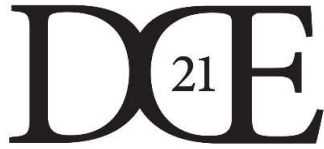


DOCTORAL CONGRESS
IN ENGINEERING

Book of Abstracts



*4th Symposium on
Chemical and Biological Engineering*



4th DOCTORAL
CONGRESS
IN ENGINEERING

Book of Abstracts

of the

4th Symposium on Chemical and Biological Engineering

Editors:

Alexandra Pinto, Ana Isabel Moreira, Ana Teresa Cerdeira, André
Torres Pinto, Cláudio Rocha, Isabel Fernandes, Maria Amélia Barros,
Maria João Romeu

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COMMITTEES	10
PROGRAMME	13
KEYNOTE SPEAKERS	17
Ana Luísa Gonçalves	18
Maria José Lima	19
Renato Sousa	20
ORAL PRESENTATIONS	21
A Conceptual Design of Pressure Swing Adsorption for Flue Gas Carbon Capture using Biochar Carbon Materials	22
Evaluation of the cosmetic potential of <i>Castanea sativa</i> shells extract prepared by Supercritical Fluids Extraction with CO ₂ – A preliminary study	26
Highly efficient photocatalytic degradation of tramadol using carbon nitride...30	30
Chaotic Mixing in the NETmix Reactors	33
A Low Footprint Ozone Mixer based on the NETmix Technology: A CFD Modelling Approach	37
Shrinkage factor of alginate microparticles produced in flow focusing microfluidic devices	41
Nitrate catalytic reduction formed during ozonation of organic contaminants	44
Anti-amyloidogenic activity of vitamin B12: A promising nutrient for the prevention and treatment of Alzheimer’s disease	48
The potential of fresh and dried Portuguese <i>Origanum vulgare</i> L. as an aromatic ingredient: an evaluation of SFE-CO ₂ extracts and hydrolate products	52
Agent-based Modelling: Simulating the Elongation Process in yeast.....	56
Optimization of Cobalt and Iodine-mediated dyesensitized solar cells for artificial light conversion	60
Enhanced performance of N-doped CNT as catalyst support for CO ₂ methanation reaction	64
3D-Printed Reactors for Photocatalytic Applications.....	68
Two-phase flow in NETmix Reactors	72
Gas-liquid mass transfer in an oscillatory flow reactor provided with smooth	

periodic constrictions	76
Development of an efficient methodology to characterize fiber orientation over the thickness direction of paper for curl troubleshooting	80
A sustainable approach for the synthesis of furfuryl alcohol by heterogeneous photocatalysis.....	84
<i>In silico</i> prediction of three-dimensional structure and docking of aptamers containing nucleic acid mimics (NAMs)	87
A comparison of distinct meshing strategies for large-eddy simulation of a high efficiency cyclone separator.....	91
Ultrafine oxygen-defective iridium oxide nanoclusters for efficient and durable water oxidation at high current densities in acidic media	95
Highly efficient and stable monolithic dye-sensitized solar cells	99
Natural Compounds Loaded into Solid Lipid Nanoparticles for Alzheimer's disease Therapy.....	103
Graphitic-C ₃ N ₄ /ZnO composites for the photocatalytic degradation of 5-Fluorouracil under visible illumination	106
Iron and Cobalt Phthalocyanines on Carbon Nanotubes as Bifunctional Oxygen Electrocatalysts	110
Microbial fuel cell operation with <i>Zygosaccharomyces bailii</i>	113
Micro-aeration to drive bioconversion of organic wastes to methane.....	117
3D-printed hybrid zeolite/activated carbon monolith for CO ₂ capture	121
Dihydroxyacetone production by glycerol oxidation over Pt commercial catalysts and purification by Simulated Moving Bed Chromatography	125
N-doped carbon catalysts for NO reduction.....	129
Implementation of Transition Metal Phosphides as Pt-free Catalysts and enhanced surface area Ir catalysts for Water Electrolysis	133
POSTERS.....	137
Pharmaceuticals removal by solar photocatalysis using TiO ₂ /Active carbon heterostructures	138
Bioactivity, Antioxidant and Radical Scavenging Activity of <i>Actinidia arguta</i> leaves extracts obtained by Subcritical Water Extraction	140
Biomass production optimization of cyanobacterium <i>Synechocystis salina</i> via a BoxBehnken model design.....	142
Optimization of enhanced Green Fluorescent Protein (eGFP) production in <i>Escherichia coli</i> biofilms.....	143
Protection of anthocyanin-rich colourants using water-in-oil-in-water (w/o/w) emulsions	145
Photocatalytically evolved H ₂ O ₂ for the oxidation of organic pollutants.....	147

Prediction of mechanical and dimensional properties of paper for a wide range of operational conditions using an efficient and theoretical sound experimental method.....	149
Assessment of the volumetric ozone-water mass transfer coefficients in the NETmix®.....	151
Mass transfer measurements by the limiting current technique in a pioneering electrochemical flow microreactor.....	153
Advanced Materials Applied on Textiles for Electromagnetic Shielding.....	155
CFD modeling and simulation of a tube-in-tube membrane reactor for ozonation towards CECs removal from municipal wastewaters.....	157
Optimization of the performance of innovative membrane photo-reactor in the removal of contaminants of emerging concern present in urban wastewater after secondary treatment.....	159
Carbon-based catalysts for NOx removal.....	161
Microalgae protein extraction using ultrasound and conventional mechanical stirring technologies.....	163
Qualitative proteomic study on cyanobacteria: from planktonic to biofilm lifestyle.....	165
Stability assessment of perovskite solar mini-modules with an active area of 26.4 cm².....	167
Removal of siloxanes from WWTP sludge to improve the efficiency of biogas production.....	169
Magnetic carbon nanotubes obtained from plastic as catalysts for wet peroxide oxidation of paracetamol.....	171
New liquid supports for the immobilization of laccase and production of polydopamine.....	172
Synthesis of Molecularly Imprinted Polymers by Solid-Phase Method using Modified Stöber Silica Nanoparticles as Template Molecule Carrier.....	174
Catalytic wet peroxide oxidation of lignin and lignin model compounds to C₄ dicarboxylic acids.....	176
Partial replacement of cement by sewage treatment plant sludge in eco-friendly cement mortar.....	177
Purification of Interferon α-2b using ionic liquid-based technologies.....	178
The Effect of CNT Loading and Textural Properties on the Antibiofilm Activity of CNT-based Surfaces.....	179
Effects of annealing temperature on structural, morphological, and photocatalytic properties of TiO₂/rGO nanocomposites.....	180
Fixed Bed Adsorption of Modified Activated Carbon for Gas Capture and Separation in Post-Combustion Conditions.....	181
Modeling the melting and degradation of polypropylene.....	182

Vitamin E encapsulation by spray-drying, using different biopolymers as encapsulating agents	183
Binary and ternary blends of biopolymers for encapsulation of retinoic acid using spray-drying technology	184
Complete separation of the quaternary mixture of nadolol stereoisomers using preparative and simulated moving bed chromatography	185
Friends with benefits: an inside look of periodontal microbes' interactions – scoping review	187
Obtainment and chemical characterization of hydrosols	188
Activated carbon and magnetite affect the methanogenic activity of acetoclastic and hydrogenotrophic methanogens	189
<i>Cynara cardunculus</i> L. var. <i>atilis</i> (DC) as a sustainable source for a biorefinery	191
Ionic liquid-based aqueous biphasic systems for the prepurification of bovine serum albumin	193
Three-phase partitioning as an alternative pretreatment approach of human serum	194
Qualitative and quantitative proteomic approach of epicardial cell secretome from atrial fibrillation patients after cholinergic stimulation	195
AWARDS	197
AUTHORS INDEX	198

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Complete separation of the quaternary mixture of nadolol stereoisomers using preparative and simulated moving bed chromatography

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Abstract

The separation and purification of high added value products by liquid chromatography is a very popular technique. The development of more stable and efficient stationary phases, together with the design of innovative and more flexible separation processes, enhanced the use of chromatographic processes, particularly at preparative and industrial scales through fixedbed and simulated moving bed (SMB) technologies. Fixed-bed and SMB techniques are more and more used in the separation of a wide range of products for the pharmaceutical, fine chemistry, biotechnology and food industries. In this context, one of the actual main challenges concerns the design and optimization of these chromatographic processes for challenging multicomponent separations. This includes the development of new and innovative chromatographic processes, combining different design strategies and modes of operation, with different types of stationary and mobile phases.

The design and optimization of a chiral separation process for a specific chiral binary or pseudo-binary mixture is based on a careful selection of the proper combination between the chiral stationary phase and the mobile phase composition. When considering multicomponent separations, the complexity deeply increases by the introducing of multi-step separation sequences (or a much more complex multi-region separation process). This can be done by opening the possibility to combine chiral and achiral stationary phases (when in presence of stereoisomers instead of just one pair of enantiomers) and to combine different separation techniques such as the fixed-bed and SMB related processes.

Nadolol is a worldwide prescribed pharmaceutical drug for the relieve of several cardiovascular diseases and represents a very interesting case-study of multicomponent chiral separation since it is composed by four stereoisomers, being two pairs of enantiomers. In this way, it introduces the possibility of alternative strategies, using different kind of preparative separation sequences and techniques, and also the use of different packings (chiral and achiral stationary phases), and the corresponding mobile phase optimization at both normal and reversed-phase modes.

The design of the complete preparative separation of nadolol stereoisomers asks for a global experimental and simulation methodology considering both the characterization and optimization of each separation step and its sequences to achieve the four nadolol components pure. New strategies using combinations of achiral and chiral stationary phases and sequences of different separation techniques will be presented. Extensive experimental and simulation results for the complete separation, using fixed-bed (Azura preparative HPLC) and SMB (LSRE-

FlexSMB) pilot units, of all the four nadolol stereoisomers using Chiralpak IA (chiral) and different Waters C18 (achiral) stationary phases will be presented.

Results will include the identification of the stereoisomers present in both nadolol racemates by means of using UV and polarimeter detectors in series. Then, a complete methodology developed during the last years by our group will be explained and applied to scale-up the separation process from analytical to preparative scales [1-4].

The results recently obtained by our research team for this topic clearly support the capacity to enhance the knowledge on the chromatographic separation of chiral pharmaceuticals using fixed-bed and SMB preparative chromatography. In this communication, it will be introduced original and innovative challenges through the real separation of multicomponent (quaternary) chiral mixtures which represents an important step forward for the pharmaceutical industry.

Author Keywords. SMB, chromatography, Nadalol, stereoisomers.

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