

Smart resilience for your water supply

Digital Twin technology to optimise the operation of drinking water treatment plants

“DrinkIA – Digital Twin[®]” technology is a decision support system developed by researchers of the University of Girona in order to optimise drinking water treatment plants' operation from an integrated approach and to address the main demographic, climate and health challenges of their management.

The complexity of drinking water treatment plants (DWTPs) is growing. On the one hand, microbiological pollution risks due to disinfection by-products should be minimized. On the other hand, new challenges come up as a result of drought and flooding's episodes linked to climate change, population growth, pandemics like COVID-19 or the rise of energy prices.

Decision Support Systems (DSS) integrate different mathematical and artificial intelligence models with the knowledge of experts in order to solve problems in a structured way. Therefore, DSS are a good tool to help DWTPs technicians and managers in complex decision-making processes.

DrinkIA – Digital Twin[®] is the first decision support system that optimises DWTPs' operation from an integrated approach and contributes to increase the resilience of these facilities to the numerous changes they experience (variation in inlet water quality and quantity, new pollutants, new legislation, climate change, etc...).

The system's architecture has three hierarchic levels: 1) data acquisition and processing, 2) diagnosis and 3) supervision.

DrinkIA-Digital Twin[®] has been developed for six years within the framework of a collaboration between UdG LEQUIA research group and water utility Ens d'Abastament d'Aigua Ter-Llobregat. In 2018 Botín Foundation awarded the initiative with the “Prize to the Young Talent for the Sustainable Water Management”.



Innovative aspects and competitive advantages:

- DrinkIA-Digital Twin® extracts data from an online data acquisition system and allows the user editing the values to assess different treatment scenarios.
- Modular system that can be adapted to different types of facilities.
- Experimental knowledge module to mitigate the formation of disinfection by-products (DBPs) by means of profuse characterization of natural organic matter (NOM) with HPLC chromatography and UV-VIS spectroscopy.
- Data-based modules to predict chemical dosage, formation of trihalomethanes and filter management.
- Expert knowledge-based modules to predict the dosage of disinfectants and coagulants, microbiologic risk and water distribution management.

Benefits for DWTPs:

- Increases the capacity of DWTPs' users through modelling and production tools.
- Improves the understanding of processes through treatment scenarios.
- Quantifies risks and consequences of some actions in the formation of disinfectant by-products and microbiological risk.
- Real time decision support system to deal with variations in inlet water quality.
Increases the autonomy of shift work operators', especially outside office worktime.
- Increases the system's resiliency to changes and upheavals.
- Reduces costs linked to bad decisions.

Status of technology development. Since September 2018, DWTPs of Llobregat and Abrera have a prototype of DrinkIA-Digital Twin® technology installed. Both facilities provide five million people in Barcelona and its metropolitan area with potable water.

Desired cooperation. We seek companies and entities to 1) validate and implant **DrinkIA-Digital Twin®** technology in drinking water treatment plants, and/or 2) develop new modules and applications.

Research team. Laboratory of Chemical and Environmental Engineering of the University of Girona, Catalonia, Spain (LEQUIA). **Contact:** Dr Hèctor Monclús, hector.monclus@udg.edu