ROLE OF AOPS IN WASTEWATER REUSE TREATMENT SOLUTIONS: IMPLEMENTATION OF EU-REUSE REGULATION

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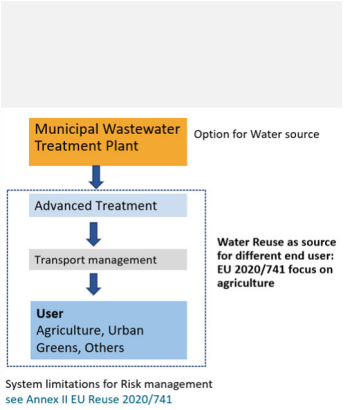

The German Federal Ministry of Education and Research (BMBF) initiated a program to develop flexible and reliable concepts for sustainable water reuse. This program is supporting the implementation of the Regulation (EU) 2020/741 of the European Parliament and of the Council on minimum requirements for water reuse (the Water Reuse Regulation).
In the development program are 4 projects evaluating the water source municipal wastewater for reuse. All 4 projects are focusing on the topic reuse of municipal wastewater but have specific objectives and goals. **PU2R** is developing decentralized systems for domestic wastewater. **FlexTreat** and **Nutzwasser** are investigating at centralized wastewater treatment plants. **HypoWave+** is implementing a hydroponic system as sustainable solution for resource efficient agricultural reuse. The results from the projects give an overview of different investigated treatment technologies and solutions. The investigated technologies include e.g. membranes, oxidation- and disinfection technologies and media filtration. To achieve the requested treatment goals single treatment steps and different treatment trains are investigated. The overall goal is to generate experiences and knowledge to support the implementation of the EU Regulation in Germany

Introduction

In the past years Water Scarcity limits the availability of water sources to fulfill the needs for agriculture and urban irrigation (EU Commission 2018; MKUNLV 2011). Germany set up a government funded program to develop flexible and sustainable concepts for water reuse to support the implementation of Regulation (EU) 2020/741 **[5]**. Finally 4 projects were evaluated and approved and started in spring 2021 and ends in 2024:

Flextreat Coordination Thomas Wintgens RWTH, Aachen; ***HypoWave+*** Coordination Thomas Dockhorn TU Braunschweig; ***Nutzwasser*** Coordination Jörg Drewes TU, München; ***PU2R*** Coordination Aki Sebastian Ruhl Umweltbundesamt Berlin

Material and Methods

Investigated Treatment Process

PU2R [1] is developing decentralized systems for domestic wastewater. The project concept is to build a mobile treatment plant which can treat the water during transporting the wastewater from a decentralized collection systems to agriculture fields. **FlexTreat [2]** and **Nutzwasser [3** focusing on centralized wastewater treatment plants. In both projects different treatment combinations are investigated to achieve required water quality. The project work-packages include several aspects: a) Technology evaluation including capex- and opex- calculations, b) Validation of disinfection log removals, c) risk management and regulatory aspects for implementation reuse in Germany. **HypoWave+ [4]** is implementing a hydroponic system as sustainable Solution for resource efficient agricultural reuse.

Results and Discussion

All projects using municipal wastewater as resource for agricultural reuse. The system limitations for the investigated solutions and risk management are shown in figure 3. This includes the necessary treatment step, the water transport and distribution to the end user and the water usage at the point of use. The Risk Management builds on the EU minimum requirement but also takes into account further containments and risks e.g. Antibiotic Resistance (bacteria, genes), Microplastics, Chemicals of Emerging Concerns (increasing list of compounds e.g PFAS), Nutrients (N, P) and Salts.

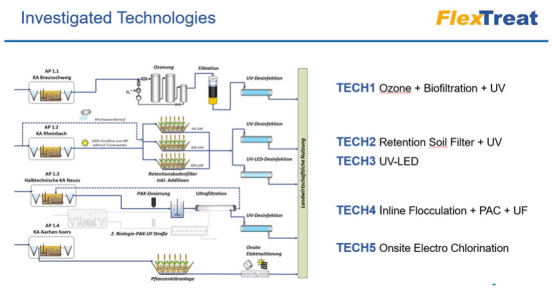

Figure1: Investigated Treatment Trains in FlexTreat project

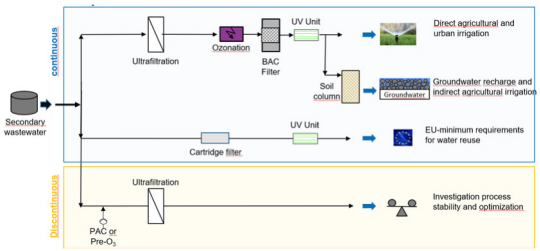

Figure2: Investigated Technologies in *Nutzwasser* project

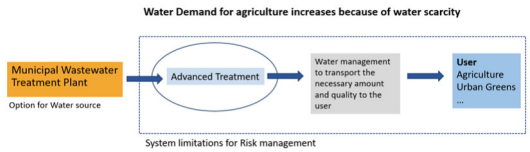

Figure3: System limitations for Risk Management

Conclusions

The overall result from the projects gives an overview of different treatment technologies and solutions. The investigated technologies include e.g. membranes, oxidation, disinfection and media filtration (see figures 1 and 2). To achieve the requested treatment goals single treatment steps and treatment trains are investigated. Beside the minimum requirements stated by the regulation EU 2020/741 other treatment goals are investigated e.g. reduction of micro pollutants. There is an upcoming need to combine the quality requirements (water reuse) with the requirements for micro-pollutant reduction (compare new EU Urban Wastewater Directive UWWTD).

Acknowledgements

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References

[1] PU2R: Verbundprojekt zur Wiederverwendung von häuslichem Abwasser | Umweltbundesamt
[2] FlexTreat: Das Projekt - RWTH AACHEN UNIVERSITY FLEXTREAT - Deutsch (rwth-aachen.de).
[3] Nutzwasser**:** Nutzwasser - Aktuelle Meldungen zum Verbundvorhaben: Nutzwasser
[4] HypoWave+: HypoWave plus: HypoWave
[5] REGULATION (EU) 2020/741 https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0741