



Emerging Pollutants: Protecting Water Quality for the Health of People and the Environment

Removal of emerging pollutants from urban water: Alternation of existing tertiary treatment process by using heterogenous photo-Fenton process

Dr. Yunus Ahmed

19 January 2023, 09:50 CET



Global Water Scarcity

About 4 billion people experience water scarcity during at least one month of the year.
(Mekonnen and Hoekstra, 2016)



Over 2 billion people live in countries experiencing high water stress.
(UN, 2018)



844 million people lack access to a basic drinking water source.
(UNICEF)

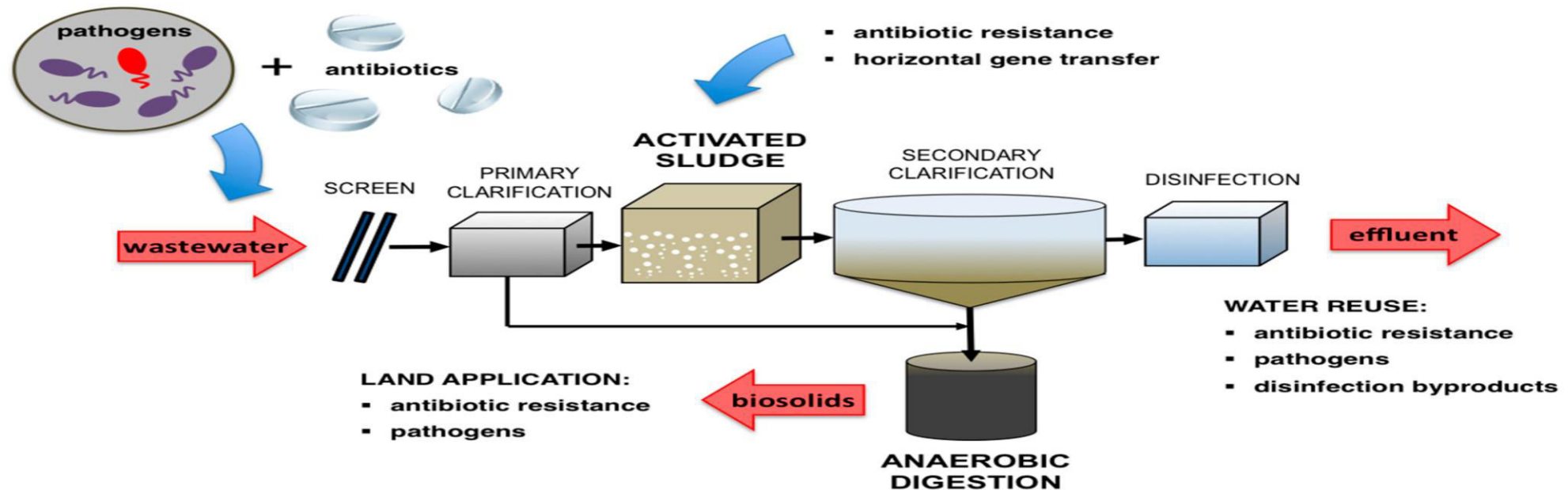
700 million people could be displaced by intense water scarcity by 2030.
(Global Water Institute, 2013)



Industrialisation and Urbanisation are changing the amount and quality of water resources.



Conventional WWTP Plants and Efficiency

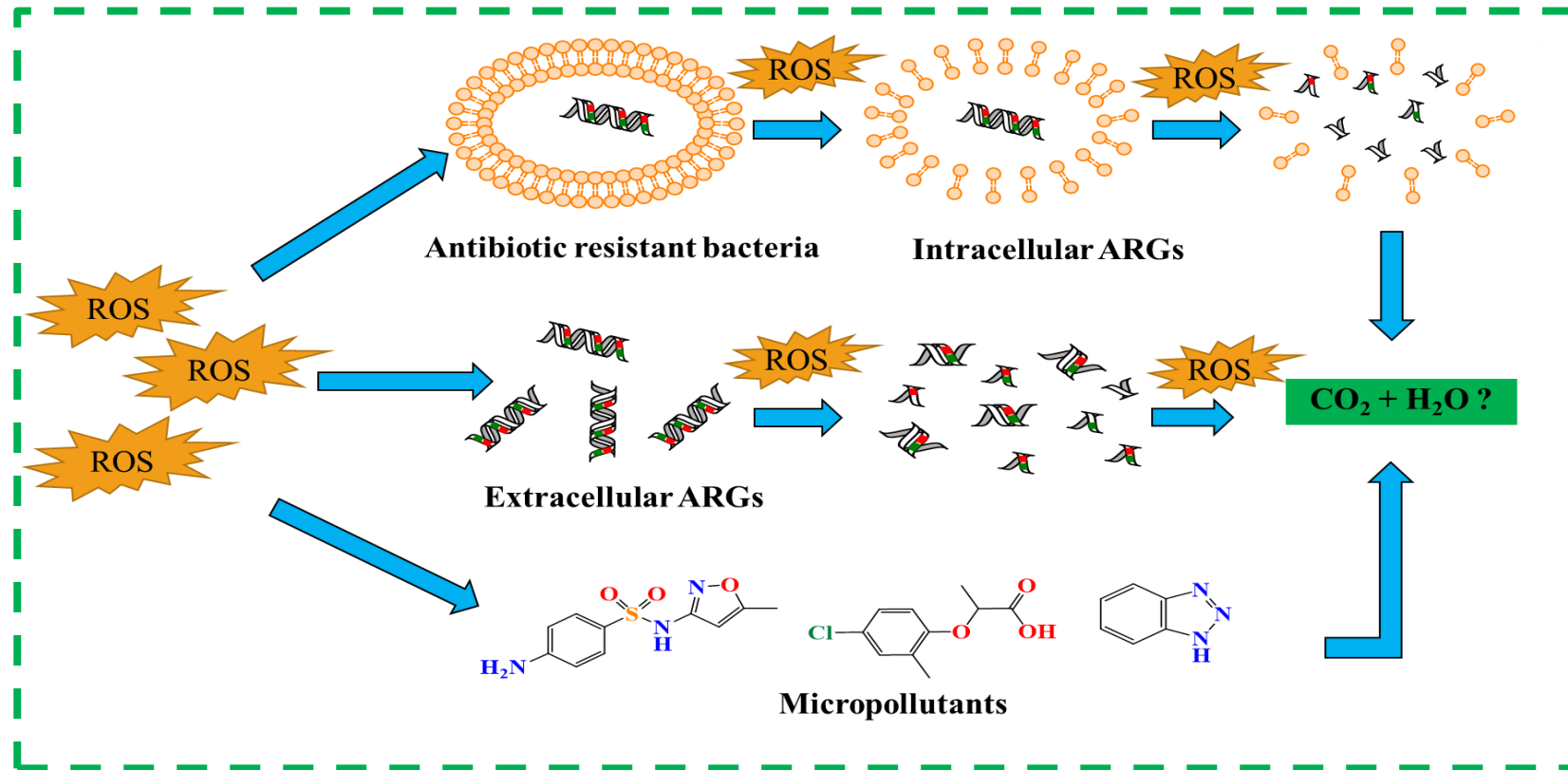


Main process for contaminants removal		Performance
MPs	Activated sludge	Negative removal, (Average ~61%)
ARB and ARGs	Disinfection	Varies, (average 3.0 log)

What Happens If not Fully Treated

- ❖ If **ARB** were not killed completely, the **residual ARB** could **spread antibiotic resistance** not only via vertical gene transfer, but also through horizontal gene transfer as the donor.
- ❖ If **ARG** were not damaged completely, the **residual ARGs** could be **uptaken by a recipient** through transformation, thus resulting in the dissemination of antibiotic resistance too.
- ❖ If **MP** were not degraded completely, it will affect the **aquatic environment** by increasing toxicity, endocrine disruption, and antibiotic-resistance development in microorganisms as well as **human chronic diseases**.

Which Processes Do We Expect ?



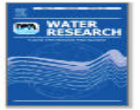
Not only inactivate ARB, but also degrade ARG and MP completely !

Research outcome of photo-Fenton process

- Removed 6-log ARB and e-ARG
- Higher treatment time and doses are required for i-ARGs than ARB.
- Faster degradation of long amplicon ARG than short amplicon ARG.
- Simultaneous removed ARB, ARG, and MP.
- >6-log ARB reduction occurs after 30 min, without further regrowth risk.
- Extracellular ARG was completely removed after 10 min treatment.
- The removal efficiency of five representative MP was up to 99%.



Water Research
Volume 179, 15 July 2020, 115878



Efficient inactivation of antibiotic resistant bacteria and antibiotic resistance genes by photo-Fenton process under visible LED light and neutral pH

Yunus Ahmed ^{a, b}, Ji Lu ^a, Zhiguo Yuan ^a, Philip L. Bond ^a, Jianhua Guo ^a



Water Research
Volume 197, 1 June 2021, 117075



Simultaneous removal of antibiotic resistant bacteria, antibiotic resistance genes, and micropollutants by a modified photo-Fenton process

Yunus Ahmed, Jiexi Zhong, Zhiguo Yuan, Jianhua Guo

Research outcome of heterogeneous photo-Fenton process

- Simultaneous **removal of ARB, ARG, and MP.**
- **>6-log ARB** reduction occurs after 30 min, without further regrowth risk.
- Extracellular **ARG was completely** removed after 7 min treatment.
- The removal efficiency of our **representative MPs was up to 99%.**
- This nanocatalyst has **photocatalytic and good recyclability.**
- The proposed process is an optimistic **‘one-stop’ solution.**



ACS Publications
Most Trusted. Most Cited. Most Read.

Search text, DOI, authors, etc.



RETURN TO ISSUE

< PREV

TREATMENT AND RESOUR...

NEXT >

ENVIRONMENTAL
Science & Technology

Simultaneous Removal of Antibiotic Resistant Bacteria, Antibiotic Resistance Genes, and Micropollutants by FeS₂@GO-Based Heterogeneous Photo-Fenton Process

Yunus Ahmed, Jiexi Zhong, Zhiliang Wang, Lianzhou Wang, Zhiguo Yuan, and Jianhua Guo*

✓ Cite this: *Environ. Sci. Technol.* 2022, 56, 21, 15156–15166

Publication Date: June 27, 2022 ✓

<https://doi.org/10.1021/acs.est.2c03334>

Copyright © 2022 American Chemical Society

[RIGHTS & PERMISSIONS](#)

Share Add to Export



Article Views

1360

Altmetric

-

Citations

-

[LEARN ABOUT THESE METRICS](#)

Read Online



PDF (3 MB)



Get e-Alerts

Acknowledgements

Supervising team



Australian Government

Australian Research Council

Research Training Program (RTP) Scholarship