Mohamed Ateia

New Materials for Removal of Emerging Pollutants from Water

Mohamed Ateia, PhD

Department of **E**nvironmental **E**ngineering and **E**arth **S**ciences
Clemson University

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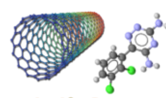
Education

Agricultural Engineering
BSc.
2009

Civil & Env. Engineering
MSc.
2014



Civil & Env. Engineering
Ph.D.
2017

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Work Experiences

Mechanical Engineer	Researcher	Postdoc Fellow
06/2009 – 04/2010	05/2010 – 03/2012	10/2017 – Current
Moon Trucks Co.	King Saud University	Clemson University
Egypt	Saudi Arabia	USA

Internship

- **08/2015 (2 months): Visiting Researcher**. Department of Chemistry, University of Copenhagen, Denmark.
- **07/2015 (3 months): Visiting Researcher**. Department of Chemistry, University of Copenhagen, Denmark.
- **08/2013 (2 weeks)**: Science Communication for Global Scientists – Overseas Internship. London, UK.

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Water Treatment History

4000 B.C. | 1500 B.C. | 1700s | 1800s | 1900s | NOW

Sand Filters | **Boiling** | **Cloth water filter** | **Sunlight**

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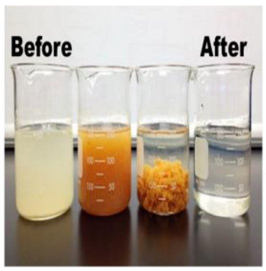
Water Treatment History

4000 B.C.	1500 B.C.	1700s	1800s	1900s	NOW



Ancient Egypt

Alum
"شبة"

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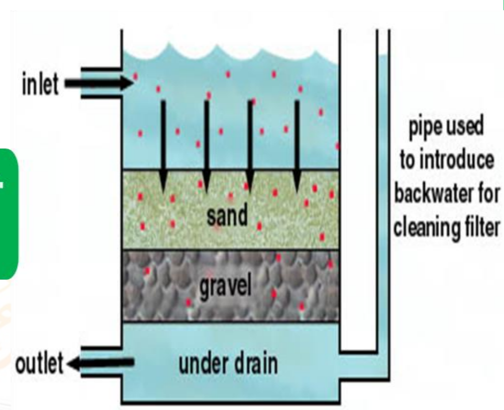
Water Treatment History

4000 B.C.	1500 B.C.	1700s	1800s	1900s	NOW

- Increase usage of filtration.
- No water quality measurements, yet!



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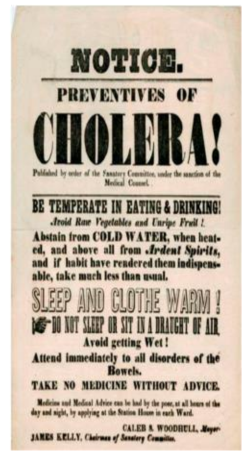
Water Treatment History

4000 B.C. | 1500 B.C. | 1700s | **1800s** | 1900s | NOW



- Identification of waterborne disease (cholera!)
- > 150,000 people died in Europe.

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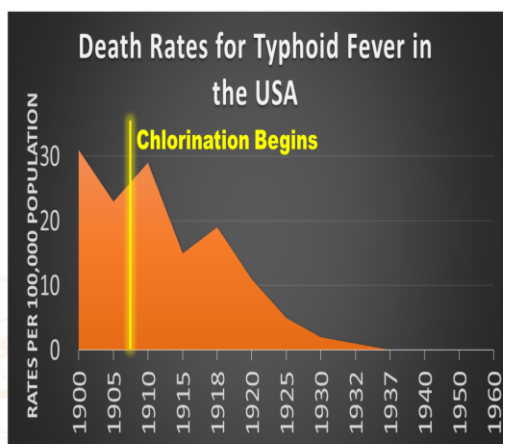
Water Treatment History

4000 B.C. | 1500 B.C. | 1700s | 1800s | **1900s** | NOW

- Identification of pathogens in drinking water in US
- Application of **disinfection.**



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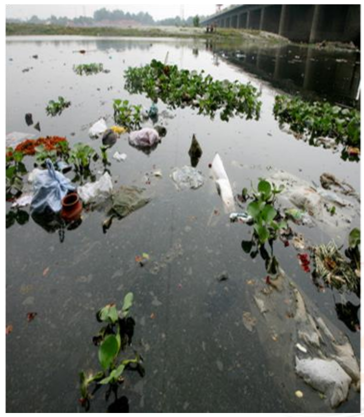
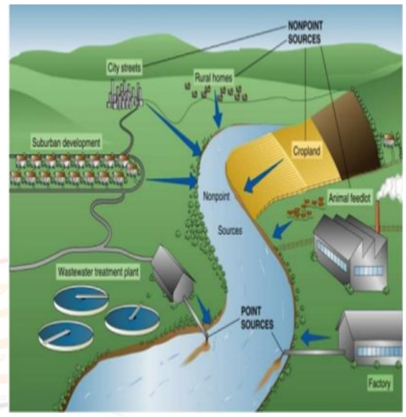
4000 B.C. | 1500 B.C. | 1700s | 1800s | 1900s | NOW

Surface Water Pollution





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4000 B.C. | 1500 B.C. | 1700s | 1800s | 1900s | NOW

Groundwater Pollution

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4000 B.C.	1500 B.C.	1700s	1800s	1900s	NOW

Oil Pollution

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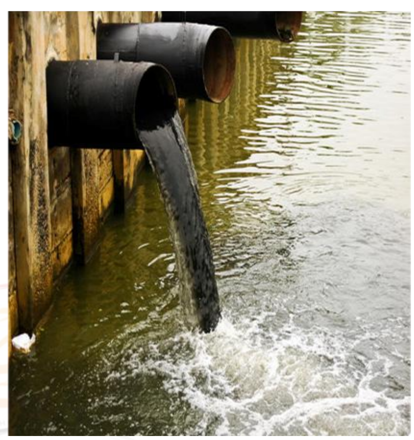
4000 B.C.	1500 B.C.	1700s	1800s	1900s	NOW

Chemical Water Pollution



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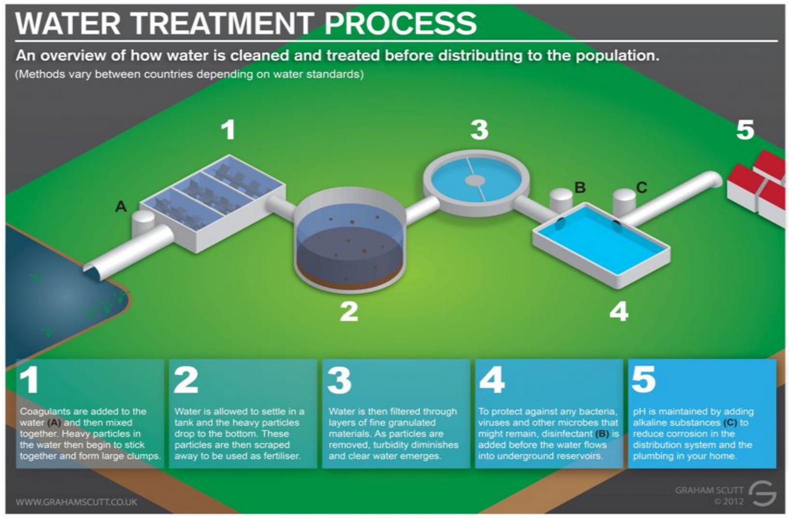

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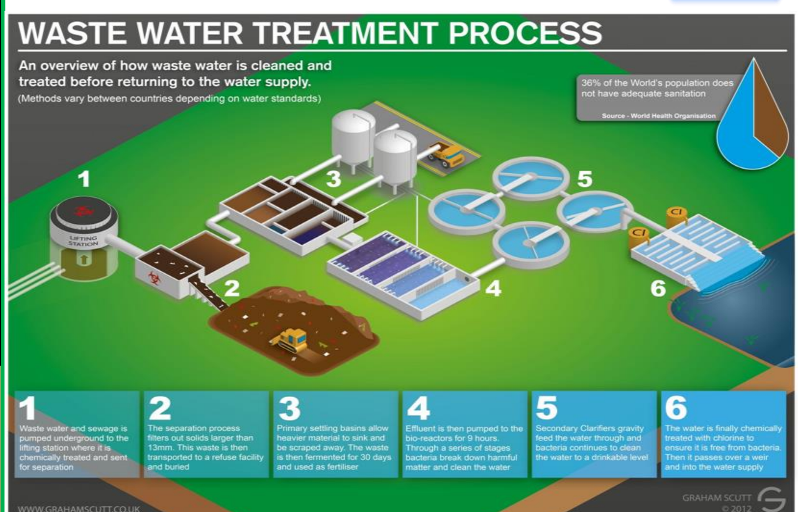

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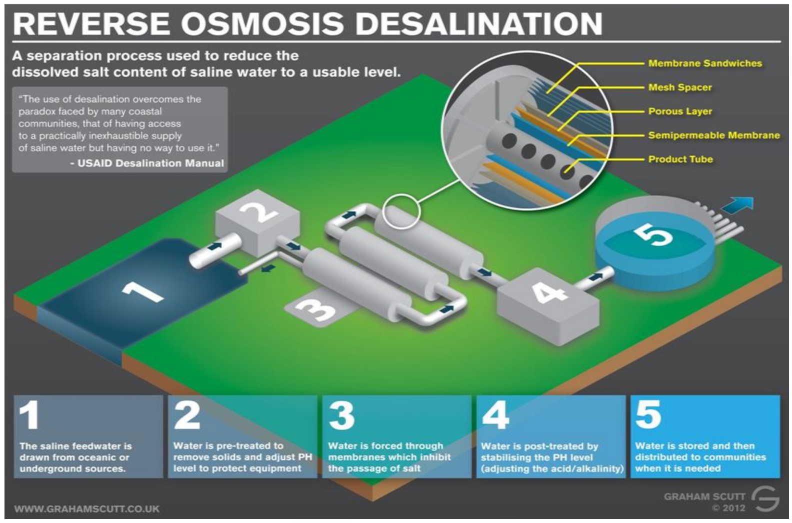

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Techniques for Pollutants Removal from Water

- Biological
- Chemical
- Physical

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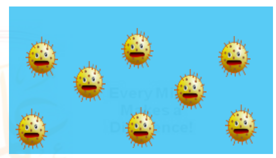
Techniques for Pollutants Removal from Water

Biological

Chemical

Physical

- Examples: Biodegradation & Activated Sludge.
- Mechanism: Organic compounds can be absorbed and/or metabolized by plants and/or microorganisms.
- Pros: Low cost & Easy to operate.
- Cons: Long treatment time, not stable "efficiency", & Requires big treatment facilities.



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Techniques for Pollutants Removal from Water

Biological

Chemical

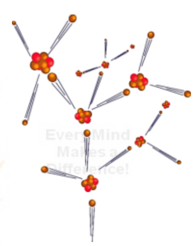
Physical

- Examples: Advanced Oxidation & Photolysis (Fenton).
- Mechanism: Utilization of radicals (HO·) to mineralize organic compounds or degrade them into biodegradable compounds.
- Pros: Effective for organics and heavy metals removal.
- Cons: It involves the use of expensive reagents leading in high treatment cost & Requires pretreatment.

$$Fe^{2+} + H_2O_2 \rightarrow Fe^{3+} + HO^- + HO^\bullet$$

$$Fe^{3+} + H_2O + UV \rightarrow Fe^{2+} + HO^\bullet + H^+$$

$$H_2O_2 + UV \rightarrow HO^\bullet + H^+$$



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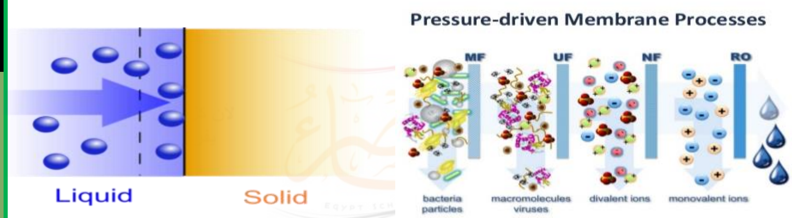
Techniques for Pollutants Removal from Water

Biological

Chemical

Physical

- Examples: Membranes & Adsorption (AC & CNT).
- Mechanism: When a solution containing absorbable solute comes into contact with a solid with a highly porous surface structure, liquid–solid intermolecular forces of attraction cause some of the solute molecules from the solution to be concentrated or deposited at the solid surface.
- Pros: Simple design, investment in term of both initial cost and land required, High efficiency & Easy to operate.
- Cons: High recovery cost, the efficiency deceases with the recycling & Spent adsorbent may be considered a hazardous waste.



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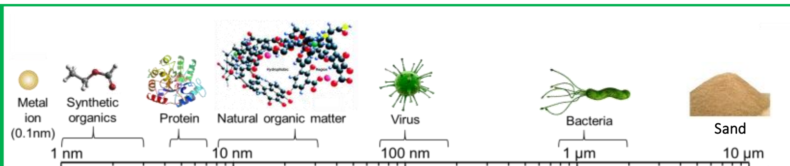

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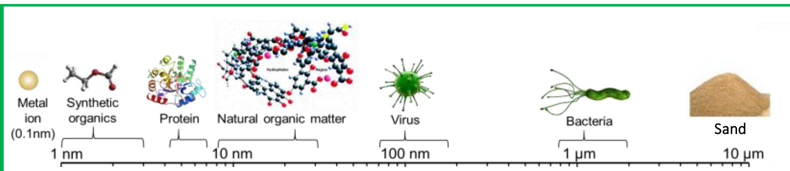

Advancement in Analytical Techniques + **Unregulated Industrial/Agricultural Chemicals**

Emerging Pollutants

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analytical chemistry — Review — pubs.acs.org/ac

Water Analysis: Emerging Contaminants and Current Issues

Susan D. Richardson*[†] and Thomas A. Ternes[‡]

[†]Department of Chemistry and Biochemistry, University of South Carolina, Columbia, South Carolina 29205, United States
[‡]Federal Institute of Hydrology, Koblenz, D-56068, Germany

■ CONTENTS

■ INTRODUCTION

This biennial Review covers developments in water analysis for emerging environmental contaminants over the period of October 2015−October 2017. *Analytical Chemistry*'s policy is to limit reviews to a maximum of ~250 significant references and to mainly focus on new trends. Therefore, only a small fraction of the quality research publications is discussed. The previous Water Analysis review (with Susana Kimura) was published in 2016.[1] This year, Thomas Ternes has joined back again to cover the section on Pharmaceuticals and Hormones.

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Examples

- SUCRALOSE AND OTHER ARTIFICIAL SWEETENERS
- NANOMATERIALS
- DRINKING WATER AND SWIMMING POOL DISINFECTION BYPRODUCTS
- PER- AND POLYFLUOROALKYL SUBSTANCES
- SUNSCREENS/UV FILTERS
- ALGAL TOXINS
- PHARMACEUTICALS AND HORMONES
- BROMINATED AND EMERGING FLAME RETARDANTS

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Science

An antibiotic-resistant strain of typhoid fever has sickened more than 2,000 people in Pakistan so far this year: Public health experts worry it could soon spread to other countries:

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'Frightening' drug-resistant strain of typhoid spreads in Pakistan

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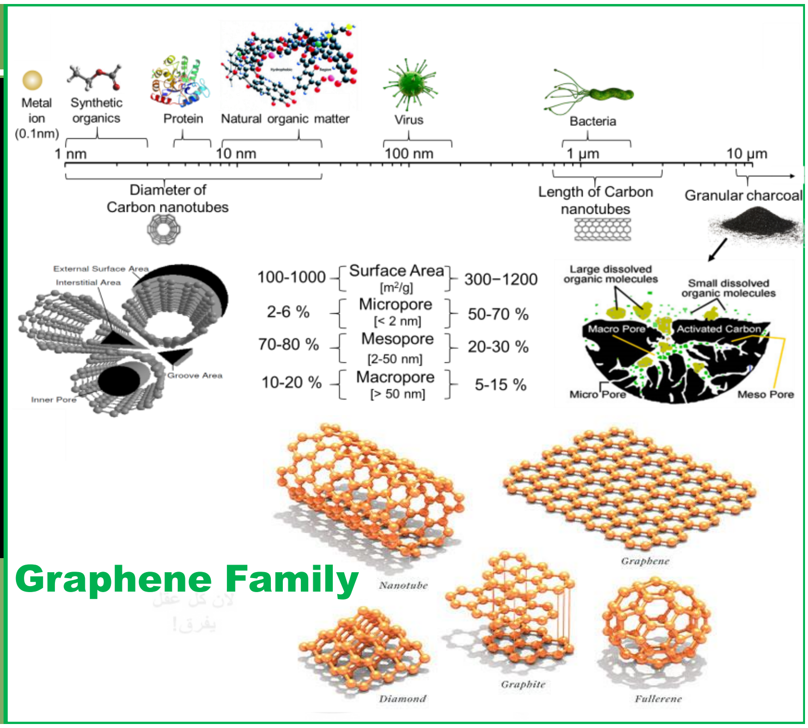

Graphene Family

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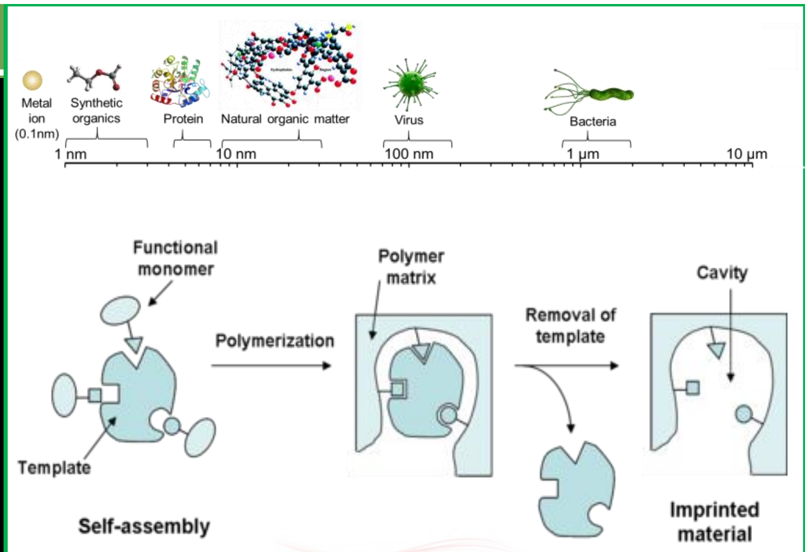

Molecular Imprinted Polymers (MIPs)

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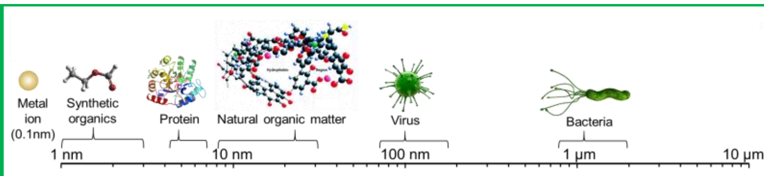

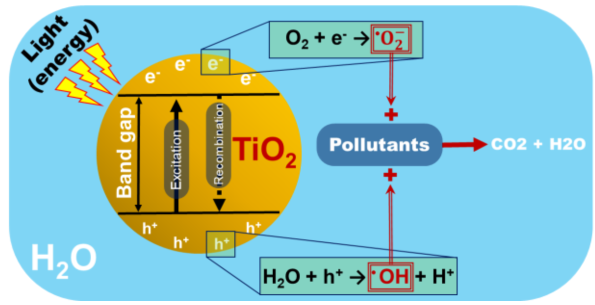

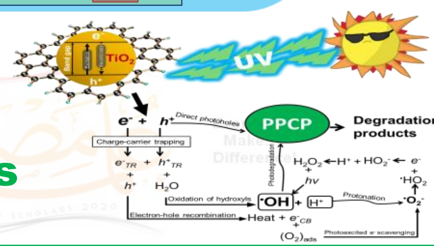

Photocatalysts

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Q & A