The academic structure divides faculties into academic departments.

An-Najah seeks to provide as many facilities as possible to its students through providing each faculty and department with a computer lab for student use. This has created a ratio of three students to each computer. Physically and visually impaired students are welcomed at An-Najah as well. A special computer lab designed for the visually impaired converts all Microsoft Office files to Braille to allow students to share lectures and submit assignments either by email or through the Braille printers available. The university also allocates special cars to transport physically and visually impaired students between campuses.

An-Najah hosts more than 20 scientific centres that offer a wide range of services to the local society. Among those are two centres that are directly connected with the local society and seek to provide high services to the people in different parts of the country. The first one is the Community Service Centre which is involved in numerous projects to help Nablus and the Northern West Bank people. The Community Service Centre also collects blood samples from the community donators for transfusions and provides hot meals to the elderly and needy families in Nablus.

In addition to the Community Service Centre, there is the Energy Research Centre (ERC) which undertakes research projects in the field of energy. The centre has completed a number of projects in several Palestinian cities and villages such as Attouf Village in which the centre provided electricity through harnessing solar power for the first time. In its endeavor to lay down foundations for knowledge-based society, the university established the Centre of Excellence in Materials Science and Nano-Technology (CEMSANT). The centre homes researchers and students to perform their works on preparation, modification and application of advanced materials.CEMSANT encourages research activities directed towards the benefit of the Palestinian society with regard to water, environment, health, renewable energy and agriculture.

# Organizers

To be in direct touch with the local community, An-Najah has its own radio and satellite television stations. Both offer programmes that provide practical training for An-Najah's students as well as an avenue to connect with the local and international community through the satellite station. To reach out to more students, videoconferences and e-learning lectures are both offered at An-Najah. The e-learning lectures are available for free on the university's website. Videoconferences have been organized with other academic, non-profit, and private institutions to discuss the academic and political situation with outside parties.

# Organizers

**Palestinian Water Authority (PWA)** was established under Presidential Decree No 90 of 1995, which stated in article 1, the Palestinian water authority, as broad Water Act (2) for the year 1996 in article (2) on the establishment of the Palestinian water authority, which has independent legal personality and its own budget, so follow the Presidnt of the Palestinian national authority and have a head appointed by the President of the PNA.

The water authority aims to achieve integrated and sustainable asset management of ed water resources; protection and preservation within organizational tools help them to gain access to a healthy environment by ensuring a balance between quantity and quality of water available and the needs of the Palestinian people to achieve sustainable development through water resources.

And then the water law (3) for the year 2002 which define the framework and levels of water sector in Palestine, in order to regulate the sector and access to the service to the appropriate level on the one hand, and the protection of water sources, on the other hand, with the allocation of functions and powers of the management of the sector into three levels, namely the organizational level and the operational level and the political level.

Water Act No. 3 of 2002 authorized the Palestinian Water Authority the water sector management task, entrusted to regulate the sector and identified the relationship with the official, private enterprises and local government authorities, each according to his specialty and Legal reference.

Through the law No 14 of 2014 on water, the water authority's powers have been clarified and reduce intersection powers. And which also aims to manage and develop water resources in Palestine and to increase capacity and improve the quality and conservation and protection from pollution

drain and improve and upgrade water services by applying principles of integrated and sustainable management of water resources.

<u>Palestinian water authority mission redrafted and defined its vision and strategic goals and objectives in line with its new duties and powers were as follows:</u>

# Organizers

**Mission of the water authority:**

A public institution working to manage, develop and protect water sources with integrated and sustainable water supply to citizens valid for different uses and ensure the protection of the environment and the achievement of the development goals of Palestinian society.

**Vision of the water authority:**

Sustainable water sources able to achieve development and basic needs of the Palestinian people.

# Organizers

**Middle East Desalination Research Center** is an International Organizationmandated to find solutions to fresh water scarcity. Established in 1996 as part of the Middle East Peace Process it conducts research, training, development coopera- -tion and transboundary water projects.

The MEDRC Headquarters is in Muscat in the Sultanate of Oman, where it operates a state of the art research facility including desalination plants, laboratories, lecture halls and administrative offices.

In delivering its mission, MEDRC aims to become a viable and transferable mechanism for governments seeking to address significant regional or trans-boundary environmental challenges.

# Committees and Boards

## Advisory Board

- Dr. Subhi samhan (PWA)
- Mr. Brendan Smith (MEDRC)
- Prof. Shehdeh Jodeh (NNU)

## Invited Speakers

- Prof. Maher Natsha (President of An-Najah National University)
- Dr. Nidal Zatar (Head of Chemistry Department, NNU)
- H.E. Ciarán Ó Cuinn (Center Director, MEDRC Water Research)
- Eng. Mazen Ghuneim (Minister and Head of Palestinian Water Authority)

## Forum Chairman

- Dr. Maen Ishtaiwi (Dean of Faculty of Science, NNU)

## Organizing Committee

- Dr. Maen Ishtaiwi (Chairman)
- Mr. Brendan Smith (MEDRC)
- Dr. Subhi Samhan (PWA)
- Eng. Hazem Kittaneh (PWA)
- Ms. Suhad Al Malki (PWA)
- Dr. Abdel Fattah Hasan (NNU)
- Dr. Nidal Zatar (NNU)
- Prof. Shehdeh Jodeh (NNU)
- Dr. Ibrahim Abu Shqair (NNU)
- Mrs. Ghadir Hanbali (NNU)
- Mr. Omair Nabulsi (NNU)
- Eng. Nisreen Hamadneh (NNU)
- Mr. Mohammed Morshed (NNU)
- Mr. Nafith Dweikat (NNU)

# Committees and Boards

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- Dr. Subhi Samhan
- Eng. Hazem Kittani
- Dr. Samar Alshakshir
- Dr. Derar Smadi
- Dr. Ibrahim Abu Shqair
- Mrs. Ghadir Hanbali
- Ms. Hiba Nassar

## Forum Secretariat

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# Chairpersons

**Dr. Maen Ishtaiwi**, Dean of the Faculty of science in An-Najah National University, was born in Nablus (Palestine) on September 20, 1984. He obtained his B.Sc degree in Physics minor Electronics, from College of Science at An-Najah National University, in May 2007. During July 2007 – August 2008, he was a Teaching Assistant in Physics Department - An Najah National University, Palestine. He obtained TOPMED program scholarship to continue his higher studies in Italy. He obtained his M.Sc. degree in Electronics Engineering from Politecnico di Torino, Italy in November 2010. He obtained his PhD degree in Electronics from Politecnico di Torino, Italy in March 2014. Currently, he is working as an Assistant professor – Physics Department - An Najah National University.

**Email: m.ishtaiwi@najah.edu**

**Dr. Nidal A. Zatar**, head of Department of Chemistry at An-Najah National University, was born in Nablus (Palestine) on December 1st, 1956. He awarded his B.Sc degree in chemistry from Birzeit University. He awarded his Ph.D degree in Analytical Chemistry from University of Kent at Canterbury, England, on February 1984. In the period 1984-1985 he was Assistant Professor at the College of Science and Technology, Abu-Deis, Jerusalem. In the period 1985-1993 he was Assistant Professor at the Department of Chemistry, An-Najah N. University. In the period 1993-Present he is Associate Professor at the Department of Chemistry Department, An-Najah N. University. In the period 1999- 2008 he was Director of Chemical, Biological and Drug Analysis Center. An-Najah N. University. In the period 2016 present he is Head of Department of Chemistry, An-Najah N. University. His research interests is: Spectrophotometric and Spectrofluorimetric determination of metal ions, separation and determination of active components from medicinal plants, separation and determination of food additives using chromatographic techniques, analysis of pharmaceutical products, quantitative and qualitative determination of food products, toxicological analysis, Food analysis and determination of nutritional values and quantitative determination of pesticides in food products using GC/MS technique.

**Email: nidalzatar@najah.edu**

# Chairpersons

**Prof. Shehdeh Jodeh**, A distinguished Professor at the Chemistry Department of An-Najah National University. He did his postdoctorate at Alamos National Labs, New Mexico USA (1991). He obtained his Ph.D in Physical Chemistry from Wayne State University, USA in 1990. His B.S Chemical Engineering from University of Mississippi (USA), 1987. His Master degree in physical Chemistry from Sam Houston State University, USA (1985). B.Sc in chemistry from Yarmouk University, Jordan 1983.

He worked as Research Scientist at General Motors R&D Michigan, USA from 1992-2004.

He published more than 150 scientific papers and supervised more than 60 graduate students at the chemistry department.

**Email: sjodeh@hotmail.com**

**Ghadir Hanbali,** PhD student in Chemistry at An-Najah National University, was born in Palestine on March 23, 1993. She graduated from An-Najah National University with a bachelor's degree in Chemistry in 2014. Through the period between 2014 and 2016, She worked as a teaching assistant in the department of chemistry. In 2016, She obtained a master's degree in the field of Organic and analytical Chemistry with an average of 4.00 out of 4.00. In the same year, she started working as a lecturer of Chemistry in An-Najah National University. Her researches in both master and PhD are funded by MEDRC.

Ghadir participated in many scientific papers; her researches are mostly concentrated on purification of water such as removal of heavy toxic metals using synthetic material that have very good adsorption efficiencies towards these toxic materials. Her main goal in this life is to work to serve its community and to become a researcher working to solve the problems facing the environment, especially the problems of the water sector. She attended and presented in many international scientific conferences inside and outside Palestine and participated in many projects

**Email: g.hanbali@najah.edu**

# Chairpersons

**Hazem Kittani** holds a Masters degree in Civil Engineering majoring in Hydraulics and Fluid Mechanics from the Missouri State University at Columbia in the United States of America. His current position is Director General of Technical Affairs at Palestinian Water Authority. He gained more than 25 years of experiences in civil engineering (construction-sites), and hands-on practical experience in designing, supervising, monitoring, and control manager in infrastructure related to water and wastewater systems in Saudi Arabia, Jordan and Palestine.

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**Subhi Samhan;** PhD in Natural Science from Martine Luther University, Halle Wittenberg Institute for Geosciences, Germany. 2013. Working as Director of Research and Development at Palestinian Water Authority since 1997 and represent PWA.

Samhan is national focal point for:

- National focal point for Sustainable Management of Available Water Resource with Innovative Technologies (SMART).
- Building Capacity and Institutional Reform for and Integrated Management of Water and Sanitation services in Rural Communities, 2009-2013, funded by Austrian
- Palestinian-Dutch Academic Cooperation Program in Water (PADUCO) 2013-2020Represent Palestinian Water Authority in Technical Advisory Committee
- Sustainable domestic Water Use in Mediterranean Regions project SWMED projects.
- Academic focal point for Austrian and Middle East Desalination Reseach Center (MEDRC) projects.
- Represent the Palestinian Water Authority in Innovative processes and practices for wastewater treatment and re-use in the Mediterranean region "INNOVA-MED, during 2007-2010. Funded by EU, www.cid.csic.es/innova-med/home.htm.

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# Abstracts

# Oral Presentations

## Universities Research Commercialization

## Challenges and Potential

Radwan Qasrawi

*Al-Quds Business Center for Innovation Technology and Entrepreneurship- Al-Quds University*

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## Abstract

Commercialization of academic research has emerged as a serious science policy and strategy challenges. Universities are asked to deliver advance research inventions, while companies are facing challenges in sustaining their business. With no doubt, the integration between academic research and business will positively affect the economic growth.

Commercialization entails many elements such as bringing new products or services to the market. Thus, it entails many key functions such as production, distribution, marketing, sales, and customer support in order to accomplish the commercial success of the new service to be available in the new market. Universities should have ecosystems to improve its department and research to business and patents fields.

Globally, universities ecosystems demand work on patent and research to business to develop one of its elements, which is decision aids. This element supports technology transfer offices TTO management when planning measures. These measures encourage academic patenting within universities, such as the social behaviors and interactions.

Mainly, universities in developing countries including, Palestine still working on the development of their ecosystems. This limits the patent and research to business production. In addition, the main objective of research commercialization in Palestine targets Responsive Research, and TTO Technology Transfer Office that supports education, technological development and innovation. By expanding this research, it strengthens linkages between industry and other private sector actors.

There are almost common problems in these universities that show a lack of basic ground for development and business experience. This refers to many reasons, for instance, there is a problem in defining the right measures that impact the process, which are monetary, non-monetary incentives and providing information. Then offer them to the right group such as scientist department at the right point of time. This illustrates the missing elements in this process, which makes it incomplete and effective. In addition, there is no cooperation between departments within the university, this limits the benefits and knowledge. Moreover, universities miss many of ecosystem components. For example, they don't expand existing technology transfer offices TTOs as active stockholders in the university ecosystem, there is no financial support, social network, technology, national program and policies, research disciplines, human capital: entrepreneur and team.

Al-Quds university is one of the acted and initiative universities in Palestine that start proposing stimulation of ecosystem in its place. It established the Al-Quds Business center for Innovation Technology and Entrepreneurship to cover the ecosystem missing components. For example, it expands the existing of technology transfer offices TTOs as an active stockholder in the university ecosystem. Besides, it provides financial support, social network, technology, national program and policies, research disciplines, academic entrepreneurship.

Developing TTOs in Al-Quds University helps us to improve university current situation, and have more aid pro-active management in knowledge-intensive organizations, and invests more searches. Besides, it helps analyzing the surrounded environment (economy, technology, society) before taking the final decision. This expands the number of patents, and generate the university network and connections. Thus, we have more interactions between the university's departments, besides fostering university–industry cooperation and academic spin-offices. The university connects with several universities within a region and outside it to gain more understanding through raising awareness, facilitating communication, promoting coordination, and mitigating conflicts.

The establishment of a Technology Transfer Office bridges many important techniques. If the responsive researchers perform newer ideas, and inventions, then new business ideas will arise and new employment opportunities for the

Palestinian youth will be open consequently. On the other hand, the concept of innovation became the competition between companies and industries.

Any company seeking for innovation and new knowledge are trying to exploit knowledge and technology in the form of partnerships, linkages, joint venture, technology and knowledge transfer and other forms of collaborations to achieve common interests of both partner's universities and companies.

Moreover, if we come to realize, Palestinian economy, Al-Quds University is in the need for resources support to transfer the documented knowledge in universities. It must be innovated marketed as a form of product, software, books and in a form of ideas. With this mentioned it would bring to Palestinian universities support and encourage new ideas. To overcome this challenge, Palestine will need to develop a partnership between society components in order to develop the socio-economic system and create a strong economy. This transformation will lead to the social impact by growing and providing a local financial impact in form of money, careers and knowledge. Furthermore, TTOs shapes identity with university academies and management.

In conclusion, the creation of a sustainable commercialization of research results, TTOs, presents the innovation ecosystem that gathers companies, experienced leaders, investors et.. the environment includes new companies with wealthy business experience, and access to capital that supports innovation in the early stages of growth. We consider education, entrepreneurial culture, and personal formation, on each stage of development of eco-innovation models. Meanwhile development models should work in innovative eco-systems, and functional complex that creates competitiveness.

## Entrepreneurship in Palestine Technical University – Kadoorie (PTUK) Innovation and Educational Technology Center (IETC)

Amjad Almasri

*Director of Innovation and Education Technology Centre, PTUK*

*Email: amjad@almasri.me*

## Abstract

Innovation and Educational Technology Center (IETC) at Palestine Technical University - Kadoorie (PTUK), works to implement activities and projects aimed at developing students' skills and providing them with the necessary capabilities to convert their entrepreneurial and scientific ideas into real projects.

IETC established Rae3 Program in 2016/2017 academic year (Rae3=Wonderful) to foster entrepreneurship and innovation. Rae3 is an annual program includes: training students on 21th century skills, generate ideas, build the business model and the business plan for their projects, connecting them with related institutions for more consultation and experience and sometimes for fund. Rea3 online platform also established to facilitate follow up and manage the registered projects by students and provide them with guidance notes.

IETC, within Rae3 program succeeded in helping some students to start up their own business, however we consider the process is in the beginning and face some challenges.

In addition to Rae3 program, IETC implements joint projects with some institution supporting innovation and entrepreneurship.

IETC participate in Fostering Entrepreneurship in STEM (Erasmus Plus Palestine) and participated in creating and teaching "From Idea to Start up" elective course for the engineering students in PTUK.

## Building a Culture of Entrepreneurship & Innovation: Placing students at the heart of the ecosystem to develop 21st century graduates

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## Abstract

In order for institutions of higher education to be powerhouses of knowledge with marked impact on the economy and the wider society, they have to be aware of and address constant shifts in political, social, economic, and environmental landscapes. Universities cannot exist in isolated spheres of academic work and rigor - but are obliged to be socially engaged and ensuring that their research, innovations, and approaches to teaching, learning, and coursework make sustainable contribution to communities - moving beyond economic benefits that are reaped from creating jobs and income – to proactively closely connecting with industries and communities – keeping abreast of the challenges that are faced by them – and working hand-in-hand with them to develop and implement creative solutions.

That's why every single person belonging to a university community – whether being a student, a faculty member, or administrative support staff, has to innovate: they need to know how to spot and uncover opportunities that others do not see, they need to know how to iterate ideas forward turning them into long-lasting impact, they need to know how to network minds in non-traditional ways – using divergent thinking - in order to solve problems that are intricate and complex.

Creating and nurturing an internal culture of innovation – entrepreneurship and entrapreneurship - is one of the top priorities for Birzeit University as it tries to keep pace with the ever-changing needs of society and economy. Amidst an era of rapid socio-economic pressures and stagnant political outlook, the university recognizes that it needs to be adaptable and resilient so that it can substantially contribute to national job creation as well as help drive growth across all industry sectors and at the same time help improve lives and the well-being of local Palestinian communities and the wider society. This means that equipping students with mainstream formal education is no longer sufficient to qualify them to meet the significant shifts that are happening in the graduates' skill set requirements driven by the evolving knowledge economy. Beyond technical skills and formal qualifications, employers are increasingly seeking graduates with a complex mix of cognitive abilities (creativity, logical reasoning, and critical thinking) and strong leadership traits including emotional intelligence, excellent communication, perseverance, teamwork, confidence and persuasion and other social skills – so as to meet the rigorous demands of the competitive workplace. Furthermore, students and graduates need to have an enterprising mindset with a propensity to focus on opportunities rather than barriers, possibilities rather than limitations, acting and making a difference – i.e. being changemakers - rather than complaining about problems and constraints.

In order to realize this mandate, Birzeit University believes that it needs to re-invent itself at many levels - making innovation and entrepreneurship a part of the DNA and fabric of the institution – and making sure that the educational journey for the students is both inspirational and life-changing in terms of propelling them onto successful and rewarding career paths.

Launched in March of 2017, the Innovation and Entrepreneurship Unit (IEU) in Birzeit University is a bold new vision that fosters an active campus of innovators (students, faculty, and staff) – one that this competitive in promoting research and knowledge transfer and exchange, and at the same time, a campus that provides a rich and engaging students' experience through skills enhancement and meaningful, structured, and reciprocal university-community engagements. The unit provides an open innovation platform and a hotbed for students, faculty, and staff to co-create and collaboratively work on new ideas and design and

implement initiatives that bolster the university's internal entrepreneurial ecosystem. Physically, the IEU operates out of the blue dome building on BZU campus - the premises of which houses a student-centered faculty-enabled open co-working space, a vibrant community of peer and mentor-support, several innovation labs, university-community engagement programs (and social-action projects), student-led initiatives, an incubator program (that helps students propel their social and business ideas as far as they can go), and a co-curricular Leadership and Active Citizenship Program. The IEU is unique in its accessibility and cross-disciplinary collaboration. It is open to any student, faculty member or staff or CBO to connect, ideate, prototype, and launch initiatives – whether being social, environmental, business, educational or a mix of all.

## Entrepreneurial Opportunities in Desalination - Case of Palestine

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## Abstract

Water shortages in Palestine and other places in the world urge the replacement of freshwater demand of agriculture and potable water with alternative sources. In the West Bank, several shallow to medium in-depth wells in the north eastern aquifer are polluted with high nitrates and fecal coliforms levels, while the deep produce hard water. Jericho governorate, with its wells in the eastern aquifers, its water was mostly characterized as brackish and hard, with increasing trend of nitrate levels. In addition, Gaza has all its well heavily polluted with high nitrates and chlorides levels, in addition to some with pesticides. The three mentioned governorates have a50% population of Palestinians in the West and Gaza, with major agricultural activities and food supplies to the Palestinian people. So far, the only available water treatment option is reverse osmosis (RO) with disinfection with several private plants implemented in Gaza and Jericho. RO has an advantage of producing water with the desired quality, but major disadvantages as high energy demand (3-10 KWh/$m^3$), and around 80% water recovery that leaves around 20% as brines for disposal. Such an issues urges entrepreneurs with water and environmental sciences and engineering backgrounds to seek solution of water treatment technologies, that is robust, inexpensive, easily operated, meets the required quality, and with low energy demand. A water treatment method based on innovative capacitive electro-dialysis (CED) was developed through the second Palestinian and Dutch Academic Cooperation Program on Water (PADUCO2). A pilot scale model was used. The pilot setup was designed to treat

water for irrigation and drinking water purposes. The pilot CED device can be set to produce water with the required quality based on the purpose of use, and in this way a decrease in energy consumption can be achieved to make it competitive to traditional reverse osmosis systems and without affecting the quality of water, need for further treatment, and production of brines. For the purpose of testing the device, a sampling campaign for brackish water in Jericho was conducted in March 2018. Several samples were collected from groundwater wells and analyzed for salinity levels and heavy metals, in addition to the available water quality data from PWA's water information system, water quality maps for Jericho was produced and showed the need for proper water treatment to sustain people and agricultural needs. Parallel to the technical part of the project, entrepreneurial opportunities in water desalination in Palestine were also investigated and showed the need for investment in the sector through research, piloting, setting business plans, initiating startup activities, and also the need for incubators to guide and provide logistic supports to young entrepreneurs to create business in the desalination field.

## Safe Recycling of Hazardous Liquid Waste as a Tool to Avoid Water Contamination

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## Abstract

Until now, liquid hazardous wastes from generators in Palestine are still not dealt properly as they are either disposed into municipality main sewage network or thrown into wadies. Due to strict environmental regulations posed on Pharmaceutical companies, they send their liquid hazardous waste to treatment companies in Israel. Universities do separate and store their hazardous waste into small containers collected by local municipalities for final disposal. Amount of generated liquid hazardous wastes is still not known but still huge enough, hence essential safe and economical ways of disposing them is needed to protect ground water and environment.

From a chemist's point of view, it is feasible to reduce the volume or the hazardous characteristics of many chemicals by conducting reactions and other hazard reduction procedures in the university/industry laboratories. It is becoming increasingly common to include such reactions as the final steps in an experimental sequence. Such procedures, as part of an academic or industrial experiment, usually involve small amounts of materials which can be handled easily and safely by laboratory personnel. Performing a hazard reduction procedure as part of an experiment has considerable economic and environmental advantages by eliminating the necessity to accumulate, handle, store, transport, and treat hazardous waste after the experiment. Furthermore, the laboratory professional who generates the potential waste often has the expertise and knowledge to safely handle the materials and perform hazard reduction procedures.

Keeping up-to-date chemical inventories can also reduce the in-laboratory hazards by simply reducing the quantity of hazardous material on-site. From the hazardous waste inventory study carried out by EL-Hamouz (2010), it was estimated that universities undergraduate labs produce yearly around 4400l of hazardous waste.

There are various methods for physical and chemical treatment of hazardous wastes, as well as methods for recycling, reclamation, and recovery of valuable materials contained in the waste. These methods include neutralization, oxidation-reduction, distillation, digestion, encapsulation, and several forms of thermal treatment. While the expense and practicality of these technologies is largely based on the specific nature and volume of the material, treatment or recycling is preferable to incineration for some hazardous wastes. For example, high- and low-pH wastes may be neutralized, resulting in treatable wastewater and salts. Incineration of mercury and other toxic metals is restricted; recycling, recovery, or encapsulation is environmentally preferred.

Therefore, this project will focus on ways of treating/recycling these hazardous liquid wastes for further uses. University labs will be taken as a cases study, but the project will target liquid hazardous waste generated from Palestinian Industrial sector. The project aims at preventing hazardous liquid waste to be thrown into main sewage system and treat the waste in safe and economical way for further use.

## Efficiency Assessment of Water Providers Based on the Installation Scenarios of Prepaid Meters Using DEA Approach

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## Abstract

In recent times, a momentous increasing in the installation of prepaid meters to the customers for either new water connection or for replacement of current postpaid meters with prepaid system. This research evaluates firstly, whether there is a significant difference in the performance of the Palestinian water providers based on the level of installation the prepaid meters. Secondly, calculating the efficiency scores using Data Envelopment Analysis based on the scenarios of prepaid level. The multivariate analysis shows that there are significant differences in the non-revenue water and debt collection performance indicators of water providers based on the prepaid meter installation. A correlation analysis demonstrates that there is negative significant relationship between the roll-out of prepaid meters, and the performance indicators of non-revenue water, per capita consumption, financial loss, staff inefficiency and water intermittent in summer season. The “DEA” results reveal that minimum cost, maximum debt collection efficiency, and maximum number of served population, can be achieved through restructuring the water providers by changing their size to medium size and changing their current meters to prepaid system, other things being equal.

## Water purification from nitrate ions by electrochemical reduction on modified nanocomposite electrode catalysts

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## Abstract

Purification of water from the hazardous nitrate ions is being studied here. The electrochemical reduction study of nitrate is underway in an undivided electrochemical cell. Different nanocomposite electrodes have been prepared, modified and examined such as: FTO, graphite/FTO and Cu/graphite/FTO, MWCNT/FTO and Cu/MWCNT/FTO (Where: FTO is fluorine doped tin oxide transparent conducting film on glass; MWCNT is multiwalled carbon nano tubes). The electroreduction has been performed at relatively low working potential (~ -1.8 V) which is much lower than other literature reports. This shows the advantages of our work compared to others. Removal of ~75% of nitrate during the first 120 min, has been observed, which is another virtue for this work.

## Assessment and Removal of Heavy Trace Metals by Magnetic Multiwall Carbon Nanotube Decorated by Novel Functionality from Ground Water in Jericho, Palestine

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## Abstract

In the present study, monitoring of seasonal variations in the concentrations of heavy metals (Pb, Fe, Mn, Co, Cd, Cu, Cr, Fe) and Na in the Jericho well during the year 2018-1019. For this purpose, sample was collected from fourteen selected study sites during two seasons i.e. summer (September) and winter (March). The concentration of heavy metals in the water samples was measured by ICP-MS. Results have shown varying in the heavy metal levels from high concentration during summer and low concentrations during winter season.

The concentrations of Co, Cu, Cr, Ni, Cd and Mn were found to be under the allowable limits of EPA and WHO. Elevated concentrations of Fe were found at all Jericho well. Also, high concentrations of Pb were found at Al Masri, Savica, Mnasrah, Dawudi, Mkarkar and AL Qutob wells. High heavy metal concentration during summer may be refer to elevated water temperature which rise metal toxicity.

Jericho water wells is relatively saline and has been verified by analysis. The results indicate that sodium concentration is high in all wells. Therefore, the focus of this study will be on trying to solve this problem by preparing multiwall carbon nanotube functionalized with hydroxyl amine, cystine and hydrazine. The final products were characterized by Fourier Transform Infrared Spectroscopy (FTIR), Ramman spectroscopy, Scanning Electron Microscopy (SEM), Transition Electron Microscopy (TEM), Brunauer–Emmett–Teller surface area analysis (BET), and thermogravimetric analysis (TGA), Vibrating Sample Magnetometer (VSM).

Batch adsorption studies were conducted to study the effects of pH, temperature, time and initial concentration of metal. Adsorption isotherm, Kinetics and thermodynamics studies also conducted. Optimum pH for the present work was nearly at 8 for three adsorbents after short time at room temperature. The adsorption followed Lamgmire isotherm model with pseudo-second order. Flame Atomic absorption and flame emittion spectroscopy were used to measure the concentration of metals in water.

## Metals content, occurance and Distribution in soil of Al-Qilt catchment.

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## Abstract

Heavy metals pollution in Palestine soils was ignored for decades; anthropogenic pollution of soil has negative effect on the environment and human life. Determination of elemental background and identifying the anthropogenic pollution in Palestine soils will help in screening the anthropogenic metal-based pollution.

The objective of this research was to make an elemental background for soil's analysis in Palestine because there is no elemental background for soil's analysis in Palestine or Arab world, and there is dependence on the world reference, but there is different of the soil nature in Palestine or Arab world with other soils, and to study the pollution origin in soil of Al-Qilt catchment.

Soil samples from pristine areas of Al-Qilt catchments were analyzed and assessment of their content for heavy and trace metals. The sources and impact of anthropogenic pollution in Al-Qilt catchment soils were also discussed.

Samples a-long Al-Qilt catchment were collected. Then were digested by aqua regia, and analyzed by using BCR fractionation method.

Data were analyzed by computing the correlation coefficient of heavy and trace metals, and graphed against Al and Fe as reference elements to facilitate the comparison between Al-Qilt sites. Fe was chosen as elemental normalizer, based on the higher values of correlation factor ($R^2$) compared to Al. This allows identifying the trace metal as a man-made pollutant, then the Enrichment Factor (EF) was calculated, this lead to identification of anomalous metal concentrations that have an anthropogenic source.

The elemental background concentrations of anthropogenic pollution in the soil of Al-Qilt catchment were determined and compared to the continental crust values.

Results showed that metal/Al and metal/Fe normalization for Ti, V, Mn, Co, Rb, Ag, Li, B and Be were used as anthropogenic pollutants for most of Al-Qilt sites, As comparison the Fe was found to be the best elemental normalizer, The EF calculation showed that Pb had the highest value of trace metals in Ramallah and Stone cut areas, and there was a moderate values for Sn and Ag in Sweanit and Sultan respectively.

Sources for pollution in Al-Qilt catchment, from heavy metals concentration in the soils of Al-Qilt catchment are higher than the average values of continental earth crust, and thus such heavy metals are considered as soils' contaminants and they affect the surface and groundwater, and ultimately the people in the surround.

## Photocatalytic degradation of imidacloprid insecticides by Al-doped ZnO under solar light radiation.

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## Abstract

ZnO nanoparticles were modified by doping with Al in different molar percentage. The photocatalytic activity of different systems was studied against *imidacloprid insecticide* which is highly used in agriculture sector in Palestine. The presence of Al shows no effect on ZnO band gap which has been measured by UV-Vis absorption and luminescence emission spectroscopy. The value is (3.2-3.3 eV). However, the increase of Al content shows depression effect on photocatalytic activity of the catalyst which reaches zero percentage at 10% of Al. The rate of degradation reaction also decreases as Al% increases. The depression in activity and rate were explained by catalyst surface charge, based on zero-point charge measurement for the catalyst systems. At Al% is more than 6%, the zero-point charge value shifts from 7 to 9. The results show that using pristine ZnO nano-particles is advantageous over the Al-doped ones in photodegradation of *imidacloprid insecticide* in contaminated water.

## Synthesize and Characterization of Cellulose Derivataized with an Aromatic Amine and Application in Waste Water Purification

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## Abstract

A cellulose derivative with several coordination sites for metal ions composed of cellulose powder extracted from olive industry waste and 1,2-pheneylnediamine was synthesized and evaluated as an adsorbent for metal ions from sewage. The adsorption efficiency of the cellulose amine polymer toward Fe (III) and Cd (II) was investigated as a function of adsorbent dose, concentration temperature, pH, and time. The adsorption parameters that gives the highest adsorption efficiency were determined. In addition, the cellulose amine polymer showed an excellent efficiency toward approximately twenty metal ions present in the sewage sample. The highest adsorption efficiency was at pH of about 8.3, room temperature and with 2mg/ml of polymer dose.

The cellulose amine polymer has various coordination sites amine, hydroxyl, and aromatic groups. The diversity and frequency of the coordination was the reason for the high efficiency of the cellulose amine polymer toward the metal ions. The thermodynamic analysis results (The Gibbs energy ($\Delta G0$), enthalpy ($\Delta H0$), and entropy ($\Delta S0$) were calculated) supported the spontaneous adsorption efficiency of the polymer at room temperature. The kinetic study revealed that the metal ion adsorption by cellulose amine polymer was pseudo-second-order and followed the Langmuir isotherm model.

# Poster Presentations

## Purification of Water in Palestine from Persistent Pesticides using New Synthesized Cellulose Nanopartices

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## Abstract

The purpose of this research is to develop several new synthesized adsorbents of Nanocellulose based derivatives modified with suitable chemical reagents including Furan-2-carbonyl chloride, Pyridine-2,6-dicarbonyl dichloride, 2-amino Pyridine or 2-Pyridinecarbonyl chloride, in order to remove different persistent pesticides (such as difenoconazole, oxadiazon, endosulfan and malathion) from water to drinkable degree. Another approach will also be considered for removing pesticides from water is by using a membrane made from functionalized cellulose. In this project both approaches will be evaluated and comparison of the efficiency of both techniques will be determined.

We will design a mini-level laboratory station to verify the effectiveness of this new method, through the knowledge of the amount of each pesticide before and after the treatment.

## Clay-supported sensitized nano-ZnO in photocatalytic degradation of aqueous halophenols using direct solar light

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## Abstract

Among the various known types of pollution, water pollution is of a great concern since water is the prime necessity of life. Only 0.02% of the total water on the earth surface is suitable for drinking. Increased industrial, agricultural and domestic activities have resulted in wastewater containing different of toxic pollutants. A number of methodologies with varying degrees of success have been developed to manage water pollution.

This work describes the adsorption and photo catalytic degradation of aqueous 2-chlorophenol (2CP) contaminant using nano sized ZnO semiconductor photo catalyst. The ZnO particles are trapped into solid natural clay particles, producing a new highly active and easy to recover ZnO catalyst system. The degradation was performed under direct sun light. This research investigates the effect of sensitization on the photocatalytic efficiency. The prepared ZnO and prepared ZnO/natural clay systems were characterized by several methods, such as FT-IR, UV-Visible, Photoluminiscence, SEM and XRD which confirmed the ZnO formation in the composite catalyst. High Performance liquid chromatography was used to study the 2-chlorophenol adsorption and degradation. The results showed that the 2CP photo-degradation on the sensitized ZnO/clay occurred with highest activity (~64% + 0.01) loss of 2CP compared with ZnO/Clay composite catalyst (~56% + 0.01) loss of 2CP under direct sun light under natural conditions. Effects of different reaction parameters onto photo degradation reaction of 2CP by natural clay/ZnO catalyst have also been studied. The ability of catalyst recovery and reuse in photo-catalytic reactions was also studied, the recovered catalyst showed loss efficiency (~41%) of 2CP. Attempts were made to regenerate efficiency of recovered catalyst by adding new dye molecules. When calculating relative catalytic efficiency, in terms of turnover number, all recovered and regenerated catalysts maintained original efficiency of fresh samples

## Solar Light in Degradation of Organic Contaminants Present in Secondary Treated Waters

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## Abstract

Waste waters are being treated in Palestine at large scale in treatment stations in different areas. The stations use primary and secondary treatments for water, and the resulting water may still include different types of soluble organic contaminants. The produced waters are therefore unsafe to use by either humans or animals.Treatment of water by several methods such as chlorination, peroxidation, ozonation and UV radiation is being used globally.However, all these are costly. In our project we use direct solar light to photodegrade remaining organic contaminants of the treated water.Activated carbon supported ZnO (AC/ZnO)is used as photodegradationcatalyst. This method is safe as the organic materials are expected to be converted into safe mineral compounds. We have seen promising results. We found that the organic compounds exist in the treated water in concentrations up to 30 ppb. Out of these organics, 80% have been totally degraded leaving no organic traces, as confirmed by total organic carbon (TOC) analysis. We have studied different parameters(such as catalyst amount, temperature, pH and time) to find out the reaction optimum parameters. The results show that using0.2 gZnO per 100ml of wastewater,at pH 5.5 for 2 h give best results. Degradation efficiency was studied using UV / visible spectroscopy and TOC.The current stage of the project involves photo degradation using the supported system Ac/ZnO. The goal is to enable recycling of the catalyst for multiple reuse.

## Cellulose based film with antimicrobial activities

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## Abstract

Cellulose is a widely available natural product and has unlimited number of industrial applications. Various functionalities could be added to the cellulose backbone each serve certain commercial application.
In this work cellulose extracted from olive industry solid waste was converted to cellulose dialdehyde by oxidation with sodium periodate then reacted with the two fatty amines N-methyl decylamine and dodecyl amine, to form cellulose fatty imine which converted to cellulose fatty amine by reaction with NaBH $(OAC)_3$ and sodium borohydride. The produced cellulose fatty amine showed plastic behavior.
The structures of the prepared cellulose aldehyde, cellulose fatty amine were investigated by FT-IR and Scanning electronic microscope (SEM). Several solutions of both cellulose fatty amines and cellulose triacetate with various rations were prepared and casted into films. The films morphologies were investigated by SEM, the SEM images showed excellent distribution of calluses fatty amine and cellulose acetate with strong bonding.
The produced films were clear and transparent. Various physical properties of the films such as tensile strength, Elongation, softening temperature (Tg) were evaluated.
The results showed that the film could suiatbe for food and drink warping. The antimicrobial activity of the produced films were evaluated against three types of bacteria two gram negative and one gram positive.
Both polymers showed excellent activities after 24 hr. against gram negative (klebsiella pneumonia, E. coli), the activity reached about 99 % and medium activity against the gram positive bacterial (staphylococcus).
The ability of the film to absorb nitrate ions from water was studied but the film showed no efficiency toward nitrate ion.

## Assessment of $TiO_2$ as photo catalyst for complete mineralization of aqueous bacteria and their organic contents

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## Abstract

Phtodegradation is one of the most useful water purifications means as it involves at a later stage the mineralization of chemical or pollutant contaminants within the water. Photo catalytic activity using titanium dioxide $TiO_2$ utilizes the longest wavelength located at the end of ultraviolet. In this work water was purified from negative and positive bacteria by complete mineralization using $TiO_2$ of both types (Rutile and Anatase) using UV tail in solar simulated radiation. The results obtained revealed the high efficiency of $TiO_2$ (Anatase) in the destruction of bacteria and mineralization. This catalyst was able to destroy the bacteria G +ve S. aureus and baptized after exposure to 4 hours of light. The catalyst also proved its ability to inhibit bacteria in the dark but to a lesser extent than under radiation. It is therefore recommended to expand the present study and include other types of biological pollutants. Study of other factors that might optimize the photo mineralization reaction.

## Polyacrylic acid with amide crosslinks decorated with silver nanoparticles: synthesis and application in wastewater Treatment

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## Abstract

In this study, Polyacrylic Acid with amide crosslinked (PAA) was decorated with Silver Nanoparticles (NPs). The resulting polymers PAA and PAA with silver NPs (PAA-Ag) were characterized by IR spectrophotometer. Both were used as adsorbents for Lead(II) and 5- Fluorouracil from aqueous solutions. The adsorption efficiency of each adsorption process was investigated as a function of adsorbent dose, adsorbate concentration, contact time, temperature and pH value.

Tendency of prepared PAA-Ag for extracting Pb(II) from water was evaluated and compared to PAA. It was observed that adsorption of lead on PAA-Ag and PAA was affected by the amount of PAA-Ag until the equilibrium level. The optimum pH value for lead adsorption was 7.33 and 4.7 for PAA-Ag and PAA respectively and the equilibrium was established within the first 10 min adsorption was done at room temperature. It was found that Lead adsorption kinetics has followed pseudo-second-order. Experimental data were analyzed using two model equations: Langmuir and Freudlinch and it was found that the data fitted well with Freundlich isotherm model.

Meanwhile, PAA-Ag was used as adsorbents for the removal of 5-FU from aqueous solution. The concentration of 5-FU in the supernatant was measured by UV-vis spectrophotometer. It was observed that adsorption of 5-FU was affected by the amount of PAA-Ag until the equilibrium level. The optimum pH value for 5-FU adsorption was 8.18 and the equilibrium was established in 5 min. It was also evident that the adsorbed 5-FU was decreasing as the concentration of 5- FU was increased in solution. It was found that 5-FU adsorption kinetics has followed pseudo-second-order. And it was found that the data fitted well with Langmuir isotherm model.

## Cellulose grafted with b-cyclodextrin for waste water purification from toxic metal ions

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## Abstract

Three polymers of crosslinked cellulose and β-cyclodextrin (A, B, and C) were designed and synthesized. The cross-linking agent used for this purpose was citric acid. Various proportion of the three materials were used for preparing the polymers. The polymer structures were determined by FT-IR and the polymer morphologies were studied by SEM. The adsorption efficiency of the three cellulose-β-cyclodextrin polymers toward Pb(II) from an aqueous solution was investigated as a function of adsorbent dose, temperature, pH and time, the adsorption parameters that lead to an excellent adsorption efficiency were determined. The high adsorption efficiency of the cellulose polymers could be attributed to the presence of various coordination sites which includes carboxyl, hydroxyl and β-cyclodextrin. Thermodynamic analysis results support the high adsorption efficiency of the polymer. The adsorption process fits well with the second pseudo order model and the adsorption isotherm follows a Freundlich isotherm model. Polymer 2 that contains the largest quantity of citric acid showed the highest efficiency toward lead (II). This could be due to the availability of carboxyl groups.


# 2nd MP WR

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