



PROVIDING ACCESS TO CLEAN WATER THROUGH NANOTECHNOLOGY

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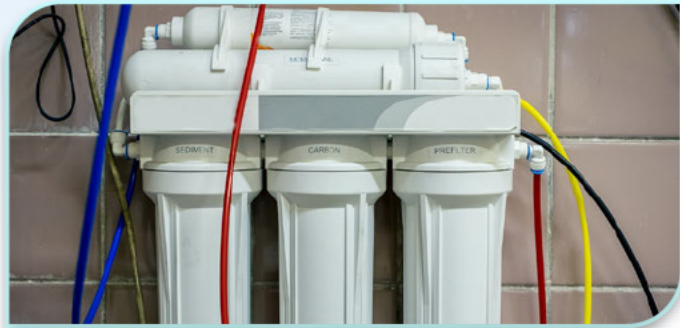


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ALARMING STATISTICS

- 2021 UNESCO World Water Report
 - **4 billion** people in **low-income countries**
 - **Huge decline** in the normal water supply [1,2]
 - About **830,000 deaths** recorded
 - Unsafe water management
 - Unsafe sanitation practices [3]
 - **No access to technologies** for effective water sanitation and purification [4]

TECHNOLOGIES USED FOR WATER PURIFICATION^[4]



Conventional Filtration Method

Use of **disinfectants/chemicals** in water treatment



Desalination

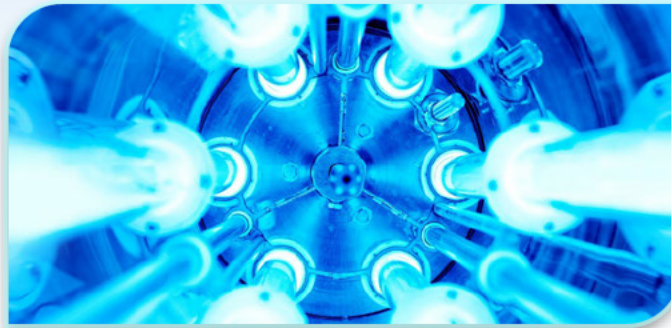
Removal of organic/
harmful **salts** from water

TECHNOLOGIES USED FOR WATER PURIFICATION, CONT'D^[4]



Decentralized Distillation

Filtration/distillation used to purify **ground water**



Ultraviolet Radiation

Use of **ultraviolet lights** to purify water



Nano-enabled Technologies

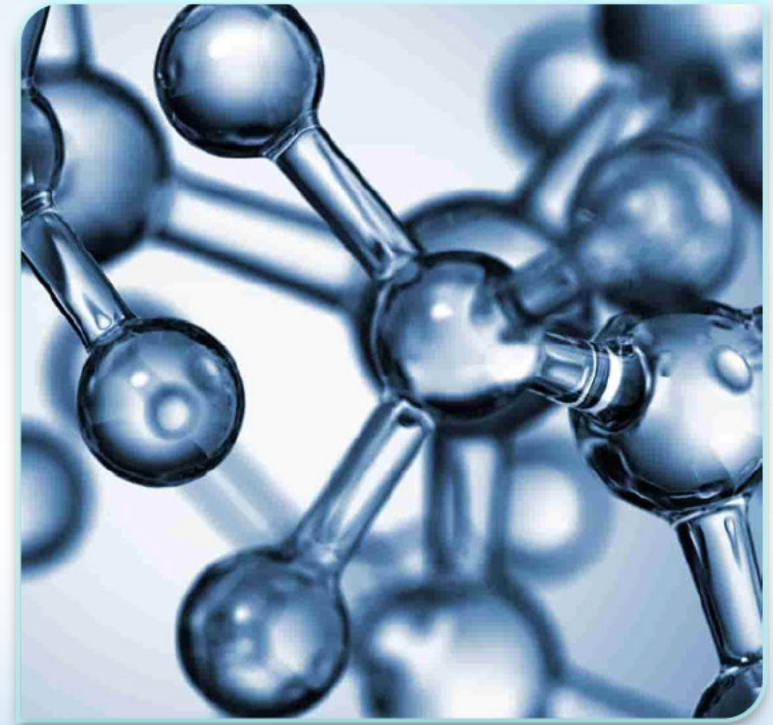
Use of **nanomaterials** in water treatment

PROBLEM IDENTIFICATION

- Different technologies have enabled proper unclean water sanitation globally
- Research supports **transition to nano-enabled technologies**
 - Effective
 - Secure
 - Sustainable

NANOTECHNOLOGY: AN OVERVIEW

- Nanotechnology in Engineering
 - Application of science to **control** things on a **molecular level** [5]
- **Cross-disciplinary** uses
 - Medical diagnostics
 - **Energy** generating **nanosystems**
 - Nuclear plants
 - Hydroelectric power plants
 - Solar panels



MANUFACTURING MECHANISMS

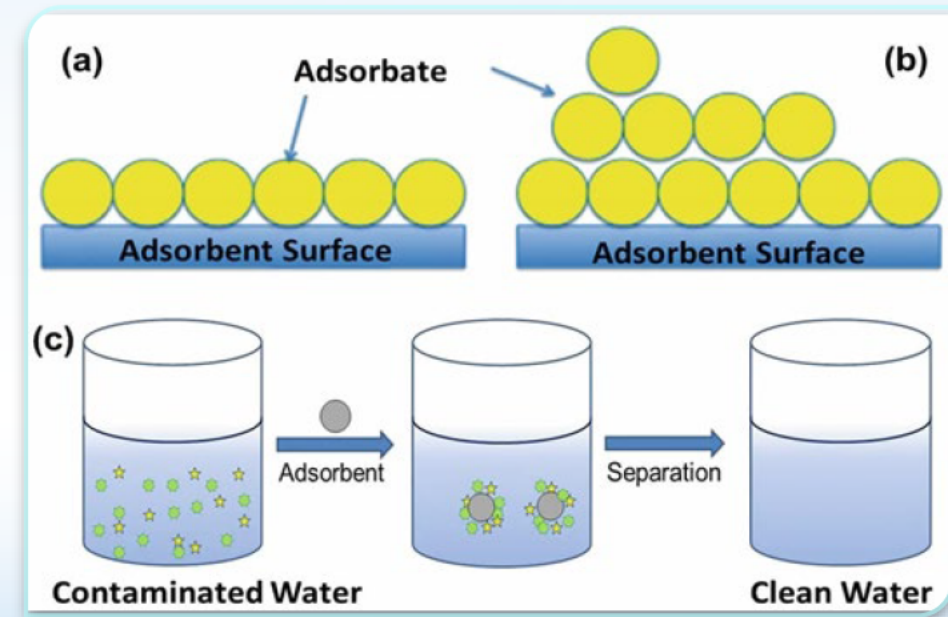
- Ongoing **evolution** of nanotechnologies
- Utilize **specialized membranes** that undergo **rigorous processing** [6]
 - Nanomagnetic materials
 - Nanoparticles
 - Nanoporous particles
- **Water purification** applications
 - **Modification** and **testing**

WATER PURIFICATION USING NANOTECHNOLOGY

- **Three major types** of nanomaterials used in modern water purification [7]
 - **Nanoadsorbents**
 - **Nanometals** and their **oxides**
 - **Nanomembranes** and **nanofilters**

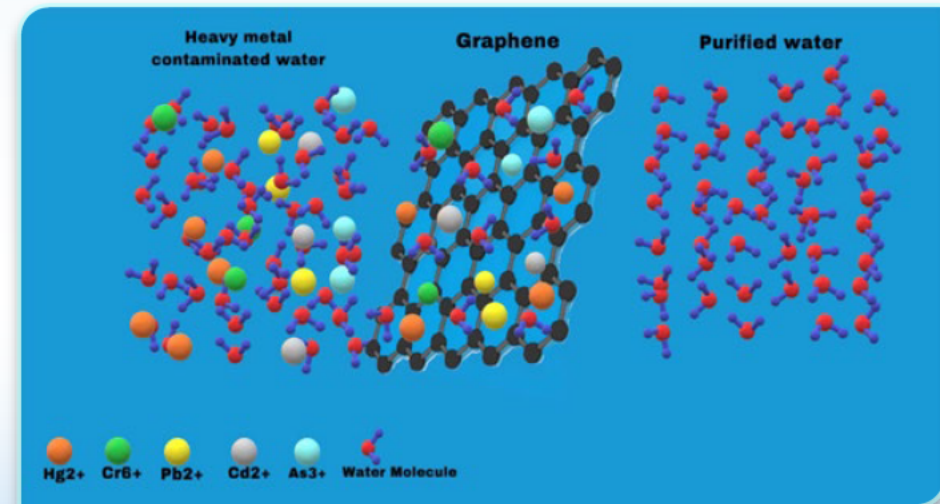
NANOADSORBENTS

- **Neutralizing** ground water **microbes** [8]
- **High internal surface area**
 - Contaminated water gets stuck and **filtered out**



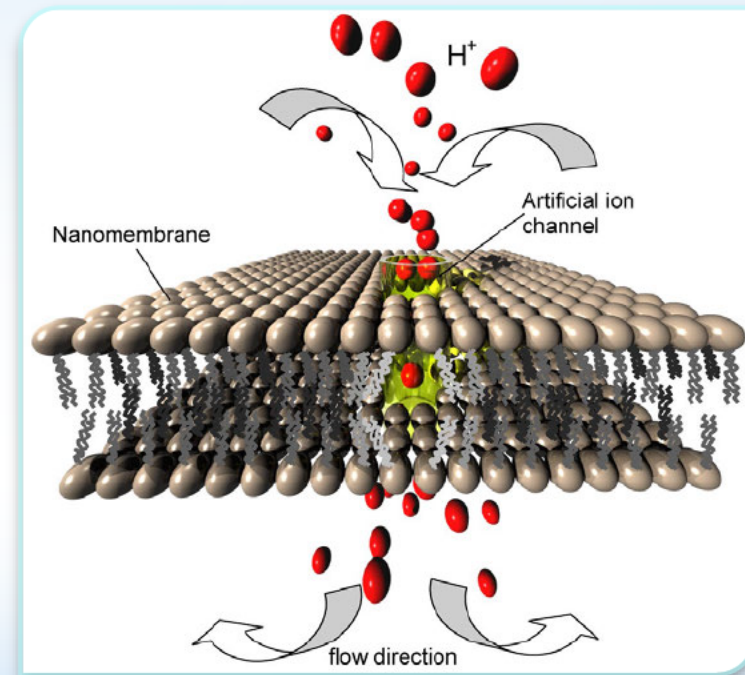
NANOMETALS AND THEIR OXIDES

- **Removal of radionuclide pollutants by diffusion** [7]
- Graphene commonly used [9]
 - Quasi-metal



NANOMEMBRANES AND NANOFILTERS

- **Mechanical** contaminant separation and **filtration**
 - Designed to **discriminate** based on **molecular size** [7]



SOME DRAWBACKS

- High **energy consumption** [8]
- Sometimes implements “visible light”
 - **Not accessible** in many **developing countries** [7]
- All nanomembranes undergo **damage** during major water treatment processes [7]

FUTURE OF NANOFILTRATION

- Ongoing research and development
- Room to grow
 - **Financial accessibility**
 - Regional awareness
 - **Developing countries** with low income **are most affected** [8]

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