COST Water_2020

CONCEIVING WASTEWATER TREATMENT IN 2020
Energetic, environmental and economic challenges
(ES1202)

WG1 Energy Efficient Technologies

06, 2016

What's Inside

ACTIVITIES & EVENTS

Chair

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About WG1

Objectives

To assess the state of the art, maturity and energy requirement of innovative efficient technologies for wastewater treatment.

Energetic self-sufficiency

Options for minimising energy consumption and optimising energy production are investigated, aiming at converting WWTPs in net energy providers. This includes activities on energy efficient processes, such as low-temperature autotrophic nitrogen removal, anaerobic – aerobic hybrid MBRs, membrane aerated biofilm reactors, supercritical water oxidation, etc.; as well as on energy recovery alternatives, like sewage sludge (co-)incineration or anaerobic (co-)digestion, microalgae photobioreactors integrated with anaerobic (co)digestion and bioelectrochemical systems (microbial fuel cells, hydrogen, etc.).

WG1 ORGANIZATION – TASK GROUPS

- **TG1 Energy Efficient Nutrient Removal**
- **TG2 Membrane Bioreactors**
- **TG3 *(joined with WG3)* Micropollutants and Recalcitrant**
- **TG4 Efficient Sludge Technologies**
- **TG5 Anaerobic Treatment of Wastewater**
- **TG6 Aerobic Granular Reactors**

TG1 HIGHLIGHTS

Leader

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Presentation and Objectives

Water 2020 TG1 gathers academia and water industry partners to assess the state of the art, maturity and opportunities for efficient technologies for nutrients removal in WWTPs in energy and cost effective way.

TG1 — Energy efficient nutrient removal

List of Publications

- Bertanza, G., Pedrazzani, R., Manili, L. Menoni, L. (2013) Bio-P release in the final clarifiers of a large WWTP with co-precipitation: key factors and troubleshooting. Chemical Engineering Journal, 230 195-201.
- Cema G., Żabczyński S., Ziembińska-Buczyńska A. (2015) The assessment of the coke wastewater treatment efficacy in rotating biological contractor. Water Science & Technology, 73(5), 1202-1210.
- Corbala-Robles L., Volcke E.I.P., Samijn A., Ronsse F., Pieters J.G. (2016) Effect of foam on temperature prediction and heat recovery potential from biological wastewater treatment. Water Research, 95, 340-347.
- Daelman M.R.J., van Voorthuizen E.M., van Dongen U.G.J., Volcke E.I.P., van Loosdrecht M.C.M. (2015) Seasonal and diurnal variability of N2O emissions from a full-scale municipal wastewater treatment plant. Science of the Total Environment, 536, 1-11.
- Díez-Montero, R., De Florio, L., González-Viar, M., Herrero, M., & Tejero, I. (2016) Performance evaluation of a novel anaerobic–anoxic sludge blanket reactor for biological nutrient removal treating municipal wastewater. Bioresource Technology, 209, 195-204.
- Díez-Montero, R., De Florio, L., González-Viar, M., Volcke, E. I. P., & Tejero, I. (2015) Feasibility of hydraulic separation in a novel anaerobic–anoxic upflow reactor for biological nutrient removal. Bioprocess and Biosystems Engineering, 38(1), 93-103.
- Guerrero, J., Guisasola, A., Baeza, J.A. (2015) Controlled crude glycerol dosage to prevent EBPR failures in C/N/P removal WWTPs. Chemical Engineering Journal, 271, 114-127.
- Gutwiński P., Cema G. (2015) Removal of Nitrogen and Phosphorus From Reject Water Using Chlorella vulgaris Algae After Partial Nitrification/Anammox Process. Water Environment Research, 87(1), 63-69.
- Gutwinski P., Cema G., Ziembinska-Buczynska A., Surmacz-Gorska J., Osadnik M. (2016) Startup of the Anammox Process in a Membrane Bioreactor (AnMBR) from Conventional Activated Sludge. Water Environment Research, 88, accepted for publication.
- Isanta E, Reino C, Carrera J, Pérez J. (2015) table partial nitritation for low-strength wastewater at low temperature in an aerobic granular reactor. Water Research, 80, 149-158.

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- Karło A., Wilk A., Ziembińska-Buczyńska A., Surmacz-Górska J. (2015) Cultivation parameters adjustment for effective algal biomass production. Annual Set The Environment Protection Rocznik Ochrona Środowiska, 17, 275-288.
- López, L.R., Díniz, T., Mora, M., Lafuente, J., Gabriel D. (2016) Influence of trickling liquid velocity and flow pattern in the improvement of oxygen transport in aerobic biotrickling filters for biogas desulfurization: Journal of Chemical Technology & Biotechnology, 91, 1031-1039.
- López, L.R., Dorado, A.D., Mora, M., Gamisans, X., Lafuente, J., Gabriel, D. (2016) Modeling an aerobic biotrickling filter for biogas desulfurization through a multi-step oxidation mechanism: Chemical Engineering Journal, 294, 447-457.
- Machado, V.C., Lafuente, J., Baeza, J.A. (2015) Model-based Control Structure Design of a Full-Scale WWTP under the Retrofitting Process. Water Science and Technology, 71.11:1661-1671.
- Mampaey, K.E., De Kreuk, M.K., van Dongen, U.G.J.M., van Loosdrecht, M.C.M., Volcke E.I.P. (2016) Identifying N2O formation and emissions from a full-scale partial nitritation reactor. Water Research 88, 575-585.
- Mampaey, K.E., van Dongen, U.G.J.M., van Loosdrecht, M.C.M., Volcke, E.I.P. (2015) Novel method for online monitoring of dissolved N_2O concentrations based on gas phase measurements. Environmental Technology, 36(13), 1680-1690.
- Midyurova, B., Bonev, B., Nenov, V. (2015) Power generation using modified cathodes in aircathode microbial fuel cell. Ecological Engineering and Environment Protection, No 2, 35-40.
- Midyurova, B., Yemendzhiev, H., Tanev, P., Nenov, V. (2015) Application of ceramic materials in microbial fuel cell design, Journal of Chemical Technology and Metallurgy, 50, 4, 543-550.
- Mora, M., Dorado, A.D., Gamisans, X., Gabriel, D. (2015) Investigating the kinetics of autotrophic denitrification with thiosulfate: modeling the denitritation mechanisms and the effect of the acclimation of SO-NR cultures to nitrite. Chemical Engineering Journal, 262: 235-241.
- Mora, M., Lopez, L.R., Lafuente, J., Pérez, J., Kleerebezem, R., van Loosdrecht M.C., Gamisans, X., Gabriel, D. (2016) Respirometric characterization of aerobic sulfide, thiosulfate and elemental sulfur oxidation by S-oxidizing biomass: Water Research, 89, 282-292.
- Nenov, V., Jemendjiev, H., Peeva, G., Bonev, B., Zerrouq., F. (2016) Recovery options in conventional wastewater treatment plants (WWTPs). J. Mater. Environ. Sci. 7 (1), 113-122.
- Peeva, G., Nenov, V. (2015) pH control during the struvite precipitation process of wastewaters, Journal of Water Resource and Protection (JWARP) Accepted for publication (Wed 10/7/2015 10:55 AM); Paper ID: 9402698

- Radev, D., Peeva, G., Nenov, V. (2015) pH Control during the Struvite Precipitation Process of Wastewaters, Journal of Water Resource and Protection, 7, 1399-1408.
- Sánchez, A. Artola, X. Font, T. Gea, R. Barrena, D. Gabriel, M.Á. Sánchez-Monedero, A. Roig, M.L. Cayuela, C. Mondi (2015) Greenhouse gas emissions from organic waste composting. Environmental Chemistry Letters, 13 (3), 223-238.
- Tayà, C., Garlapati, V.K., Guisasola, A., Baeza, J.A. (2015) Assessment of crude glycerol for Enhanced Biological Phosphorus Removal: stability and role of long chain fatty acids. Chemosphere, 141, 50-56.

Projects

- Optimization of an innovative low cost integrated biological process for nutrient removal from wastewater. Environmental Engineering Group (University of Cantabria), SADYT and Centro para el Desarrollo Tecnológico Industrial (Spanish Government). 2015-2017.
- Integrated technology for improved energy balance and reduced greenhouse gas emissions at municipal wastewater treatment plants “BARITECH” - This project is founded from Norway Grants in the Polish-Norwegian Research Programme operated by the National Centre for Research and Development.
- Production of sustainable energy from wastewater by microbial electrolysis cells. VALTEC13-1-0140. Generalitat de Catalunya. GENOCOV (UAB). 01/01/2014 - 31/12/2015. PI: Albert Guisasola Canudas.
- Development of an energetically self-sufficient urban wastewater treatment plant through autotrophic nitrogen removal in the mainstream and phosphorus recovery. CTQ2014-60495-R. MINECO. UAB. 01/01/2015 - 31/12/2017. PI: Juan Antonio Baeza and Julián Carrera.
- Scale-up of low-carbon footprint material recovery techniques in existing wastewater treatment plants (SMART-Plant). Call H2020-WATER-2015-two-stage, ID 690323. EU H2020, WATER-1b-2015. 01/05/2016 - 31/04/2019.: Project coordinator UVerona: Francesco Fatone. UAB: Juan Antonio Baeza.
- LIFE14 ENV/ES/000633 – LIFE SAVING-E “Two-Stage Autotrophic N-remoVal for mainstream sewaGe trEatment”. The challenge of SAVING-E is to radically redesign the urban WWTPs in a way they become energy-producers rather than energy consumers, without affecting its performance or even improving it. More information www.saving-e.eu. Follow us on Twitter: @Life_SAVING_E
- RETOS 2015 - CTQ2015-69802-C2-1-R–SONOVA “SONOVA: Development of a comprehensive treatment process for SOx and NOx from flue gas addressed to waste gases valorization”.
- CYTED network 316RT0508 - TRITÓN “Treatment and Recycling of Industrial Waters Through Sustainable Solutions Based in Biological Processes” (Tratamiento y Reciclaje de Aguas Industriales Mediante Soluciones Sostenibles Fundamentadas en Procesos Biológicos). The treatment and recycling of industrial water is a problem that is not completely solved in Latin America. This problem is worse for Small and Medium Enterprises (SMEs), which often do not have sufficient means and knowledge to address the problem. In addition, the lack of harmonized legislation hinders the transfer and application of

technologies between companies in different countries. TRITON network aims the treatment and recycling of wastewaters from the Latin American SMEs through sustainable solutions based in biological processes. More information http://triton-cyted.com/ (in Spanish). Follow us on Twitter: @triton_cyted.

Conferences

- Baeza, J.A. Biological nutrient removal: mathematical modelling as a good strategy for control system design. Activated sludge 100 plus 1 years. New trends and perspectives. Palermo (Italia), 11 May 2015.
- Baeza, J.A., Guerrero, J., Guisasola, A. Optimising a novel SBR configuration for Enhanced Biological Phosphorus Removal and Recovery (EBPR2). EuroMed 2015 Desalination for Clean Water and Energy, Palermo (Italia), 10-14 May 2015.
- Blázquez, E., Lafuente, J., Gabriel, D. Biotrickling filtration of High loads of Ammonia: a lab-scale experience. Oral Presentation. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.
- Blázquez, E., Baeza, J.A., Gabriel, D., Guisasola A. Promoting autotrophic sulfate reduction in bioelectrochemical systems. Oral Presentation. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.
- Cema, G., Szatkowska, B., Gutwiński, P., Ziembińska-Buczyńska, A., Płonka, L., Karło, A., Surmacz-Górska, J. Impact of NOB activity on single stage partial nitritation/Anammox. IWA 3rd Specialized International Conference Ecotechnologies for Wastewatewr Treatment 2016 ecoSTP16; Cambridge, UK, 27-30 Jun 2016
- Dimitrova, Y., Nenov, V. Sea water desalinating by Microbial Fuel Cell- Fourth National Conference with International Participation and Youth Scientific Session „Ecological Engineering and Environment Protection "(EEEP'2015) 3-6 June, 2015.
- Gabriel, D., Gamisans, X. (2015) Biological desulfurization of biogas: developments, challenges and opportunities. 5th International workshop on higher education, Vic (Spain), June 2015.
- Gabriel, D. Role and diversity of microbial cultures in bioreactors for waste gas treatment: biogas desulfurization as a case study. International Workshop: "From hell to heaven: extremophiles for environmental biotechnology". IRTA, Caldes de Montbui (Spain). July 2015.
- Guimerà, X., Dorado, A.D., Bonsfills, A., Gabriel, D., Gamisans X. (2015) Effect of biomass density on oxygen diffusivity measured inside biofilms with a MEA Sensor. 7th European Meeting on Chemical Industry and Environment (EMCHIE 2015), Tarragona (Spain), June 2015.Guimerà, X., Moya, A., Gabriel, D., Villa, R., Dorado, A.D., Gabriel, G., Gamisans, X. Simultaneous oxygen and pH profiling within biofilms using a minimally invasive multielectrode array sensor. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.
- Gutwiński, P., Cema, G., Ziembińska-Buczyńska, A. The anaerobic ammonium oxidation process start-up In membrane bioreactor (MBR) – a lab-scale experiment. IWA Specialist Conference Nutrient Removal and Recovery: moving innovation into practice. 18-21 May 2015, Gdańsk, Poland.

- Gutwiński, P., Cema, G., Surmacz-Górska, J. Lead (Pb) Inhibition of Anammox Biomass After Short-Term Exposure – Batch Experiments" 8th Eastern European Young Water Professionals Conference, 11–14 May 2016, Gdańsk, Poland.

- Jankowska, E., Szatkowska, B., Jaroszyński, Ł, Cema, G., Karło, A., Ziembińska-Buczyńska, A., Surmacz-Górska, J., Paulsrud, B., Oleśkowicz-Popiel, P. Biogas production using microalgae cultivated on reject water. (In Polish: Produkcja biogazu z biomasy mikroglonów kultywowanej na odcieku z procesu Anammox). HYDROMICRO 2015 8th Polish Conference on hydromicrobiology Microorganisms – Man – Environment (VIII Ogólnopolska Konferencja Hydromikrobiologiczna Mikroorganizmy - Człowiek – Środowisko) September, 14-16 2015, Gliwice, Poland.

- Karło, A, Ziembińska-Buczyńska, A., Cema, G, Surmacz-Górska, J. Influence of technological parameters on biodiversity of anammox bacteria. (In Polish: Analiza wpływu zmiennych parametrów technologicznych na bioróżnorodność biocenozy Anammox oczyszczającej wody osadowe). HYDROMICRO 2015 8th Polish Conference on hydromicrobiology Microorganisms – Man – Environment (VIII Ogólnopolska Konferencja Hydromikrobiologiczna Mikroorganizmy - Człowiek – Środowisko) September, 14-16 2015, Gliwice, Poland.

- López, L.R., Dorado, A.D., Mora, M., Prades, Ll., Gamisans, X., Lafuente, J., Gabriel, D. Modelling biotrickling filters to minimize elemental sulfur accumulation during biogas desulfurization under aerobic conditions. 7th European Meeting on Chemical Industry and Environment (EMCHIE 2015), Tarragona (Spain), June 2015.

- López, L.R., Mora, M., Justo, T., Lafuente, J., Gabriel, D. Optimization of biogas desulfurization in aerobic biotrickling filters through the trickling liquid velocity regulation under variable loading rate conditions. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.

- Mora, M., Gamisans, X., Gabriel, D. Respirometry as a tool for microbial activity monitoring in biotrickling filters. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.

- Morral, E., Lao-Luque, C., Gabriel, D., Dorado, A.D., Gamisans, X. Elimination of hydrophobic volatile organic odorous compounds using a microporous membrane bioreactor. Oral Presentation. 6th International Conference on Biotechniques for Air Pollution Control, Ghent (Belgium), September 2015.

- Nazarewicz K., Cema G., Schneider Y., Beier M. Influence of free ammonia and its ionized form on the Anammox process activity. IWA Specialist Conference Nutrient Removal and Recovery: moving innovation into practice. 18-21 May 2015, Gdańsk, Poland.

- Nenov, V. Struvite recovery options in conventional wastewater treatment plants First BWA Conference on "WWTP Sludge: Problems and Solutions" 10 May 2016, Sofia, Bulgaria.

- Nenov, V., Jemendjiev, H., Peeva, G. Struvite recovery options in conventional wastewater treatment plants(WWTPs). Colloque International Fes University, 28 et 29 octobre 2015 « Eau, Recyclage et Valorisation des Déchets.

- Reino, C., Pérez, J. Suárez-Ojeda, M.E., Carrera, J. Towards an energy-producer wastewater treatment plant. 7th European Meeting on Chemical Industry (EMChIE-2015). Tarragona (Spain) June 10-12, 2015.
- Val del Río, A., Stachurski, A., Méndez, R., Campos, J.L., Surmacz-Górska, J., Mosquera-Corral, A. Short and long term orange dye effects over AOB and anammox activities. IWA 3rd Specialized International Conference Ecotechnologies for Wastewatewr Treatment 2016 ecoSTP16; Cambridge, UK, 27-30 Jun 2016.
- Tomaszewski, M., Cema, G., Ziembińska-Buczyńska, A. Dynamics of nitrifiers, denitrifiers and anammox bacteria changes during process Anammox start-up (in Polish: Dynamika zmian nitryfikatorów, denitryfikatorów i bakterii Anammox podczas wpracowania procesu Anammox). HYDROMICRO 2015 8th Polish Conference on hydromicrobiology Microorganisms – Man – Environment (VIII Ogólnopolska Konferencja Hydromikrobiologiczna Mikroorganizmy - Człowiek – Środowisko) September, 14-16 2015, Gliwice, Poland.
- Torà, J.A., Lafuente, J., Garcia-Belinchón, C., Bouchy, L., Carrera, J., Baeza, J.A. Controlled partial nitritation of reject water to guarantee a stable influent for anammox reactors. IWA NRR 2015 - Nutrient Removal and Recovery: moving innovation into practice. Gdańsk (Poland), 18-21 May 2015.
- Ziembińska-Buczyńska, A., Cema, G., Żabczyński, S. Nitrogen removal bacteria dynamics in rotating biological contractor biofilm treating coke wastewater. IWA Balkan Young Water Professionals 2015, 10-12 May 2015 Thessaloniki, Greece.

STSM – cooperation activities

- Research stay of Anna Węgrzyn (Silesian University of Technology, Environmental Biotechnology Department) at Department Environmental Genomics (EGEN), Helmholtz Zentrum München German Research Center for Environmental Health, responsible Prof. Peter Schröder. STMS title 'Endophytic bacterial diversity in roots of Miscanthus sp. in wetlands treating wastewater containing pharmaceuticals', from 1st March to 30th April 2016.

TG2 HIGHLIGHTS

Leader

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Presentation and Objectives

Given the expertize of the TG2 components, potential topics for the Task Group are:

- Anaerobic MBR
- Post treatment of anaerobic reactors
- Membrane fouling
- Energy usage
- Removal of nutrients & emerging pollutants

Potential deliverables of TG2 are:

- Recommendations on when to use an mbr
- Paper on the current state of the art in europe with respect to MBR

TG2 — Membrane bioreactors

List of Publications

- Collivignarelli, M.C., Abbà, A., Bertanza, G. (2015) Why use a Thermophilic Aerobic Membrane Reactor (TAMR) for the treatment of industrial wastewater/liquid waste? Environmental Technology, 36(16), 2115-2124.
- González-Viar, M., Díez-Montero, R., Molinos-Senante, M., De-Florio, L., Esteban-García, A. L., Sala-Garrido, R., Hernández-Sancho, F., & Tejero, I. (2016) Cost-effectiveness analysis of sewer mining versus centralized wastewater treatment: Case study of the Arga river basin, Spain. Urban Water Journal, 13(3), 321-330.
- Midyurova, B., Nenov, V. Novel proton exchange membranes and separators applied in Microbial Fuel Cells (MFC) Journal of the Balkan Tribological Association.
- Nenov, V., Bonev, B., Shaikhiev, I., Dryakhlov, V., Safina, G., Nazmieva A. (2015) Effluent treatment of production an olive oil using membranes processed in ground of corona discharge, Annual of Burgas University, Burgas Bulgaria, 2015, т. XLIV(1).
- Sánchez, A., Rodríguez-Hernández, L., Buntner, D., Esteban-García, A.L., Tejero, I., Garrido, J. M. (2016) Denitrification coupled with methane oxidation in a membrane bioreactor after methanogenic pre-treatment of wastewater. Journal of Chemical Technology and Biotechnology. DOI 10.1002/jctb.4913.

Projects

- Research of a process for the Energy-Efficient Removal of Nitrogen in Wastewaters, "E3N". Environmental Engineering Group (University of Cantabria), FCC-Aqualia and Government of Cantabria. 2016-2017.

Conferences

- Aybar, M., Perez-Calleja,P., Picioreanu,C, Esteban Garcia, A.L., Nerenberg, R. Effects of Gas Back-diffusion on the Membrane-Biofilm Reactor (MBfR) for Water Treatment. In IWA Specialized Conference, Biofilms in drinking water systems - From treatment to tap, 23 – 26 August 2015 in Arosa (Switzerland).
- Midyurova, B., Ates, M., Zerrouq, F., Nenov, V. Improvements of MFC's Proton Exchange membranes and Cathodes. Colloque International Fes University, 28 et 29 octobre 2015 "Eau, Recyclage et Valorisation des Déchets".

- Pérez-Calleja, P., Aybar, M., Picioreanu, C., Esteban-García, A.L., Nerenberg, R. Membrane-Biofilm Reactors (MBfR) For Water Treatment: Overcoming Gas Back Diffusion Effects. AEESP Research and Education Conference. Environmental Engineering and Science at the nexus. June 13-16, 2015, Yale University, Commons, New Haven.
- Pérez-Calleja, P., Aybar, M., Picioreanu, C., Esteban-García, A.L., Nerenberg, R. Enhanced Operation of Membrane-Biofilm Reactor (MBfR) for Waste Water Treatment by Mitigation of Gas Back-Diffusion Effect. Proceedings of WEFTEC 2015, Chicago USA, pp. 4268-4270.
- Romano, R., Vaccari, M., Perteghella, A., Bertanza, G. L'impianto di depurazione MBR di Verziano (BS): rese di processo e criticità gestionali. BioMac "Trattamenti biologici avanzati", by V. Belgiorno, V. Naddeo, edizioni ASTER. Collana editoriale di Ingegneria Ambientale. ISBN 978-1-326-45298-8, pp.103-117.

TG3 HIGHLIGHTS

Leader

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Presentation and Objectives

The main objective of TG3 is to review the micropollutants in wastewater treatment worldwide and to communicate this issue in europe.

In fact, across Europe, most people don´t know where our drinking water comes from, or how big the efforts are to allow us to perform the most normal daily action, namely to open the tap and to consume clean, clear and pure water. Still, it is the extremely high quality of our drinking water that ensures the healthy life we lead. In fact, to provide unpolluted water as a resource for drinking water supply, food production but also other aspects of daily life, is one of the major challenges for Europe in the closer future. Whereas well-assessed treatment strategies exist for classical issues such as removal of nutrients (phosphorus and nitrogen), detergents and even microorganisms, novel emergent organic compounds pose a threat to our water reserves. More than 100,000 different chemi¬cals are presently distributed on the European market, one third of them exceeding quantities of one ton per year. Thanks to the continuous improvement of analytical techniques, a large number of pharmaceuticals has been detected and identified frequently during the last years in effluents from wastewater treatment plant, surface waters or ground waters. Since the majority of all significant waters, lakes and streams are shared between several European countries, the EU has to find a common strategy for the treatment of wastewater, and a zero pollution regime for effluents. Furthermore it will be necessary to expand the scope of water protection to all waters, surface waters and groundwater; to achieve satisfactory status for all waters by a set deadline; and to delegate water management to regional authorities based on river basins.

TG3 — Micropollutants and recalcitrant

List of Publications

- Bing Zhu, B., Zonja, B., Gonzalez, O., Sans, C., Pérez, S., Barceló, D., Esplugas, S., Xu, K.;, Qiang, K. (2015) Degradation kinetics and pathways of three calcium channel blockers under UV irradiation. Water Research, 86, 9 – 16.
- Burak Ozkal, C., Koruyucu, A., Meric, S. (2016) Heterogeneous photocatalytic degradation, mineralization and detoxification of ampicillin under varying pH and incident photon flux conditions, Desalination and Water Treatment, DOI:10.1080/19443994.2016.1155175
- Ferreira, V.R.A., Amorim, C.L., Cravo, S.M., Tiritan, M.E., Castro, P.M.L., Afonso, C.M.M. Fluoroquinolones biosorption onto microbial biomass: activated sludge and aerobic granular sludge. International Biodeterioration & Biodegradation 110, 53-60.
- Giménez, J., Bayarri, B., González, O., Malato, S., Peral, J., Esplugas, S. (2015) A comparison of the environment impact of different AOPs: risk indexes. Molecules, 20, 503 – 518.
- Papa, M., Alfonsín, C., Moreira, M.T., Bertanza G. (2016) Ranking wastewater treatment trains based on their impacts and benefits on human health: a "Biological Assay and Disease" approach. Journal of Cleaner Production, 113, 311-317.
- Papa, M., Ceretti, E., Viola, G.C.V., Feretti, D., Zerbini, I., Mazzoleni, G., Steimberg, N., Pedrazzani, R., Bertanza G. (2016) The assessment of WWTP performance: towards a jigsaw puzzle evaluation? Chemosphere, 145, 291-300.
- Pereira, S.V., Reis, T., Souza, B.S., Dantas, R.F., Azevedo, D.A., Dezotti, M., Sans, C., Esplugas, S. (2015) Estrogenicity assessment of s-triazines by-products during ozonation. Environmental Technology, 36, 1 - 25.
- Pereira, R., Dantas, R.F., Wender, H., Bayarri, B., González, O., Giménez, J., Esplugas, S., Machulek Jr., A. (2015) Photocatalytic treatment of metoprolol with B-doped TiO²: Effect of water matrix, toxicological evaluation and identification of intermediates. Applied Catalysis B-Environmental, 176, 173 – 182.
- Pereira, R., Dantas, R.F., Bayarri, B., González, O., Giménez, J., Esplugas, S., Machulek Jr., A. (2015) Synthesis and characterization of B-doped TiO_2 and their performance for the degradation of metoprolol. Catalysis Today, 252, 27 – 34.

- Ramos, C., Suárez-Ojeda, M.E., Carrera, J. (2016) Long-term performance and stability of a continuous granular airlift reactor treating a high-strength wastewater containing a mixture of aromatic compounds. Journal of Hazardous Materials, 303, 154-161.
- Ramos, C., Suárez-Ojeda, M.E., Carrera, J. (2016) Denitritation in an anoxic granular reactor using phenol as sole organic carbon source. Chemical Engineering Journal, 288, 289-297.
- Ramos, C., Suárez-Ojeda, M.E., Carrera, J. (2016) Biodegradation of a high-strength wastewater containing a mixture of ammonium, aromatic compounds and salts with simultaneous nitritation in an aerobic granular reactor. Process Biochemistry, 51, 399-407.
- Ramos, C., Fernández, I., Suárez-Ojeda, M.E., Carrera, J. (2015) Inhibition of the anammox activity by aromatic compounds. Chemical Engineering Journal, 279, 681-688.
- Schröder, P., Helmreich, B., Škrbić, B., Carballa, M., Papa, M., Pastore, C., Emre, Z., Oehmen, A. Langenhoff, A.,Molinos, M., Dvarioniene, J., Huberl, C., Tsagarakis, K.P., Martinez-Lopez, E., Meric Pagano, S., Vogelsang, C., Mascolo. G. Status of hormones and painkillers in wastewater effluents across several European states—considerations for the EU watch list concerning estradiols and diclofenac. Environ Sci Pollut Res, DOI 10.1007/s11356-016-6503-x.
- Yuan, X., Lacorte, S., Cristale, J., Dantas, R.F., Sans, C., Esplugas, S., Qiang, Z. (2015) Removal of organophosphate esters from municipal secondary effluents by ozone and UV/H_2O_2 treatments. Separation and Purification Technology, 156, 1028 – 1034.

Projects

- Degradation of pharmaceuticals in wastewater by biological processes and advanced oxidation. 2015-1016. Convénio entre Portugal (FCT) e Itália (CNR) - CNR-IRSA.
- DISRUPT ☐ Environmental Endocrine Disruptors: Current Situation in Macao, Neurobehavioral Effects and Bioremediation Strategies - FDCT EED. 2014-2017.
- Enginyeria de processos d'oxidació avançada (AGAUR-2014SGR245. SPAIN) 2014-2018.
- Aplicación de los procesos de oxidación avanzada a la reutilización de agua (CTQ2011-26258. SPAIN) 2012-2015.
- Advanced Treatments for Water Sustainability in Europe and China (PIRSES-GA-2012-318926.EU) 2012-2015.
- Procesos de oxidación avanzada en el tratamiento de contaminantes emergentes: aplicacion, impacto y estandarización (CTQ2014-52607-R) 2015-2018.
- Microbiology Project – Degree in Microbiology from ESB – UCP (March 2016 - June 2016) Enrichment of endocrine disruptors from soils and sediments – Catarina Camilo and Maria Teixeira.

Conferences

- Afkhami, A., Marco, P., Esplugas, S. Degradation of Diphenhydramine by homogeneous photo-Fenton process. In: Abstracts of 7th European Meeting on Chemical Industry and Environment (EMChIE 2015) Tarragona (SPAIN) June 2015.

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- Amorim, C.L., Henriques, I.S., Castro, P.M.L. Microbial population dynamics within aerobic granular sludge exposed to a mixture of pharmaceuticals. 6th Congress of Microbiology and Biotechnology: Microbiotec15. Évora, Portugal, 10-12 December 2015. http://hdl.handle.net/10400.14/19838

- Amorim, C.L., Moreira, I.S., Ribeiro, A.R., Santos, L.H.M.L.M., Delerue-Matos, C., Tiritan, M.E., Castro, P.M.L. Removal of a mixture of chiral pharmaceuticals by an aerobic granular sludge bioreactor and its effects on the biomass. VI International Conference on Environmental, Industrial and Applied Microbiology - BioMicroWorld2015. Barcelona, Spain 28-30 October 2015. http://www.formatex.info/biomicroworld2015/acceptedabstracts.php

- Amorim, C.L., Moreira, I.S., Ribeiro, A.R., Santos, L.H.M.L.M., Delerue-Matos, C., Tiritan, M.E., Castro, P.M.L. Enantiomeric fraction evaluation of pharmaceuticals in an aerobic granular sludge sequencing batch reactor. 42nd International Symposium on High Performance Liquid Phase Separations. Geneva, Switzerland, 21-25 June 2015. http://hdl.handle.net/10400.14/18187; http://www.hplc2015-geneva.org/wp-content/uploads/2015/05/150619_HPLC15_Poster-presentations.pdf

- Cavalcante, R.P., Dantas, R.F., de Oliveira, S.C., Giménez, J., Esplugas, S., Machulek Jr, A. The effect of dissolved oxygen on the photocatalytic degradation of metoprolol in different types of tio2 nanoparticles. In: Abstracts of II Congresso Iberoamericano de Processos Oxidativos Avançados. Belo Horizonte (BRAZIL) November 2015.

- Cruz, A., Sans, C., Esplugas, S. Synthesis and evaluation of a new Fe/alginate heterogeneous catalyst for photo-Fenton at neutral pH. In: Abstracts of 7th European Meeting on Chemical Industry and Environment (EMChIE 2015) Tarragona (SPAIN) June 2015.

- Esplugas, S., Marcé, M., Baig, S. Key Aspects in the Ozonation of Municipal Wastewater Effluents. In: Abstracts of 21st International Conference on Advanced Oxidation Technologies for Treatment of Water, Air and Soil (AOTs-21) San Diego (California, USA) November 2015.

- Esplugas, S. Ozonation of Urban Wastewater Effluents for Water Reuse. Mediterranean Forum on Water Resources - EXPO Milano, Matera (ITALY) October 2015.

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- Marce, M., Arnal, J., Izquierdo, A., Martins, R.C., Quinta-Ferreira, R.M., Esplugas, S. Treatment of muncipal primary wastewater effluents by non-catalytic and catalytic ozonation. In: Abstracts of 2015 Ozono World Congress. Barcelona (SPAIN) Julio 2015.

- Marce, M., Cortés-Francisco, N., Bartolomé, A., Caixach, J., Baig, S., Esplugas, S. Application of ozone process among wastewater treatment line to improve micropollutant removals. In: Abstracts of 7th European Meeting on Chemical Industry and Environment (EMChIE 2015) Tarragona. 10-15 June 2015.

- Moreira, I. S., van Acker, J., Amorim, C.L., Castro, P.M.L. Biodegradation potential of the soil bacterial community from a polluted site in the northern of Portugal. VI International Conference on Environmental, Industrial and Applied Microbiology - BioMicroWorld2015. Barcelona, Spain 28-30 October 2015. http://www.formatex.info/biomicroworld2015/acceptedabstracts.phpText

- Papa, M., Gonzalez, L., Feretti, D., Ceretti, E., Mazzoleni, G., Steimberg, N., Pedrazzani, R., Bertanza, G., Lema J., Carballa, M. Fate and removal of organic micropollutants during anaerobic digestion of sewage sludge: are chemical + biological assays a winning combination?. Proceedings of AD14 - World Congress on Anaerobic Digestion, Vina del Mar, Chile, 15-18 November 2015.

- Ramos, C., Pérez, J., Suárez-Ojeda, M.E., Carrera, J. Development of a full biological process to treat industrial recalcitrant wastewaters. 7th European Meeting on Chemical Industry (EMChIE-2015). Tarragona (Spain). June 10-12, 2015.

Other events

- Micropollutants in Water, Specialised Online Course (SpOC) by Joint Task Force on Micropollutants and recalcitrant compounds (WG3 headed by Peter Schroeder, and co-lead Giuseppe Mascolo from WG1).

TG4 HIGHLIGHTS

Leader

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Presentation and Objectives

The main objective of TG4 is to review the advanced sludge treatment technologies worldwide and to develop a common strategy in Europe.

Sludge has been considered and treated during many years as a waste and the strategies proposed had as objective a safe disposal of the sludge. However during the last years it has been demonstrated that sewage sludge can be considered as a source for both energy and raw materials.

In this task group the most advanced technologies and processes aiming focused on the resource recovery from sewage sludge will be listed and analysed to determine the most promising technologies. Among these technologies we can find some well-consolidated biological processes such us anaerobic digestion and composting while some thermal treatments such as Drying and Incineration can be also found and implemented at industrial level in Europe.

However, the TG4 will pay special attention to the novel technologies such as Pyrolysis and Gasification and to the emerging technologies that are currently being developed being the most important the Supercritical Water Gasification and Biodrying.

The benefits, advantages, weaknesses and disadvantages of the current, novel and emerging technologies will be studied so as result some recommendations could be done in order to develop an appropriate future strategy for the sustainable processing of the sewage sludge.

TG4 — Efficient sludge technologies

List of Publications

- Bertanza, G., Baroni, P., Canato, M. (2016) Ranking sewage sludge management strategies by means of Decision Support Systems: a case study. Resources, Conservation & Recycling, DOI 10.1016/j.resconrec.2016.03.011
- Bertanza, G., Galessi, R., Menoni, L., Pedrazzani, R., Salvetti, R., Zanaboni, S. (2015) Anaerobic treatability of liquid residue from wet oxidation of sewage sludge. Environ. Sci. Pollut. Res., 22, 7317–7326.
- Bertanza, G., Canato, M., Heimersson, S., Laera, G., Salvetti, R., Slavik, E., Svanström, M. (2015) Techno-economic and environmental assessment of sewage sludge wet oxidation. Environ. Sci. Pollut. Res., 22, 7327–7338.
- Bertanza, G., Galessi, R., Menoni, L., Salvetti, R., Slavik, E., Zanaboni, S. (2015) Wet oxidation of sewage sludge: full scale experience and process modelling. Environ. Sci. Pollut. Res., 22, 7306–7316.
- Bertanza, G., Canato, M., Laera, G., Tomei, M.C. (2015) Methodology for technical and economic assessment of advanced routes for sludge processing and disposal. Environ. Sci. Pollut. Res., 22, 7190–7202.
- Collivignarelli, M.C., Castagnola, F., Sordi, M., Bertanza, G. (2015) Treatment of sewage sludge in a thermophilic membrane reactor (TMR) with alternate aeration cycles. Journal of Environmental Management 162, 132-138.
- Dorado, A.D., Gabriel, D., Gamisans, X. (2015) Biofiltration of WWTP sludge composting emissions at contact times of 2 to 10 sec by structured/unstructured packing materials. Process Biochemistry, 50, 1405-1412.
- Gianico, A., Bertanza, G., Braguglia, C.M., Canato, M., Laera, G., Heimersson, S., Svanström, M., Mininni, G. (2015) Upgrading a wastewater treatment plant with thermophilic digestion of thermally pre-treated secondary sludge: techno-economic and environmental assessment. Journal of Cleaner Production, 102, 353-361.
- Gianico, A., Bertanza, G., Braguglia, C.M., Canato, M., Gallipoli, A., Laera, G., Levantesi, C. Mininni, G. (2016) Enhanced versus conventional sludge anaerobic processes: performances and techno-economic assessment. Water Environ. Res. 88(5), 468-478.
- Mininni, G. Laera, G. Bertanza, G., Canato, M., Sbrilli, A. (2015) Mass and energy balances of sludge processing in reference and up-graded wastewater treatment plants" - Environ. Sci. Pollut. Res., 22, 7203–7215.
- Sánchez, A., Artola, A., Font, X., Gea, T., Barrena, R., Gabriel, D., Sánchez-Monedero, M.A., Roig, A., Cayuela, M.L., Mondini, C. (2015) Greenhouse gas emissions from organic waste composting. Environmental Chemistry Letters, 13 (3), 223-238.

- Slavik, E., Galessi, R., Rapisardi, A., Salvetti, R., Bonzagni, P., Bertanza, G., Menoni, L., Orhon, D., Sözen, S. (2015) Wet oxidation as an advanced and sustainable technology for sludge treatment and management: results from research activities and industrial-scale experiences. Drying Technology, Volume 33, Issue 11, August, 1309-1317.
- Tomei, M.C., Bertanza, G., Canato, M., Heimersson, S., Laera, G., Svanström, M. (2016) Techno-Economic and Environmental Assessment of Upgrading Alternatives for Sludge Stabilization in Municipal Wastewater Treatment Plants. Journal of Cleaner Production, 112, 3106-3115.
- Tomei, M.C., Mosca Angelucci, D., Levantesi, C. (2016) Two-stage anaerobic and post-aerobic mesophilic digestion of sewage sludge: analysis of process performance and hygienization potential. Science of the Total Environment 545–546, 453–464.
- Tomei, M.C., Carozza, N.A., Mosca Angelucci, D. (2016) Post-aerobic digestion of waste sludge: performance analysis and modelling of nitrogen fate under alternating aeration. International Journal of Environmental Science and Technology, 13 (1), 21-30.

Conferences

- Gianico, A., Bertanza, G., Braguglia, C.M., Canato, M., Gallipoli, A., Levantesi, C., Mininni, G. Enhanced anaerobic processes on waste activated sludge: methane yields, hygienization potential and techno-economic feasibility. Proceedings of WEF/IWA Residuals and Biosolids Conference 2015, June 7–10, Washington, DC.
- Mosca Angelucci, D., Tomei, M.C. Biopolymer Fate And Modelling In Sequential Mesophilic Anaerobic-aerobic Digestion Of Waste Activated Sludge. Accettato da 3rd IWA Specialized International Conference Ecotechnologies for Wastewater Treatment 2016 (ecoSTP16). Cambridge, UK, June, 27-30 2016.
- Tomei, M.C., Mosca Angelucci, D. Sequential Anaerobic-Aerobic Digestion of Secondary Sludge: Aerobic Temperature Effect on the Process Performance. WEF/IWA Residuals and Biosolids Conference 2015: The Next Generation of Science, Technology, and Management, 2015, June 7–10, Washington, DC.

TG5 HIGHLIGHTS

Leader

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Presentation and Objectives

Wastewater treatment plants are typically the largest energy consumers of municipalities. There are many methods and processes to treat wastewater, where the secondary aerobic treatment is the largest energy consumer (30 to 60% of total plant usage). The current demand for switching from carbon removal to both carbon removal and nitrification/de-nitrification lead to an increase of the total plant energy consumption by 40 to 50 percent (Metcalf and Eddy, 2003).

In recent years, there has been growing interests in anaerobic biological treatment for low-strength wastewaters because of its low energy consumption, minimized sludge production and energy recovery through biogas production. Although research suggests that anaerobic treatment of low-strength domestic wastewater is possible in temperate climates, to date, full-scale applications have only been pioneered in hot regions (i.e. Latin America, India).

The overall objective of TG5 is to explore the different constrains and problem that limit the diffusion of anaerobic treatment for domestic wastewater and the application of full-scale based on the innovative anaerobic technologies that can increase the process stability. In addition, efforts will be given to explore the challenges for this application including technical and operational aspects as well as the potential for more benefical products (i.e., organic acids, biopolymers).

TG5 — Anaerobic treatment of wastewater

List of Publications

- Krayzelova, L., Bartacek, J., Díaz, I., Jeison, D., Volcke, E.I.P., Jenicek P. (2015) Microaeration for hydrogen sulfide removal during anaerobic treatment - a review. Reviews in Environmental Science and Bio/Technology, 14(4), 703-725.
- Montpart, N., Rago, L., Baeza, J.A., Guisasola, A. (2015) Hydrogen production in single chamber microbial electrolysis cells with different complex substrates. Water Research, 68, 601-615.
- Rago, L., Ruiz, Y., Baeza, J.A., Guisasola, A., Cortés, P. (2015) Microbial community analysis in a long-term membrane-less microbial electrolysis cell with hydrogen and methane production. Bioelectrochemistry, 106, 359-368.
- Rago, L., Guerrero, J., Baeza, J.A., Guisasola, A. (2015) 2-bromoethanesulfonate degradation in bioelectrochemical systems. Bioelectrochemistry, 105, 44-49.
- Rago, L., Montpart, N., Cortés, P., Baeza, J.A., Guisasola, A. (2016) Performance of microbial electrolysis cells with bioanodes grown at different external resistances. Water Science and Technology, 73.5, 1129-1135.
- Rago, L., Baeza, J.A., Guisasola, A. (2016) Increased performance of hydrogen production in microbial electrolysis cells under alkaline conditions. Bioelectrochemistry, 109, 57-62.
- Rago, L., Baeza, J.A., Guisasola, A. (2016) Bioelectrochemical hydrogen production with cheese whey as sole substrate. Journal of Chemical Technology and Biotechnology (in press).
- Ruiz, Y., Baeza, J.A., Guisasola, A. (2015) Enhanced Performance of Bioelectrochemical Hydrogen Production with a pH Control Strategy. Chem Sus Chem, 8(2), 389-397.
- Ruiz, Y., Ribot-Llobet, E., Baeza, J.A., Guisasola, A. (2015) Conditions for high resistance to starvation periods in bioelectrochemical systems. Bioelectrochemistry, 106, 328-334.
- Ruiz, Y., Baeza, J.A., Guisasola, A. (2016) Microbial electrolysis cell performance using non-buffered and low conductivity wastewaters. Chemical Engineering Journal, 289, 341-348.

Conferences

- Rago, L., Badia, M., Baeza, J.A., Guisasola, A. Extending the applicability range for bioelectrochemical systems: prospects for alkaline exoelectrogenesis. ISMET 2015 - the fifth international meeting on microbial electrochemistry and technologies. Arizona (USA), 1-4 october 2015.

- Rago, L., Guerrero, J., Ruiz, Y., Baeza, J.A., Guisasola, A. Experiences with real cheese-whey wastewater in bioelectrochemical hydrogen production: from lab to pilot scale. ISMET 2015 - the fifth international meeting on microbial electrochemistry and technologies. Arizona (USA), 1-4 october 2015.

Projects

- Bioelectrochemical recovery of elemental sulfur from highly-loaded sulfate wastewaters (REBECA). CTM2014-62179-EXP. MINECO. UAB. 01/09/2015 - 31/08/2017. PI: David Gabriel

TG6 HIGHLIGHTS

Leader

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Presentation and Objectives

The aerobic sludge granulation is attracting more and more interest from researchers worldwide. in fact after the first paper published in 1997, the number of papers per year has continuously increased during the last decade reaching 120 in 2014 (source: scopus). the number of papers published from the beginning of the current year also indicates that probably during this year it will be exceeded this figure.

Although the high interest and the significant advantages of the aerobic granular bioreactors over the conventional technologies (consisting in a both low energy and area requirement) only a few full scale applications have been reported so far after almost two decades from its first development.

The overall objective of this task is to create a group of experts in the field of aerobic granular bioreactors for exchanging experience in order to shed light on the reasons that have prevented or slowed the full scale application of this innovative treatment technique

TG6 — Aerobic granular reactors

List of Publications

- Amorim, C.L., Moreira, I.S., Duque, A.F., van Loosdrecht, M.C.M. and Castro, P.M.L. Aerobic Granular Sludge -Treatment of industrial wastewaters. In: Technologies for the Treatment and Recovery of Nutrients from Industrial Wastewater edited by Anuska Mosquera, Luis Campos and Ángeles Val, IGI-Global *(Accepted for publication)*.
- Ferreira, V.R.A., Amorim, C.L., Cravo, S.M., Tiritan, M.E., Castro, P.M.L., and Afonso, C.M.M. Fluoroquinolones biosorption onto microbial biomass: activated sludge and aerobic granular sludge. International Biodeterioration & Biodegradation, 110, 53-60.
- Jemaat, Z., Tora J.A., Bartroli, A., Carrera, J., Perez, J. (2015) Achievement of high rate nitritation with aerobic granular sludge reactors enhanced by sludge recirculation events. Frontiers of Environmental Science & Engineering, 9(3), 528-533.
- Ramos, C., Suárez-Ojeda, M.E., Carrera, J. (2015) Long. Long-term impact of salinity on the performance and microbial population of an aerobic granular reactor treating a high-strength aromatic wastewater. Bioresource Technology, 198, 844-851.
- Reino, C., Suárez-Ojeda, M.E., Pérez, J., Carrera, J. (2016) Kinetic and microbiological characterization of aerobic granules performing partial nitritation of a low-strength wastewater at 10 °C. Water Research, in press doi:10.1016/j.watres.2016.05.059.
- Winkler, M.K., Le, Q.H., Volcke, E.I.P. (2015) Influence of partial denitrification and mixotrophic growth of NOB on microbial distribution in aerobic granular sludge. Environmental Science & Technology, 49 (18), 11003–11010.
- Ziembińska-Buczyńska, A., Kociołek, B., Ślipko, K., Daniłowicz, A., Cema, G., Surmacz-Górska, J. (2015) The adjustment of granular sludge DNA isolation for PCR-based methods, ACEE Journal, 2, 91-96.

Projects

- Projecto de Microbiologia e Qualidade Ambiental – Master in Applied Microbiology from ESB – UCP (October 2015 - December 2015) Impact of pharmaceuticals on ammonia-oxidizing bacteria within aerobic granular sludge - Ana Meireles; Ângela Alves; Marta Carvalho

Conferences

- Amorim, C.L., Moreira, I.S., Ribeiro, A.R., Santos, L.H.M.L.M., Delerue-Matos, C., Tiritan, M.E., Castro, P.M.L. Removal of a mixture of chiral pharmaceuticals by an aerobic granular sludge bioreactor and its effects on the biomass. VI International Conference on Environmental, Industrial and Applied Microbiology - BioMicroWorld2015. Barcelona, Spain 28-30 October 2015. http://www.formatex.info/biomicroworld2015/acceptedabstracts.php

- Amorim, C.L., Henriques, I.S., Castro, P.M.L. Microbial population dynamics within aerobic granular sludge exposed to a mixture of pharmaceuticals. 6th Congress of Microbiology and Biotechnology: Microbiotec15. Évora, Portugal, 10-12 December 2015. http://hdl.handle.net/10400.14/19838.

- Amorim, C.L., Moreira, I.S., Ribeiro, A.R., Santos, L.H.M.L.M., Delerue-Matos, C., Tiritan, M.E., Castro, P.M.L. Enantiomeric fraction evaluation of pharmaceuticals in an aerobic granular sludge sequencing batch reactor. 42nd International Symposium on High Performance Liquid Phase Separations. Geneva, Switzerland, 21-25 June 2015. http://hdl.handle.net/10400.14/18187; http://www.hplc2015-geneva.org/wp-content/uploads/2015/05/150619_HPLC15_Poster-presentations.pdf.

Other events

- Internship – Erasmus+ Placement (January 2016 – March 2016) Pharmaceuticals and Aerobic Granular Sludge: Biosorption and salt effect - Stella Parmaki.

Next events

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