

Activities in Wastewater Treatment Plants

Laboratori d'Enginyeria Química i Ambiental

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Introduction

Our research group have a wide experience in the field of wastewater treatment plant control and supervision, mainly in the application of natural computing techniques to improve management of real plants. Though we started with a classical approach, applying our previous experience in the control of lab bioreactors, soon we realised that classical control methods show some limitations when dealing with complex environmental processes. Based on this idea, we have been working for more than ten years in close association with several research groups on Environmental Engineering, Chemical Engineering and Artificial Intelligence, concluding that it is necessary to integrate an array of specific supervisory intelligent systems and numerical computations for detailed engineering, when trying to manage optimally complex environmental problems. In this sense, our research covers different topics such as data mining, signal filtering, simulation, modelling, soft computing, knowledge-based systems, case based reasoning and transition networks.

Another important line in our department consists of sludge revalorization. It is based on the transformation of surplus biological sludge from wastewater treatment plants to activated carbon. The adsorption capacity of this carbon is used to remove refractory and non-biodegradable compounds contained in wastewater.

A third line focuses on attached growth systems, specifically on a Submerged Biological Contactor, which carry out the nitrification of the secondary effluent from a large wastewater treatment plant. The aim of the project is to determine the ammonia oxidisers and nitrite oxidisers activities and to study the effect of operational conditions and toxicants on them. The results are then related with data on the biofilm community, obtained with molecular biology techniques.

Life Cycle Analysis is a new line that is emerging recently in our department, mainly focused on energy evaluation in wastewater treatment processes. In this sense, we have joined a Spanish dynamic network in research and development of Life Cycle Analysis.

Fundamental projects

Financial support from the Spanish Government

- Development of a knowledge based system for the supervision and retrofit of biotechnological processes. Bio94-0679-C02
- Application of knowledge based systems in the management of biologic wastewater treatment plants: simultaneous removal of carbon, nitrogen and phosphorous. CICYT Amb 97-889
- Molecular analysis of bacterial communities related to nitrification/denitrification treatments. Application to improve wastewater treatment plant performance. CICYT Bio96-1229

Financial support from the Catalan Government

- Impact assessment of small villages (< 2000 inhabitants) discharge into the rivers of Alt Empordà.
- Evaluation of nutrient removal process in big (>10000 inhabitants) wastewater treatment plants)
- Transformation of surplus biological sludge from WWTP into activated carbon

Financial support from private enterprises, e.g.

- Improvement of wastewater treatment plant performance by simulation, with Fundació Aigües de Barcelona
- Application of expert systems as a tool to improve wastewater treatment plant operation, with Consorci per a la Defensa de la Conca del Riu Besòs)
- Optimisation of different industrial wastewater treatment plants, with ESTEVE QUÍMICA, S.A; MENADIONA, S.L. and MEDICHEM, S.A.

List of researchers in Laboratori d'Enginyeria Química i Ambiental (LEQUIA)

Manel Poch, Marilos Balaguer, Miquel Rigola, Jesús Colprim, Maria J. Martín, Ignasi R.-Roda, Joaquim Comas, Estefania Amer, Elvira Serra, Esther Llorençs, Jordi Bartrolí, and Oriol Gutierrez.