

Partner Universities

INTRODUCING THE 25+ YEARS OLD ENVIRONMENTAL POLLUTION AND TREATMENT RESEARCH GROUP AT UNIVERSITY OF UDINE, ITALY

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The Environmental pollution and treatment research group belongs to the Polytechnic Department of Engineering and Architecture (DPIA) at University of Udine (Italy), and was founded in 1995 by prof. Daniele Goi, who is currently Associate professor of Environmental Sanitary Engineering, and other colleagues and technicians working in the environmental field within Friuli Venezia Giulia region. University of Udine was founded in 1978 thanks to a popular initiative following the 1976's earthquake that severely struck the area. University of Udine is currently structured in 8 Departments and at present involves about 15,000 students, 700 professors, 500 technical and administrative personnel.

More specifically, the Environmental pollution and treatment research group is active in the broad field of **water, wastewater and waste characterization and treatment**. A large number of collaborations has been established throughout time at **local, national and international level**, including both public authorities, water utilities, private companies, universities. The group involved in this large timeframe a wide number of students, researchers, and technicians: in 25 years of activities, more than 100 bachelor's and master's degree thesis were produced in the water, wastewater and waste treatment field, together with 20 Ph.D. programs, belonging to the course of "Environmental and Energy Engineering Sciences" at University of Udine. A spin-off company was founded by the researchers employed in the group in 2008, which performed experimental and research activity in connection with the group itself until 2016.

The activities carried out during the most recent years included:

- Energy recovery from anaerobic digestion (AD) of liquid and solid substrates, both in mono-digestion and co-digestion mode, aimed at exploiting local circular economies with an increase in renewable energy generation in biogas form. In particular, recent research activities were aimed at assessing the energy potential of sea-grass from the High-Adriatic coast, either alone or in co-digestion with sewage sludge. In addition, different pre-treatments were investigated on sewage sludge AD, with the overall aim of improving energy generation, reducing environmental emissions and leading to a positive economic balance;
- Characterization of municipal and industrial sludge from different scale wastewater treatment plants



University of Udine: location.



A PhD student working on a wastewater treatment pilot plant.



(WWTPs) aimed at assessing its properties for a safe agricultural reuse, enhancing the knowledge about substrate's composition (including macro- and micronutrients, heavy metals, emerging pollutants) before agricultural reutilization;

- Advanced oxidation processes (AOPs), including ozonation and sonication, for wastewater remediation and reuse, considering the required legislative standards and the peculiar effluent characteristics. Water recovery and reuse through fertigation practices can lead to a virtuous paradigm where both nutrients and water present in wastewater are exploited in a safe manner;
- Life cycle assessment modelling, aimed at evaluating the environmental impacts of alternative waste management strategies (e.g., AD, composting, landfill), considering meaningful impact categories such as global warming potential, eutrophication, ozone depletion;
- Respirometric tests, as a useful technique to characterize biomass and wastewater streams from WWTPs. This assay can help in obtaining a detailed influent and sludge characterization in view of the application of mathematical modelling, but also give insights in toxic or inhibitory effects to the biomass. More recently, respirometry has been proposed also to evaluate the activity of microalgae technologies for wastewater remediation;
- Mathematical modelling of processes and multi-parameter techno-economic optimization, with the purpose of improving WWTP operations and proposing innovative solutions to exploit and connect renewable energy generations within WWTPs, leading to an energy and economic saving.

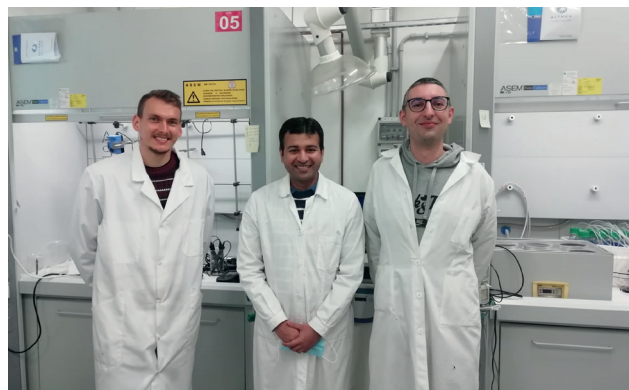
The Group is recently proposing a new paradigm-project considering a partnership, as suggested by the 2030 Agenda for Sustainable Development, adopted by all United Nations Member States (Sustainable Development Goals 6, 12, 17), with water&waste management companies and Friuli Venezia Giulia Regional Authority for water and waste services (AUSIR). The target is to organize a place in which students, scholars and people together are sharing, teaching and learning water&waste awareness within their own territory. A Technical Scientific Committee was instituted to reach in next years the objective to translate theories to practices and common understanding.

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A bench top pilot plant to study wastewater biological treatment.



Some PhD students and postdoctoral researcher in chemistry laboratory.



A Christmas lab meeting.



Friuli Venezia Giulia water&waste management companies, AUSIR and University of Udine join a partnership.