FCT Relatório Científico 2008 Print: 08-11-2013 10:06:10 [Centro de Química]

General Information

Name of Research Unit:	(QUI-Norte-686) Centro de Química
Coordinator:	Maria João Ribeiro Peixoto de Queiroz
Main Scientific Domain:	Química
Other Subdomains:	n/a

Host Institutions

Leading Host Institution:	Universidade do Minho
Other Institutions Involved:	

Objectives & Achievements

Unit Description

CQ-FCT is a research unit that functions within the University of Minho promoting research in the domain of Chemistry. The internal regulations of the Chemistry Research Centre (CQ) determine the organization and management procedures of the research unit. CQ members are either FTE researchers with a PhD degree or associate members (PhD and MSc students and young researchers supported by externally financed projects). In December 2008, the CQ-FCT had 37 researchers with a PhD degree and 62 associate members.

The members of the Centre are distributed between 4 groups according to their scientific interests and affinities:

Electrochemistry and Environment (EE, 12 FTE researchers and 19.5 collaborators);

Synthesis and Application of Heterocycles (HC, 13.5 FTE researchers and 18 collaborators);

Synthesis and Application of Amino Acids (AA, 7.5 FTE researchers and 13.5 collaborators);

Biological Chemistry (BC, 3 FTE researchers and 9 collaborators).

The management of all scientific and financial aspects of the CQ-FCT is performed by a scientific council (composed of all permanent staff members) and an executive or coordinating committee. The Director of the research unit presides over the meetings of both these committees. The coordinating committee is composed of the principal investigators and a delegate from each of the four research groups. This committee manages and plans all research activities of the unit and compiles documental support for the annual and pluriannual plans, reports and budgets for approval by the scientific council. The unit Director officially represents the unit, convenes committee meetings and implements the decisions of these committees.

Preliminary contacts have been established to create an advisory committee that will accompany and advise members of the Centre in future research activities, in accordance with FCT regulations. The present financial constraints and the uncertainty concerning future financial support are however expected to delay the full implementation of the activity of this committee.

General Objectives

Three main areas have emerged as important domains for future investment in Chemistry: health, environment and new materials. Three MSc courses in Medicinal Chemistry, Environmental Chemistry and Techniques of Chemical Characterization were prepared and approved in the competent university organs in 2006. The degree in Medicinal Chemistry received its first entrant students in October 2007. In the following year students were also admitted to the MSc course in Techniques of Chemical Characterization. Teaching activities within these specific areas is expected to consolidate research in related topics and attract students to be trained in a research environment.

Most of the researchers working in Organic Chemistry (HC and AA groups) have focused their activity on the synthesis of new drug candidates. They developed the capacity to synthesize a considerable number of novel organic molecules incorporating N, O or S heteroatoms. These skills, combined with national and international collaborations mainly for testing the diverse biological activity of the new compounds, is an important step to consolidate research in Medicinal Chemistry. The study of the structure-activity relationships, which can be carried out using molecular modelling software, is expected to help identify binding interactions between a drug and its target and may provide support in deciding which analogues should be synthesized. The research centre is committed to develop this area, and a post-doc position was recently filled in the domain of Computational Chemistry (FCT - Compromisso com a Ciência). This new researcher with a solid background in biochemistry will also collaborate with members of the BC group in the study of computer aided drug design methodologies. Other interests of this group include the synthesis of contrast agents for medical imaging and the purification of therapeutic macromolecules.

The new 400 MHz NMR instrument, acquired with FCT and FEDER funds and installed in September 2007, is fully-operational under the National NMR network. The need for an expert to explore and implement new techniques for complex molecule characterization and to operate other instruments available through the network was recognized. A vacancy was opened for a researcher in this area (FCT - Compromisso com a Ciência), and we are currently searching for a suitable candidate.

A significant part of the research effort of the EE group involves preparation and characterization of more efficient or more specific materials that are less aggressive to the environment. Collaboration with members of the HC group provides an important contribution for the organic synthesis of some of these materials. Consolidation of expertise in the domains of heterogeneous catalysis, nano-structured materials and environmental analytical chemistry was viewed as a strategic development and post-doctoral positions were opened to provide additional support for continuing group activity. In May 2008, a researcher was contracted to work in the area of Nanochemistry, in particular the application of advanced techniques for nanomaterials manipulation and characterization. In September 2008, another post-doc fellow initiated research in Environmental Catalysis, mainly to develop new heterogeneous catalysts with reduced environmental impact. The multidisciplinary character of these topics is expected to strengthen the interaction between members of different groups within the research center and to stimulate collaborative research with national and international partners in these areas.

Main Achievements during the year of 2008

During the period included in this report, the 37 members of the Research Unit prepared one patent and 2 book chapters, published 43 papers in international journals (a further 28 were accepted) and 14 in conference proceedings and presented 122 communications (oral and poster) at national and international conferences. Training of graduates within the unit resulted in the qualification of one PhD and ten MSc students.

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The results of research carried out by members of the Electrochemistry and Environment group have been published in scientific journals covering a wide range of chemical interests. The main achievements of the group include the development of analytical methods for evaluating the quality of beverages, the optimization of low-impact synthetic methods based on electrochemical processes and the preparation and characterization of environmentally-friendly catalysts. Materials with potential application in energy storage/conversion or in devices that contribute to the reduction of energy consumption were prepared and characterized. Physical/chemical consequences of photodegradation of polymer blends were studied and new photodegradation-resistant formulations were developed.

The researchers dedicated to Heterocyclic Chemistry developed new synthetic methods, including eco-friendly approaches, and prepared a variety of organic compounds. The biological activity of some of these molecules was evaluated: nitrogen heterocycles incorporating hydrazides and substituted imidazoles were tested against Mtb and 26 active molecules were identified; tacrine analogs were tested as AchE inhibitors; di(hetero)arylamines and chromene dimmers showed antifungal activity; a number of phenolic imidazoles, purines and pyrimido-pyrimidines and benzo[b]thiophene-based diarylamines showed antioxidant properties; heteroaromatic compounds showed antitumor activity.

New (oligo)thiophenes, thienylpyrroles, benz-X-azoles, pyridazines, phenanthrolines, bis-indolylmethanes, crown ethers and modified amino acids bearing (oligo)thiophenes and benzoxazole moieties were prepared and their photophysical, thermal, NLO and sensor properties were evaluated. These compounds may be used as solvatochromic and fluorescence probes, as efficient and thermally stable catalysts, photochromic, NLO materials, and as ion sensors.

The Amino Acids group continued to develop synthetic methods for the preparation of new intermediates for amino acid and peptide synthesis in solution and also in solid phase. A variety of non-proteinogenic amino acids with several applications particularly as fluorescent and/or solvatochromic probes, in materials for non linear optics and as antimicrobial or antioxidant compounds were prepared. Kinetic studies of the photocleavage reaction of several fluorescent bioconjugates of amino acids were carried out. Tri- and pentapeptides with a central alpha.alpha-dialkylglycine or N,alpha.alpha-trialkylglycine residue, were synthesized and the evaluation of the applicability of the C-terminal amide bond cleavage reaction to “in situ” formation of novel peptide bonds is ongoing.

The main achievements of the Biological Chemistry group include the design, synthesis and characterization in vitro and in vivo of new metal-containing compounds (chelates, and nanoparticles) for medical imaging applications (PET, nuclear scintingraphy and MRI). Selection of adequate ligands and aqueous two-phase systems for plasmid purification was also achieved. The identification of a phosphorylable peptide that might function as a molecular switch to control the levels of Elastase in chronic wounds was another significant development.

Activities

Integrative/multidisciplinary activities during the year of 2008

Although a substantial part of the work reported by members of this research unit involves internal collaboration of staff within each programmed sub-task, a high percentage of the published results are a consequence of interaction of members with other groups of the Chemistry Research Centre, of other research centres of the Univ. Minho, of other portuguese centres and through international contacts.

Some examples of these collaborative interactions include projects in which members of the Heterocyclic Chemistry group (HC) prepare ligands that are incorporated into organo-metallic complexes with NLO properties, characterized by members of the Electrochemistry and Environment group (EE) and from the Physics Research Centre (UM). Other new materials prepared by HC and Amino Acids group (AA) are evaluated for their photophysical, thermal and sensor properties by researchers from Malaga and Valência Univ., Spain and from UNLisboa. A productive interaction between members of HC and EE involves the use of electrosynthesis to perform selective cyclization on organic molecules prepared by a member of the HC group. This group is also modifying polymers to be used by the Biological Chemistry Group (BC) as selective ligands in the purification of plasmids in aqueous two-phase systems.

Other examples of interdisciplinary collaboration include exchange with colleagues from the Biology Research Centre (UM) and members of EE using electroanalytical methods to characterize biological systems. Interaction between members of EE and staff from research centres from the Biological Engineering and Polymer Engineering continue to provide new topics for future collaborative research in the domains of energy conversion, catalysis and polymer photodegradation.

Electrode films produced by collaborators from Physics Research Centres of the Univ. Aveiro and the UNLisboa are assembled with multi-functional polymer components prepared by members of the EE to produce prototype electrochromic devices. Certain aspects of the performance of these devices are subsequently evaluated by physicists working in Aveiro and Lisbon.

The synthesis of drug candidates involves members of HC partially in collaboration with researchers from the AA group. Testing the new compounds involves national and international collaborators (TAACF-USA for antituberculosis activity, the USC-Spain and UTAD-Portugal for antipsychotic activity, Fac. Pharmacy-UPorto and the Biology and Biological Engineering Depts.-UM for antifungal and antitumor activities and IPBragança for antioxidant activity).

The imaging agents synthesized by BC are also evaluated within national (UC) and international collaborations (Univ. Hospital, Basel and École Polytechnique Féderal de Lausanne, Switzerland; Centre de Biophysique Moléculaire CNRS, France). The development of protein based ligands for the affinity purification of plasmids in aqueous two-phase systems is carried out in collaboration with the Univ. of Aston, Cambridge and London.

These examples are intended to illustrate just some of the multi-disciplinary and inter-institutional projects that have been developed by members of the centre. The effectiveness of these activities can be measured by the contribution that co-authored papers have made to the publications of the centre.

Outreach activities during the year of 2008

During the last year members of the Chemical Research Centre have continued to dedicate special attention to activities that promote the image of Chemistry within the civilian population. These activities have included a wide variety of outreach projects intended, in part, to attract students to the degree courses available in the Department of Chemistry. Different activities were planned and implemented for different age groups: "Vamos Kimikar" and "Olimpíadas de Química" for 13-14 year olds; "QSI - a closer look at Chemistry" and "Around about a crime" for 16-17 year olds; "Science in the summer" for 15 year olds. A total of about 600 school-children and almost 100 school-teachers were directly involved in these activities.

The "Sentido de Ciências" project is a two-year externally-supported program with the objective of promoting scientific culture within the local community. Members of the Centre participated in a team formed with research staff from other departments of the School of Sciences, to organize events including the exhibition “Percepções: A Ciência e os cientistas aos olhos da sociedade” and the symposium "Science and Art".

Various members of the Chemical Research Centre also prepared several short courses for school-teachers as in-service training modules. These courses were accredited by the competent portuguese authority and included topics relating to laboratory activities with schoolchildren in the 16 and 17 year-old group. "Electrochemistry (energy, corrosion and environment)", "Chemistry and the environment" and "Analysis and

Activities

estimation of experimental error" are three of the courses that were organized and administered by members of the Electrochemistry and Environment group. Two other courses based on the preparation of laboratory activities for specific age-groups were implemented by members of other research groups of the centre. Almost 100 school-teachers participated in the various course modules available in the Chemistry Department, an increase of almost 100% relative to the courses that took place in 2007.

National and international researchers were regularly invited by the research centre to deliver lectures on their research work. A cycle of monthly seminars by PhD students was initiated with presentations of experimental results within their project themes.

Finally, a series of open lectures were organized in the "Bioquímica 2010, Perspectivas para a próxima década" initiative. The objective of this activity was to provide an overview of the principal challenges that face Biochemistry and relate these challenges to the opportunities of employment for graduates in this domain.

Funding

	2008	2009	2010	2011
LA FCT	0,00	0,00		
Units FCT	143.775,00	192.500,00	138.600,00	58.307,55
Projects FCT	217.793,00	144.968,00	197.865,00	166.729,00
Other (National)	5.000,00	46.416,00	1.000,00	13.250,00
Other (International)	9.500,00	0,00	0,00	0,00
National Industry	0,00	0,00	1.000,00	0,00
International Industry	0,00	0,00	0,00	0,00
	376.068,00	**383.884,00**	**338.465,00**	**238.286,55**

General Indicators

	2007	2008	2009	2010	2011	Total
No. of Researchers Proposed	0,00	0,00	0,00	0,00	0,00	0,00
No. of Researchers Hired (LA)	0,00	0,00	0,00	0,00	0,00	0,00
Balance	0,00	0,00	0,00	0,00	0,00	0,00
No. of Researchers Hired (Ciência Programme)	0,00	2,00	0,00	0,00	0,00	2,00
No. of Researchers integrated with PhD	0,00	35,00	0,00	0,00	0,00	
Training Masters (Master thesis completed)	0,00	10,00	0,00	0,00	0,00	10,00
Training PhDs (PhD thesis completed)	0,00	1,00	0,00	0,00	0,00	1,00

Researchers Hired

Name	Start Date	End Date	Other Institution
Dr. Sarala Naik	15-09-2008	15-09-2014	-
Issam Oueslati	02-05-2008	02-05-2013	-
Iwona Kuzniarska-Biernacka	01-09-2008	15-09-2013	-

Technical Personnel Hired

Name	Start Date	End Date	Other Institution
No technical personnel found...			

Additional Comments

Additional Comments

The 37 members of the Centre with a PhD degree are directly engaged in research work and participate in the training of young researchers by supervising:

- PhD students (25 PhD research projects currently ongoing)

- MSc students (14 MSc projects currently ongoing)

- Other young researchers supported by externally financed projects (a total of 3 researchers collaborate in ongoing projects)

- Undergraduate students on their final year project or awarded BII grants from FCT (a total of 9 undergraduate students collaborate in ongoing projects).

Three new post-doctoral researchers were hired during 2008, two of them under the FCT "Compromisso com a Ciência" program and one with an FCT post-doc grant:

Sarala Naik (SFRH/BPD/37840/2007) is working on "Synthesis and applications of long-wavelength fluorophores based on oxazine heterocycles", under the supervision of M. Sameiro Gonçalves (Chemistry Center) and Paulo J. Coutinho (Physics Center).

The work is directed to the synthesis of oxazine type chromophores, such as benzo[a]phenoxazinium salts to be evaluated as covalent as well as non-covalent labels of biomolecules. Studies of their photophysical properties in homogeneous media using absorption and fluorescence

Additional Comments

measurements are performed in the UV-VIS-NIR region with biomimicking sell-assembled systems using Triton® X-100 and CTAB micelles, as well as with phospholipids and DNA. Photostability will be determined with monochromatic radiation in the UV-visible spectral region.

Iwona Kuzniarska-Biernacka was hired on September 2008 under "Compromisso com a Ciência" program to collaborate with members of the Centre and develop new capabilities in the field of Environmental Catalysis. Her research work is focused on the synthesis and characterization of new copper-based catalysts, using heterocyclic ligands.

Issam Oueslati was hired on May 2008 under "Compromisso com a Ciência" program to collaborate with members of the Centre and develop new capabilities in the field of applications of Nanochemistry. He was expected to develop research work on the synthesis, characterization and applications of new nanomaterials, with particular emphasis on medical applications. His expertise addresses calixarene chemistry.

No technical personnel were hired during the period under evaluation.

Research Groups

Reference	Title / Principal Investigator
RG-Norte-686-1064	Biological Chemistry (Joao Carlos Ramos Nunes Marcos)
RG-Norte-686-1656	Electrochemistry and Environment (EE) (Michael John Smith)
RG-Norte-686-1733	Heterocyclic Compounds (HC) (Maria Fernanda de Jesus Rego Paiva Proença)
RG-Norte-686-1930	Amino Acids (AA) (Paula Margarida Vidigal Soares Teixeira Ferreira)

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Group Description

Title of Research Group:	(RG-Norte-686-1930) Amino Acids (AA)
Principal Investigator:	Paula Margarida Vidigal Soares Teixeira Ferreira
Main Scientific Domain:	n/a
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

PTDC/QUI/69607/2006 (PI/AA), initiated in January 2008, 29 100.00 € (total funding 97 000.00 €)

PTDC/QUI/66250/2006 (PI/HC, AA), initiated in January 2008, 27 276.00 € (total funding 110 000.00 €)

POCI/QUI/59407/2004 (PI/HC, AA), 11 000.00, terminated August 2008.

SFRH/BD/32664/2006, A. Fonseca, initiated in September 2007, 2 750.00 €.

SFRH/BD/36695/2007, M.J. Fernandes, initiated in February 2008, 2 520.00 €.

SFRH/BD/36396/2007 (Supervisors HC/AA), R. Batista, initiated in October 2007, 1 375.00 €.

SFRH/BD/35905/2007 E. Oliveira, initiated in 2007.

SFRH/BD/SFRH/BD/38766/2007, G. Pereira, initiated in September 2008, 917.00 €.

Objectives & Achievements

Objectives

- Synthesis of tri- and pentapeptides with a central alpa,alpha-dialkylglycine or N,alpha,alpha-trialkylglycine residue, to test the novel methodology previously reported. Evaluation of the applicability of the studied C-terminal amide bond cleavage reaction to "in situ" formation of novel peptide bonds.

- Synthesis of new amino acid derivatives and new heterocyclic compounds from dehydroamino acids to be used as conformational and/or fluorescent probes. Evaluation of the photophysical and electrochemical properties of the compounds prepared.

- Solid phase synthesis of biologically active peptides containing some of the fluorescent probes prepared.

- Synthesis of bis-amino acids to be used in the preparation of cyclic peptides. The former were obtained from dehydroamino acids and amino acids containing functionalized side-chains using Michael addition reactions and metal catalyzed cross-couplings (C-C, C-N and C-O).

- Synthesis of fluorescent heterocycles for application as photocleavable protecting groups for biomolecules, namely amino acid residues, including neurotransmitter amino acids, and peptides via different linkages (C-, N- and O-protection) and as photocleavable dual-linkers for solid phase peptide synthesis.

- Investigation of the photochemical stability of the amino acid-fluorophore linkage. Kinetics studies of the photocleavage reaction of several fluorescently bioconjugates of amino acids.

- Synthesis of fluorescent heterocycles for biomedical applications (benzo[a]phenoxazines and naphtho[2,3-a]phenoxazines) and in materials science [benz-X-azoles (X=S, O and N) derivatives], with application as solvatochromic probes, as chemosensors for anions and cations and as non-linear optical (NLO) materials. Evaluation of their photophysical properties.

- Molecular modeling and synthesis of analogues of bioactive peptides containing non coded amino acids.

Main Achievements

The molecular dynamic simulations, and the synthesis of two mimetics of angiotensin II were accomplished.

Collaborative work on fluorescent N-glycopeptides (small peptides and RGD peptide) containing D-glucose, naphtalenetriazole and coumarin derivatives were synthesized.

Collaborative work on synthesis of heterocycles (tacrine, pyrazole and pyrimidine derivatives) was carried out.

New fluorescent amino acids and peptides were prepared from dehydroamino acids and inserted into peptides.

The evalution of the anti-oxidant activity of the dehydroamino acids was carried out.

A modification of our previous methodology for the solution synthesis of dehydroamino acids that allowed the preparation of N-monoprotected dehydroamino acids was developed.

Several new strategies were developed for cross-linking amino acids using metal catalyzed cross-couplings (C-C, C-N and C-O), Michael addition and substitution reactions. These compounds will be used in the synthesis of cyclic analogues of biologically active peptides.

The synthesis of substituted oxazole derivatives was accomplished by iodocyclization from N-acyl-beta-hydroxyamino acids.

Several indole derivatives were synthezised from beta,beta-disubstituted dehydroamino acids by an intramolecular metal assisted C-N cyclization reaction. The evaluation of the photophysical and biological properties of some of these compounds revealed their potential use as probes and/or as anti-tumoral compounds.

Fluorescent functionalized heterocycles, namely benzopyrans, oxobenzo[f]benzopyrans and quinolones were synthesized and coupled to amino acids via different linkages. Photocleavage and kinetic studies of the fluorescent conjugates were carried out.

Several new benzo[a]phenoxazine and naphtho[2,3-a]phenoxazine derivatives were synthesized and their photophysical properties studied, in addition to the evaluation of structure-activity relationships as new antimicrobials.

Benz-X-azoles derivatives coupled to amino acids, crown ethers, oligothiophiophenes, arylthiophenes and imidazophenanthrolines were synthesized and characterized for application as fluorescent and solvatochromic probes, chemosensors for anions and cations and non-linear

Objectives & Achievements

optical materials.

Tri- and pentapeptides with a central alpha,alpha-dialkylglycine or N,alpha,alpha-trialkylglycine residue, were synthesized and the corresponding PhD thesis terminated. The evaluation of the applicability of the studied C-terminal amide bond cleavage reaction to "in situ" formation of novel peptide bonds is ongoing.

Group Productivity

Publications in peer review Journals

AA1-M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Comparative study of polyaromatic and polyheteroaromatic fluorescent photocleavable protecting groups", Tetrahedron, 2008, 64, 3032-3038. (IF 2.869)

AA2-M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Neurotransmitter amino acid – oxobenzo[f]benzopyran conjugates: synthesis and photorelease studies", Tetrahedron, 2008, 64, 11175–11179. (IF 2.869)

AA3-M.S.T. Gonçalves, "Fluorescent labeling of biomolecules with organic probes", Chem. Rev., 2008, accepted, doi: 10.1021/cr0783840. (IF 22.757)

AA4-M.A.C. Preto, A.Melo, L.M. Rodrigues, H.L.S. Maia, M.J. Ramos, "Structural insight on the activity of Type 1 Angiotensin II peptide antagonists using MD simulations", J. Chem. Phys. B, 2008, 112, (43), 13620-13628. (IF 4.986).

AA5-P.M.T. Ferreira, L.S. Monteiro, G. Pereira, "Synthesis of substituted oxazoles from N-acyl-beta-hydroxyamino acid derivatives"Eur. J. Org. Chem., 2008, 4676-4683. (IF 2.914)

HC4/AA6-S. Gupta, L.M. Rodrigues, A.P. Esteves, A.M.F. Oliveira-Campos, M.S.- J. Nascimento, N. Nazareth, H. Cidade, M.P. Neves, E. Fernandes, M. Pinto, N. M.F.S.A. Cerqueira, N. Brás, "Synthesis of N-aryl-5-amino-4-cyanopyrazole derivatives as potent xanthine oxidase inhibitors", Eur.J.Med.Chem. 2008, 48, 771-780. (IF 2.301).

HC5/AA7-A.M.F. Oliveira-Campos, A. Sivasubramanian, L.M. Rodrigues, J.A. Seijas, M.P. Vázquez-Tato, F. Peixoto, C.G. Abreu, H. Cidade, A.E. Oliveira, M. Pinto, "Substituted Pyrazolo[3,4-d]pyrimidines: Microwave Assisted, Solvent Free Synthesis and Biological Evaluation", Helv.Chim.Acta 2008, 91 (7), 1336-1345 (IF 1.515).

HC6/AA8-A. Eduardo, N.M.B. Neto, L.T. Ueno, L.F. Paula, D.M.S. Araújo, R. Paula, P.L. Franzen, S.C Zilio, A.M.F. Oliveira-Campos, A.M. Fonseca, L.M. Rodrigues, P.O. Nkeonye, R. Hrdina, "Study of spectroscopic properties and first hyperpolarizability of disperse azo dyes derived from 2-amino-5-nitrothiazole", J. Photochem. Photobiol.A: Chem. 2008, 199 (1), 23-33 (IF 1.911).

HC7/AA9-F. Peixoto, A. Sivasubramanian, L. M. Rodrigues, C. G.Abreu and A. M. F. Oliveira-Campos, "Antifungal evaluation of substituted pyrazolo[3,4-d]pyrimidines", Acta Hort. (ISHS), 2008, 784, 193-196.

HC8/AA10-A.M. Salaheldin, A.M.F. Oliveira-Campos, L.M. Rodrigues, "3-Aminopyrroles and their application in the Synthesis of Pyrrolo[3,2-d]pyrimidine (9 Deazapurine) Derivative", ARKIVOC 2008 (xiv) 180-190. (IF = 1.253).

HC9/AA11-L. M. Rodrigues, C.S. Francisco, A.M.F. Oliveira-Campos, A.M. Salaheldin "Synthesis of tacrine analogues derived from n-aryl-5-amino-4-cyanopyrazoles " Synthetic Communications, 2008, 38 (24), 4369-4378. (IF = 0.977).

HC10/AA12-M.-J. R.P. Queiroz, E. M.S. Castanheira, M. S. D. Carvalho, A. S. Abreu, P. M.T. Ferreira, H. Karadeniz, A. Erdem "New tetracyclic heteroaromatic compounds based on dehydroamino acids. Photophysical and electrochemical studies of interaction with DNA" Tetrahedron 2008, 64, 382-391 (IF = 2.869).

HC11/AA13-M.-J.R.P. Queiroz, A.S. Abreu, R.C. Calhelha, M.S.D. Carvalho, P.M.T. Ferreira "New strategies for the synthesis of heteroannulated 2-pyridinones, substituted 2-quinolinones and coumarins from dehydroamino acid derivatives" Tetrahedron 2008, 64, 5139-5146. (IF = 2.869).

HC12/AA14-M.-J.R.P. Queiroz, A.S. Abreu, M.S.D. Carvalho, P.M.T. Ferreira, N. Nazareth, M.S.- J. Nascimento "Synthesis of new heteroaryl and heteroannulated indoles from dehydrophenylalanines. Antitumor evaluation" Bioorg. Med. Chem. 2008, 16, 5584-5589. (IF = 2.662).

HC14/AA15-M.-J.R.P. Queiroz, A. Begouin, G. Pereira, P.M.T. Ferreira "New synthesis of methyl 5-aryl or heteroaryl pyrrole-2-carboxylates by a tandem Sonogashira coupling/5-endo-dig-cyclization from beta-iododehydroamino acid esters and terminal alkynes" Tetrahedron, 2008, 64, 10714-10720. (IF = 2.869).

HC15/AA16-A.S. Abreu, E.M.S. Castanheira, P.M.T. Ferreira, L.S. Monteiro, G. Pereira, M.-J.R.P. Queiroz "Pyrenylamino acids: Synthesis, photophysical and electrochemical studies" Eur.J.Org.Chem. 2008, 5697-5703 (IF = 2.914).

HC17/AA17-V.H.J. Frade, M.J. Sousa, J.C.V.P. Moura, M.S.T. Gonçalves, "Synthesis of naphtho[2,3-a]phenoxazinium chlorides. "Structure-activity relationships of these heterocycles and benzo[a]phenoxazinium chlorides as new antimicrobials", Bioorg. Med. Chem. 2008, 16, 3274-3282 (IF 2.662).

HC20/AA18-R.M.F. Batista, S.P.G. Costa, C. Lodeiro, M. Belsley, M.M.M. Raposo, "Synthesis and characterization of novel (oligo)thienyl-imidazo-phenanthrolines as versatile pi-conjugated heterocyclic systems for several optical applications nonlinear optical (NLO) chromophores", Tetrahedron 2008, 64(39), 9230-9238. (IF = 2.869).

HC21/AA19-S.P.G. Costa, E. Oliveira, C. Lodeiro, M.M.M. Raposo, "Hetaromatic alanine derivatives bearing (oligo)thiophene units: synthesis and photophysical properties" Tet. Lett. 2008, 49(36), 5258-5261 (IF = 2.615).

HC22/AA20-S.P.G. Costa, R.M.F. Batista, M.M.M. Raposo "Synthesis and photophysical characterization of new fluorescent bis-amino acids bearing a heterocyclic bridge containing benzoxazole and thiophene" Tetrahedron 2008, 64(41), 9733-9737 (IF = 2.869).

HC23/AA21-R.M.F. Batista, E. Oliveira, S.P.G. Costa, C. Lodeiro, M.M.M. Raposo, "Synthesis and evaluation of bipendent-armed (oligo)thiophene crown ether derivatives as new chemical sensors", Tet.Lett., 2008, 49(46), 6575-6578. (IF = 2.615).

Other publications International

C.M.A. Alves, P.J.G. Coutinho, M.S.T. Gonçalves, "Synthesis and photophysical characterisation of long alkyl side-chain derivatives of benzo[a]phenoxazinium salts", Proceedings of ECSOC-12, The Twelfth International Electronic Conference on Synthetic Organic Chemistry, http://www.usc.es/congresos/ecsoc/, J.A. Seijas e M.P.V. Tato (Eds), MDPI, Basel, 2008, A0032 (ISBN 3-906980-20-0)

M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Photocleavage studies of gama-aminobutyric acid (GABA) conjugates", Proceedings of ECSOC-11, 11th International Electronic Conference on Synthetic Organic Chemistry, http://www.mdpi.net/ecsoc/, J.A. Seijas e M.P.V. Tato (Eds), MDPI, Basel, 2008, C003.

M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Fused oxopyrans as fluorescent labels for neurotransmitter amino acids", Proceedings of

Group Productivity

ECSOC-11, 11th International Electronic Conference on Synthetic Organic Chemistry, http://www.mdpi.net/ecsoc/, J.A. Seijas e M.P.V. Tato (Eds), MDPI, Basel, 2008, A015.

R.M.F. Batista, S.P.G. Costa, C. Lodeiro, M. Belsley, E.M. Gomes, M.M.M. Raposo, "New oligothienyl-imidazo-phenanthroline chromophores for NLO applications", Adv. Mat. Forum IV, 2008, 587-588, 263-267.

G. Pereira, P.M.T. Ferreira, L.S. Monteiro, "Synthesis of pyrenyl amino acid derivatives", 11th Iberian Peptide Meeting, University of Santiago de Compostela, Santiago de Compostela, Spain, 5-6 March 2008.

S.M.M.A. Pereira-Lima, F.C.S.C. Pinto, H.L.S. Maia, "alpha,alpha-dialkyl and N,alpha,alpha-trialkylglycine peptides obtained from Ugi reaction adducts", 11th Iberian Peptide Meeting, University of Santiago de Compostela, Santiago de Compostela, Spain, 5-6 March 2008.

M.-J.R.P. Queiroz, A.S. Abreu, P.M.T. Ferreira, L.A. Vale-Silva, E. Pinto, M.S.-J. Nascimento. "Antitumor evaluation of benzothienyl substituted thienoindoles and a benzothienopyrrole obtained from dehydroamino acids" International Conference on Medicinal Chemistry- 44èmes Rencontres de Chimie therapeutique- Interfacing Chemical Biology, Natural Products and Drug Discovery, 2-4 July 2008, Angers, France.

A.S. Abreu, M.S.D. Carvalho, E.M.S. Castanheira, M.-J.R.P. Queiroz, P.M.T. Ferreira "Interaction of a potential antitumoral benzothieno[3,2-b]pyrrole with lipid membranes and salmon sperm DNA" 1st Portuguese-Spanish-British Joint Biophysics Congress, 10-13 July 2008, Lisbon, Portugal.

E.M.S. Castanheira, A.S. Abreu, M.S.D. Carvalho, P.M.T. Ferreira, M.-J.R.P. Queiroz "Fluorescence studies of new potential antitumoral indole derivatives in lipid membranes" 1st Portuguese-Spanish-British Joint Biophysics Congress, 10-13 July 2008, Lisbon, Portugal.

P.J.G. Coutinho, C.M.A. Alves, M.S.T. Gonçalves, "Long alkyl side-chain derivatives of benzo[a]phenoxazinium salts as membrane fluorescence probes", (P51B), 19th IUPAC - Conference on Physical Organic Chemistry 2008, Santiago de Compostela, Spain, 13-18 July 2008.

M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Photocleavage kinetics of C-protected neurotransmitter amino acids with a benzocoumarin", (P14B), 19th IUPAC - Conference on Physical Organic Chemistry 2008, Santiago de Compostela, Spain, 13-18 July 2008.

A.S.C. Fonseca, M.S.T. Gonçalves, S.P.G. Costa, "Light-induced cleavage of bioconjugates based on O and N heterocycles", (P13B), 19th IUPAC - Conference on Physical Organic Chemistry 2008, Santiago de Compostela, Spain, 13-18 July 2008.

C.M.A. Alves, P.J.G. Coutinho, M.S.T. Gonçalves, "Synthesis of long alkyl side-chain 5,9-diaminobenzo[a]phenoxazinium salts", (P200), 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

M.J.G. Fernandes, M.S.T. Gonçalves, S.P.G. Costa, "Oxobenzobenzopyran-neurotransmitter amino acid conjugates: synthesis and optical properties", (P072), 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

A.S.C. Fonseca, M.S.T. Gonçalves, S.P.G. Costa, "Synthesis and photophysical characterization of phenylalanine derivatives bearing O and N heterocyclic tags", 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

P.M.T. Ferreira, L.S. Monteiro, G. Pereira "Synthesis of substituted oxazoles from N-acyldehydroamino acids", (P077), 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

A.M.F. Oliveira-Campos, J. Pereira, L.M. Rodrigues, P. Parpot, "Reactivity of p-toluenesulphonylindole with AlCl3 or light", 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

A. Begouin, M.-J.R.P. Queiroz, G. Pereira, P.M.T. Ferreira "A new synthesis of substituted pyrrole-2-carboxylates by a tandem Sonogashira coupling 5-endo-dig-cyclization from a beta-iododehydrophenylalanine and terminal alkynes "23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

A.S. Abreu, G. Pereira, P.M.T. Ferreira, M.-J.R.P. Queiroz, EM.S. Castanheira "Synthesis of fluorescent indoles from pyrenyldehydroamino acid derivatives" 23rd European Colloquium on Heterocyclic Chemistry, University of Antwerp, Antwerp, Belgium, 9-13 September 2008.

Master and Ph.D. thesis completed

Filipa Pinto, "Investigação da aplicabilidade da reacção de Ugi-Passerini na síntese de péptidos com α,α-dialquilglicinas", Supervisors: Hernâni Maia/Sílvia Pereira-Lima. Ph.D thesis completed October 2008.

Ana Maria Ferreira da Silva, "Síntese de péptidos com glicinas α,α-dissubstituidas" Supervisor: Sílvia Pereira-Lima. Master Thesis completed July 2008.

Ana Isabel Rodrigues, "Synthesis of fluorescent glycopeptides". Supervisors: Lígia M. Rodrigues, Ana Paula Esteves. Master Thesis completed April 2008

Carla Francisco, "Synthesis of tacrine analogues". Supervisor: Lígia M. Rodrigues. Master Thesis completed December 2008

Internationalization

Collaborative work with Dr. Sibel Suzen of the Department of Pharmaceutical Chemistry, Faculty of Pharmacy, Ankara University, Turkey, which led to the publication "Comparative effect of N-substituted dehydroamino acids and alpha-tocopherol on rat liver lipid peroxidation activities", P.M.T. Ferreira, L.S. Monteiro, T. Coban, S. Suzen, J. Enzyme Inh. Med. Chem., 2009, accepted for publication.

FCT Relatório Científico 2008 Print: 08-11-2013 10:06:44 [Centro de Química]

Group Description

Title of Research Group:	(RG-Norte-686-1064) Biological Chemistry
Principal Investigator:	Joao Carlos Ramos Nunes Marcos
Main Scientific Domain:	n/a
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

Projects funded by FCT:

PTDC/QUI/70063/2006 "Targeted nanoconstructs for multimodal medical imaging" Coordinated by Prof. Carlos Geraldes (CNC-UC). JAM and JPA team members. (01/01/08-31/12/10) 61296€

PTDC/QUI/69607/2006 "New photolabile groups as phototriggers and protecting groups: synthesis, photophysics and photorelease studies" Coordinated by Profª Susana Costa (AA/CQ-UM). JCM team member. (01/01/08-31/12/10) 29100€

Ph.D. Students funded by FCT:

Helder Barbosa SFRH/BD/16296/2004/XS49 (01/01/05- 31/12/08) 2750€

Sandra Barros SFRH/BD/36522/2007 (01/04/09-01/03/12) 2063€

Objectives & Achievements

Objectives

The Biological Chemistry group encompasses several chemical studies connected with biological systems. In the past this had included the synthesis of contrast agents target at specific organs, the purification of therapeutic macromolecules, and the utilization of yeast as bioremediation agents. With the retirement of one group member (MTR) the last area of research was discontinued. However was initiated a new line of research that deals with the selection and design of potential drug candidates. As before the different areas of research were divided in different tasks that have now the following objectives:

Task 1- Design, synthesis, physico-chemical characterization and pharmacological evaluation (in vivo – biodistribution and in vitro - cell line studies) of new metal complexes (Gd(III), Ga(III), Al(III)) as potential agents for medical imaging (MRI, gamma scintigraphy and PET).

Synthesis and characterization (UV-VIS spectroscopy, Dynamic Light Scattering and Zeta potential) of paramagnetic gold nanoparticles, functionalized with Gd(III)-chelates, for Magnetic Ressonance Imaging

Task 2- Development of aqueous two-phase systems (ATPS) for the large-scale affinity purification of plasmid to be used on molecular therapies. Two main objectives were pursued:

i) Selection of small DNA binding molecules to be used as affinity ligands

ii) Selection of appropriate polymer-polymer systems for affinity purification

Task 3 – Selection of new peptide inhibitors of Human Neutrophilic Elastase (HNE) derived from proteins that are know to inhibit this enzyme in vivo. Phosphorylation of the selected peptides and kinetics studies of the inhibition of the phosphorylated and non-phosphorylate peptide. The final goal is to obtain a peptide inhibitor to be incorporated in bandages for chronic wounds and control the levels of HNE.

Main Achievements

Task 1- New amphiphilic triaza and tetraaza based chelates of Ga(III) and Al(III) with relevance for medical imaging (gamma scintigraphy and PET) have been synthesized and characterized in vitro and in vivo (acid-base properties; structure and dynamics in solution; cmc determination; biodistribution and gamma imaging). Synthetic routes have developed for the preparation of bifunctional w-thiol-derivatized metal chelators. Preliminary results indicate that the bifunctional metal chelators can be used for the synthesis of stable nanoparticles that can be charged with high loadings of Gd(III) ions without precipitation.

The unloaded and Gd(III)-loaded gold nanoparticles have been characterised by UV-VIS spectroscopy, Dynamic Light Scattering, Zeta potential measurements.

Task 2 – The partition of total Protein, total DNA and total RNA from an alkaline bacterial cell lysate in Poly(ethylene glycol) (PEG) / Dextran (DEX) systems was studied to find appropriate systems for pDNA affinity purification. Suitable systems for the utilization of PEGylated DNA affinity ligands or native protein ligands were selected. The affinity of several DNA-binding antibiotics to plasmid DNA namely kanamycin, neomycin, berberine and berenil was determined in the presence and absence of sodium chloride. From these berenil seems to be the most promising to future affinity purification studies given its high affinity (Kd= 79 mM) in the presence of 1.0 M NaCl and the possibility to reduce it by increasing the salt concentration to 2.0 M NaCl (Kd=500 mM).

Task 3 – Using a microarray with 49 peptides (13 residues each) derived from Secretory Leucocyte Protease Inhibitor (SLPI), R-Elafin, Human Eosinophil Cationic Protein (ECP) e Human Surfactant Protein D (SP-D) a phosphorylable peptide was selected. The phosphorylated and non-phosphorylated peptide were tested as inhibitors of elastase and the first shows less inhibition than the second one. This shows that it should be possible to implement a reversible Phosphorylation/Dephosphorylation that function as a molecular switch to control the levels of HNE.

Group Productivity

Publications in peer review Journals

Group Productivity

BC1- S. Torres, M.I.M. Prata, A.C. Santos, J.P. Andre´, J.A. Martins, L. Helm, E. Toth, M.L. Garcia-Martin, T.B. Rodrigues, P. López-Larrubia, S. Cerdan and C. F.G.C. Geraldes, "Gd(III)-EPTPAC16, a new self-assembling potential liver MRI contrast agent: in vitro characterization and in vivo animal imaging studies", NMR Biomed., 2008, 21, 322–336

BC2- Barbosa, H, Hine, A.V., Brocchini, S., Slater, N.K.H., Marcos, J.C. "Affinity partitioning of plasmid DNA with a zinc finger protein". Journal of Chromatography A (2008) 1206, (2), 105-112

BC3- M. Fani, J.P. André, H.R. Maecke, 68Ga-PET: a Powerful Generator-Based Alternative to Cyclon-Based PET Radiopharmaceuticals, Contrast Media and Molecular Imaging, 2008, 3, 67-77

BC4- A. Heppeler, J. P. André, I. Buschmann, X. Wang, J. C. Reubi, M. Hennig, T. Kaden, H.R. Maecke, Metal-Ion-Dependent Biological Properties of a Chelator-Derived Somatostatin Analogue for Tumour Targeting, Chemistry - a European Journal, 2008, 14: 3026-3034

Master and Ph.D. thesis completed

In the framework of a collaboration with Universidade da Beira Interior the following two Master thesis in Biochemistry were co-supervised by João Carlos Marcos and finished and presented in that University in 2008 :

- Catarina Caramelo Nunes "Purificação de plasmídeos para terapia génica por interacção de afinidade", September 2008

- Teresa Susana Ferreira Tente "Selecção de ligandos naturais para a purificação de DNA plasmídico por métodos de afinidade" September 2008

Internationalization

The research work is carried out through collaboration with well established and reputed international institutions:

- Institute of Nuclear Medicine of University Hospital Basel, Switzerland (group of Prof. H. Maecke)

- Laboratoire de Chimie Inorganique et Bioinorganique, École Polytechnique Fédérale de Lausanne, Switzerland (groups of Prof. André Merbach and Prof. Lothar Helm)

- Centre de Biophysique Moléculaire, CNRS, Orleans, France (group of Dr. Éva Tóth)

- Instituto de Investigaciones Biomédicas "Alberto Sols", CSIC-UAM, Madrid, Spain (group of Prof. Sebastián Cerdán)

- Department of Chemical Engineering , University of Cambridge (group of Prof. Nigel Slater) – Joint Ph.D. student

- School of Pharmacy, University of London (group of Prof. Steve Brocchini)

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Group Description

Title of Research Group:	(RG-Norte-686-1656) Electrochemistry and Environment (EE)
Principal Investigator:	Michael John Smith
Main Scientific Domain:	n/a
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

This group of researchers received the sum of 22 880 Euros from the Centre of Research in Chemistry, through the FCT pluriannual funding program in 2008. Additional funding of a total of approximately 33 750 Euros was received from projects included in specific FCT programs designated as "Science, Technology and Innovation (POCTI)" and 8 Human Resources PhD grants (PBarbosa 2270/2005, LRodrigues 38616/2007, LPeixoto 38331/2007, LGonçalves 38262/2007, RSantos BDE/15657/2007, BSilva 28203/2006, HFigueiredo 28201/2006 and RAraújo 38318/2007).

A further contribution to research activities of the group of about 9 500 Euros was received from international support attributed through grants from the European Network FAME, the ISE, the US Global Office of Naval Research and the US Air Force Office of Aerospace Research.

Finally, the Committee of Rectors of Portuguese Universities International Exchange fund contributed 1 500 Euros in support of an ongoing collaboration.

Objectives & Achievements

Objectives

In projects that benefitted from cooperation with colleagues from other sub-domains of Chemistry, from other science or engineering departments, the objectives of this group included: the synthesis and characterization of new materials for technological applications, the development of electrosynthetic and electroanalytical methods and the characterization of electrooxidative and photo- and thermooxidative reactions of natural and synthetic polymers. During 2008 the activity of the group was directed towards sub-tasks with the following specific objectives:

. The synthesis of metal complexes encapsulated or immobilized in inert nano-supports for evaluation as new environmentally-friendly catalysts;

. The preparation of zeolite-supported biofilms for treatment of polluted effluents;

. The preparation and characterization of organic and organo-metallic compounds with appropriate properties for application in optical signal transmission;

. The preparation and characterization of hybrid organic-inorganic composites doped with metal and semiconductor nanoparticles for optical applications;

. The preparation and characterization of new solid polymer electrolytes for application in novel electrochromic devices and efficient, cost-effective batteries with negligible environmental impact;

. The electrosynthesis of organosulphur and heterocyclic compounds with commercial value in non-toxic microemulsion media;

. The selective, high-yield transformation of biomass-derived carbohydrates by electro-oxidation using modified electrodes and mediators in aqueous and low environmental impact ionic liquids;

. The development of novel methods for the evaluation of food or beverage quality and shelf-life stability;

. The synthesis and characterization of polymeric materials to identify chemical modifications that enhance the bio-degradability of polymer residues.

Main Achievements

During 2008 the research carried out in collaboration with national and international partners led to publication of 16 papers in international journals and a further 10 have been accepted for publication.

A method has been developed for measuring oxidation resistance of white wines by cyclic voltammetry. This method is based on the analysis of characteristic parameters or "feature extraction" of voltammetric waves. Voltammetric data together with chemical characterization of a large number of wines was shown to be useful in the prediction of white wine shelf life.

An electrochemical method for conversion of bromo propargyloxy and allyloxy derivatives into substituted tetrahydrofurans has been developed using a nickel(II) catalyst in non-toxic microemulsions. The reaction mechanism has been elucidated.

A new approach to the preparation of environmentally-friendly catalysts was developed using metal complexes encapsulated/immobilised in zeolites. The catalytic activity of these novel materials was evaluated in studies of oxidation reactions in gas and liquid phases.

High yields and selectivities were obtained for mono di- and polysaccharides oxidation using mediators.

The electroreactivity of bacteria suspended in aqueous medium at a carbon electrode was investigated and kinetic parameters of redox reactions were determined by cyclic voltammetry.

In a joint project developed with collaborators from the Heterocyclic Chemistry group, a series of novel organo-metallic compounds were prepared and evaluated as potential candidates for non-linear optical applications.

New procedures for the synthesis of semiconductors (CdSe, CdS@ZnS and CdSe@ZnS) were implemented. Experimental procedures necessary for improved characterization of surface properties of funcionalized carbon based nanoparticles were optimized.

Photodegradation of ABS copolymers was studied and chemical and physical alterations were characterized. Polymer formulations with improved properties were developed.

Inorganic/organic hybrid electrolytes were prepared and characterized. The most promising formulations were evaluated as conducting, adhesive and sealing components in prototype electrochromic devices.

Group Productivity

Publications in peer review Journals

EE1/HC18. H. Figueiredo, B. Silva, M.M.M. Raposo, A.M. Fonseca, I.C. Neves, C. Quintelas, T. Tavares, "Immobilization of Pyridazine derivative Iron(III) Complexes prepared from Biosorbents supported on Zeolites", Microporous and Mesoporous Materials 109 (2008) 163-171. (IF08 2,555)

EE2/HC24. A.P. Esteves, M.J. Medeiros, C.S.S. Neves, D. Pletcher, "Organic cyclisation of propargyl and ally bromoesters in microemulsions catalyzed by electrogenereted Nickel(I) tetramethylcyclam", Journal of Electroanalytical Chemistry 614 (2008) 131-138. (IF08 2,484)

EE3/HC25 - A.L. Santos, R.M. Takeuchi, N.R. Stradiotto, A.P. Esteves, M.J. Medeiros, "Study of the Electrochemical Reduction of Amoebicide Teclozan and its Amperometric Determination in Pharmaceutical Formulations", J. Braz. Chem. Soc., 2008, 19, 1144-1152 (IF08=1,539)

EE4/HC26. C. Teixeira, P. Pescarmona, M.A. Carvalho, A.M. Fonseca, I.C. Neves, "Host(Beta Zeolite)-Guest(Copper(II)-Methyladenine Complex) Nanomaterials: Synthesis and Characterization", New Journal of Chemistry, 32 (2008) 2263-2269. (IF08 2,942)

EE5. S. C. Nunes, V. de Zea Bermudez, D._ Ostrovskii, P. C Barbosa, M. M Silva, M. J Smith, "Cationic and anionic environments in LiTFSI-doped di-ureasils with application in solid-state electrochemical devices", Chemical Physics 345 (2008) 32-40. (IF08 1,961)

EE6. S.C. Nunes, V. de Zea Bermudez, D. Ostrovskii, L.D. Carlos, M.M. Silva, M.J. Smith, "Cation coordination and hydrogen bonding in potassium and magnesium based-di-amidosil hybrids", Journal of Molecular Structure 874 (2008) 128-137. (IF08 1,594)

EE7. P.C. Barbosa, L.C. Rodrigues, M.M. Silva, M.J. Smith, "Preparation of hybrid organic-inorganic materials based on a di-ureasil matrix doped with lithium bis(trifluoromethanesulfonyl)imide", J. Power Sources 180 (2008) 607-611. (IF08 3.477)

EE8. S.C. Nunes, V. de Zea Bermudez, J. Cybinska, R.A. Sá Ferreira, L.D. Carlos, J. Legendziewicz, M.M. Silva, M.J. Smith, D. Ostrovskii, "Structure and photoluminescence of di-amidosil nanohybrids incorporating europium triflate", Journal of Alloys and Compounds (2008) 451 (2008) 510-515. (IF08 1,510)

EE9. P.C. Barbosa, M.M. Silva, M.J. Smith, A. Gonçalves, E. Fortunato, "Solid-state electrochromic devices based on poly(trimethylene carbonate) and lithium salts", Thin Solid Films 516 (2008) 1480-1483. (IF08 1,884)

EE10. G. Botelho, S. Lanceros-Mendez, M. Gonçalves, V. Sencadas, J. G. Rocha, "Relationship between processing conditions, defects and thermal degradation of poly(vinylidene fluoride) in the _-phase" Journal of Non Crystalline Solids 354 (2008) 72-78. (IF08 1,449)

EE11. M. J. Oliveira, G. Botelho "Degradation of polyamide 11 in rotational moulding" Polymer Degradation & Stability" Polymer Degradation and Stability 93 (2008) 139-146.(IF08 2.320)

EE12. G. Botelho, M. M. Silva, A. M. Gonçalves, S. Lanceros-Mendez "Poly(vinylidene fluoride) performance against UV radiation" Polymer Testing 27 (2008) 818-822. (IF08 1,736)

EE13. B. Silva, H. Figueiredo, C. Quintelas, I.C. Neves, T. Tavares, "Zeolites as supports for the biorecovery of hexavalent and trivalent chromium", Microporous and Mesoporous Materials, 116 (2008) 555-560. (IF08 2.555)

EE14. E. Duñach, M. J. Medeiros, "Indirect electrochemical cyclisation of bromoalkoxylated derivatives mediated by nickel(I) complex in environmentally friendly medium", Electrochimica Acta 53 (2008) 4470-4477. (IF08 3.078)

EE15. M.J. Medeiros, D. Pletcher, D. Sidorin, "The catalysis of carbon dioxide hydration by acetate ion", Journal of Electroanalytical Chemistry 619-620 (2008) 83-86. (IF08 2,484)

EE16. R. Martins, R. Oliveira, F. Bento, D. Geraldo, V. Lopes, P. Guedes de Pinho, C. Oliveira, A. Silva Ferreira, "Oxidation management of white wines using cycling voltammetry and multivariate process monitoring", J. Agric. Food Chem. 56 (2008) 12092–12098. (IF08 2.562)

Other publications International

EE1. F.M. Gray, M.J. Smith, "Lithium polymer batteries: principles and applications", In Encyclopedia of Electrochemical Power Sources, Ed:. J. Garche, Elsevier B.V.: Amsterdam (2008).

EE2. C. Teixeira, P. Parpot, I.C. Neves, A.M. Fonseca, "Application of a Novel Modified Electrode based on NaY-Encapsulated Co(PAN) complex", Materials Science Forum IV, (2008) Vols. 587-588, 109-113.

EE3. I. Moura, A. V. Machado, F. M. Duarte, G. Botelho, R. Nogueira "Preparation of biodegradable materials by reactive extrusion", Materials Science Forum IV, (2008) 520-524.

EE4. A. M. Gonçalves, J. Serrado-Nunes, V. Sencadas, G. Botelho, M. Belsley, S. Lanceros-Mendéz "Photo-degradation studies of poly(vinylidene fluoride)", Materials Science Forum IV, (2008) 543-547.

EE5. M. P. Silva, V. Sencadas, A.G. Rolo, G. Botelho, A. V. Machado, J.G. Rocha and S. Lanceros-Méndez, "Influence of the crystallization kinetics on the microstructural properties of g-PVDF", Materials Science Forum IV, (2008) 534-537.

EE6. B. Silva, H. Figueiredo, C. Quintelas, I.C. Neves, T. Tavares, "Iron and Chromium Removal from Binary Solutions of Fe(III)/Cr(III) and Fe(III)/Cr(VI) by biosorbents supported on zeolites", Materials Science Forum IV, 587-588 (2008) 463-467.

EE7. B. Silva, H. Figueiredo, C. Quintelas, I. C. Neves, T. Tavares, "Biosorption of hexavalent chromium by Arthrobacter viscosus", Proceedings of the 10th International Chemical and Biological Engineering Conference - CHEMPOR 2008, 2008, pp. 483-488 (ISBN: 978-972-97810-3-2).

EE8. H. Figueiredo, B. Silva, C. Quintelas, I.C. Neves, T. Tavares, "Biosorption of CrVI supported on mordenite zeolite", Proceedings of the 10th International Chemical and Biological Engineering Conference - CHEMPOR 2008, 2008, pp. 248-252 (ISBN: 978-972-97810-3-2).

EE9. B. Silva, H. Figueiredo, I.C. Neves, T. Tavares, "The role of pH on Cr(VI) reduction and removal by Arthrobacter viscosus", Proceedings of World Academy of Science, Engineering and Technology, Vol. 33, 2008, the WASET conference proceedings (ISSN 2070-3740).

Master and Ph.D. thesis completed

During the year 2008 four MSc theses were completed by students supervised by members of the Electrochemistry and Environment group.

1. Francisco Fernandes, MSc student, concluded in January 2008, co-supervised by CJ Silva and MF Proença.

2. Óscar Samuel Novais Carvalho, MSc student, concluded in February 2008, co-supervised by AM Fonseca and F Silva.

3. José Manuel Troina Lima, MSc student, concluded in May 2008, supervised by AM Fonseca.

4. Manuela Alexandra Silva, MSc student, concluded in April 2008, co-supervised by A Queirós and G Botelho.

Organization of conferences

Group Productivity

Two members of the Electrochemistry and Environment group participated in the organization of the 11th International Symposium on Solid Polymer Electrolytes, held in Ofir between the 31st August and the 5th of September, as Conference chairperson (MMS) and member of the organizing committee (MJS). External financial support was obtained from various sources.

The symposium "Ciência e Arte" was organized by two members (GB and ICN) and coordinated by one of the members (ICN) of the Electrochemistry and Environment group and took place on the 14th and 15th of June. This symposium was one of the activities included in the program of the Sentido de Ciências project, financed by FCT with the objective of projecting a positive image of scientific culture within the public domain.

Industry contract research

One of the members (GB) of the Electrochemistry and Environment group participated as co-supervisor in collaboration with the Department of Polymer Engineering (UM) in the orientation of a PhD student involved in industrial research and sponsored by a portuguese company, Colorgal. A dutch company, DSM Research, also participates in this project as an external consultant and the project is scheduled to terminate in October 2011. The objectives of this project include the improvement of the UV radiation resistance of ABS composites.

Another project, sponsored by an industrial partner Simbiente during 2007 and 2008, involves the participation of one of the group members (ICN) in the development of biosorption materials for the treatment of specific industrial effluents.

Recent contacts with a portuguese laboratory (Vinalia) have resulted in a new contract, formalized at the end of 2008. This contract supports the development of new GC-MS and LC-MS methods for chemical analysis of pesticide content in wines (PP). This collaboration was extended to the application of spectroscopic techniques to quantify heavy metal ion contamination in wines (CJS).

Internationalization

The bibliographic consequences of the last year of research in the Electrochemistry and Environment group has been the publication of 16 papers in international journals and the acceptance of a further 10 papers for publication in 2009. The importance of international scientific exchange may be demonstrated by the fact that more than 30% of these papers are co-authored with foreign collaborators. Discussion of results and access to facilities available abroad, both for permanent staff members of the centre and students studying for MSc and PhD qualifications, are important benefits that are provided by the continuation of these international contacts.

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Group Description

Title of Research Group:	(RG-Norte-686-1733) Heterocyclic Compounds (HC)
Principal Investigator:	Maria Fernanda de Jesus Rego Paiva Proença
Main Scientific Domain:	n/a
Group Host Institution:	Universidade do Minho

Funding, source, dates

Funding, source, dates

Projects funded by FCT and FEDER:

POCI/QUI/57400/2004 (PI/HC, AA) (1/9/2005-31/8/2008, total funding 60 000 €) 2008, 11 000 €.

PPCDT/QUI/59356/2004 (PI/HC) concluded 2008, 12 500 €.

POCI/QUI/59407/2004 (PI/HC, AA) (1/9/2005-31/8/2008, total funding 60 000 €), 2008, 11 000 €.

POCI/QUI/59835/2004 (HC, EE, PI/IPC-UM) concluded 2008, 2000 euros.

PTDC/QUI/66250/2006, (PI/HC, AA, UNLisboa) (01.01.2008 – 31.12.2010, total funding 110 100 €), 2008, 27 276 €

PTDC/QUI/81238/2006 (HC, AA, PI/CF-UM) (1/11/2008-31/10/2011, total funding 89 325 €) 2008, 1000 €.

Projects funded by the Council of Rectors of the Portuguese Universities:

CRUP-AI-F37/08, 2008, 1 500 €

CRUP-AI-E97/08, 2008, 2 000 €

PhD students funded by FCT:

Alexandra Ribeiro, SFRH/BD/24760/2005, Jan 2006, 2750 €

Ana Bacelar, SFRH/BD/24959/2005, Jan 2006, 2750 €

Carla Correia, SFRH/BD/22270/2005, Jan 2006, 2750 €

Ricardo Calhelha, SFRH/BD/29274/2006, Oct. 2006, 2750 €

Marta Costa, SFRH/BD/31531/2007, May 2007, 2750 €

Rui Araújo, SFRH/BD/38318/2007, (Supervisors HC/EE), Dec. 2007, 1375 €

Rosa Batista, SFRH/BD/36396/2007, (Supervisors HC/AA), Oct. 2007, 1375 €

Post-Doc researchers funded by FCT:

Magdi Zaki, SFRH/BPD/27029/2006, Feb 07

Abdellatif Salaheldin, SFRH/BPD/31490/2006, Feb 07

Ana Abreu, SFRH/BPD/24548/2005, (HC/AA and CF-UM) May 06

Agathe Begouin, SFRH/BPD/36753/2007, Nov. 07

Objectives & Achievements

Objectives

The search for new synthetic methods, including eco-friendly approaches for the preparation of heterocyclic compounds, is a challenge embraced by some researchers. The synthetic skills developed over the years to generate a diversity of heterocyclic molecules incorporating N, O or S heteroatoms are now invested in the development of their potential applications. Two main areas have emerged: the synthesis of new drug candidates and the synthesis of new materials, complemented with the collaboration of national and international experts, in particular for the study of their biological and physical properties.

The synthesis of new heterocycles with potential biological activity addresses the preparation and testing of:

- Anti-tubercular agents in particular compounds incorporating hydrazides (including Isoniazid), imidazolyl-triazoles, imidazolyl-imidazoles and functionalized 2-oxoimidazoles analogues of PA824.

- CNS active drugs namely new chromene derivatives, substituted 8-oxopurines, 6-aminopurines and tacrine analogues

- Antifungal agents including chromene dimmers and benzo[b]thiophene-based di(hetero)arylamines obtained by Pd-catalyzed C-N Buchwald-Hartwig coupling.

- Anticancer agents such as polyheteroaromatic compounds obtained by Pd/Cu-assisted reactions from dehydroamino acids and heterocycles.

- Antioxidants including benzo[b]thiophene-based di(hetero)arylamines, heteroarylnitrones and phenolic purine and imidazole-based heterocycles.

The synthesis of new heterocyclic/organic-based materials includes:

- New functionalized heterocyclic derivatives such as (oligo)thiophenes, thienylpyrroles, benz-X-azoles, pyridazines, phenanthrolines, bis-indolylmethanes, crown ethers and modified amino acids bearing heterocyclic moieties, solvatochromic and fluorescence probes, NLO, sensors of cations and anions for analytical, medicinal and environmental applications.

- Fluorescent heteroaromatic compounds as DNA intercalators. Interaction with liposomes.

- Carbon-based nanomaterials, including the functionalization of CNTs and CNFs.

Objectives & Achievements

- Synthesis of polyhydroxylated pyrrolidines and aziridinopyrrolidines based on Diels-Alder reactions.

- Development of a diastereoselective methodology towards azafagomine and analogues.

-Tri-substituted tetrahydrofurans by reductive cyclisation using indirect electrochemical methods in "green" media.

Main Achievements

Results on the synthesis of new drug candidates include:

-Phenol-substituted imidazoles, purines and pyrimidopyrimidines, fused heterocyclic N-oxides and benzo[b]thiophene-based diarylamines as antioxidants.

-Di(hetero)arylamines and chromene dimmers as antifungals.

-N-heterocycles incorporating hydrazides and functionalized imidazoles (150 new structures) were sent to be tested against Mtb (TAACF-USA). Previous results identified 26 active structures.

-Tacrine analogues derived from aminocyanopyrazoles and 4-aminopyrrolo-3-carbonitrile as AChE inhibitors.

-Substituted chromenes, 6-aminopurines and substituted 8-oxoimidazoles obtained by a regioselective approach, identified as active antipsychotics by an in silico prediction were submitted to biological tests.

-Heteroaromatic fluorescent compounds from dehydroAAs and heterocycles using Pd/Cu-assisted reactions, as antitumorals. DNA binding and interaction with liposomes was studied by photophysical and electrochemical methods.

The synthesis of new materials contemplates:

-(Oligo)thiophenes, thienylpyrroles, benz-X-azoles, pyridazines, phenanthrolines, bis-indolylmethanes, crown ethers and modified AAs bearing (oligo)thiophenes and benzoxazole moieties. Evaluation of their photophysical, thermal, NLO and sensor properties indicates that they may be used as solvatochromic and fluorescence probes, as efficient and thermally stable catalysts, photochromic, NLO materials and as ion sensors.

-CNTs functionalized by Diels-Alder reactions.

New synthetic methods were developed for the preparation of:

-5-(Hetero)arylpyrrole-2-carboxylates by a one pot Pd/Cu Sonogashira coupling of iododehydroAAs with terminal acetylenes and a 5-endo-dig cyclization.

-Amino quinolinones and coumarins by Suzuki coupling of bromodehydroAAs with o-amino or o-hydroxy phenylpinacolborane esters and cyclization.

-Heteroannullated pyridin-2-ones from heteroaryldehydroAAs in acidic medium.

-PyrenyldehydroAAs and their photophysical and electrochemical behaviour.

-Polyhydroxy and aziridino pyrrolidines from [4+2] cycloadducts of cyclopentadiene and imines/2H-azirines.

-Azafagomine derivatives in very high d.e. by Diels-Alder addition of 1-glucosyl-1,3-butadiene to 3,5-dihydro-4-phenyl-4H-triazol-3,5-dione.

-Triazoleglycoconjugates derived from 6-azido acetylated glucose.

-Heterocycles by electrosynthesis in non-toxic microemulsions using olefinic or acetylenic substrates, some bearing acetylated D-glucose.

-Fluorescent N-glycopeptides with D-glucose, naphtalene triazole and coumarine derivatives.

Group Productivity

Publications in peer review Journals

HC1- J.P. Silva, M.F. Proença O.P. Coutinho, "Protective role of new nitrogen compounds on ROS/RNS-mediated damage to PC12 cells" Free Radical Research 2008, 42 (1), 57-69 (IF2007 2.925).

HC2- M. Costa, F. Areias, L. Abrunhosa, A. Venâncio. F. Proença, "The condensation of salicylaldehydes and malononitrile revisited: synthesis of new dimeric chromene derivatives" J. Org.Chem. 2008, 73 (5), 1954-1960 (IF 3.959).

HC3 - M. Costa, F. Proença, "A simple and eco-friendly approach for the synthesis of 2-imino and 2-oxo-2H-chromene-3-carboxamides" Green Chem.2008, (9), 995-998 (IF 4.836).

HC4/AA6- S. Gupta, L.M. Rodrigues, A.P. Esteves, A.M.F. Oliveira-Campos, M.S.- J. Nascimento, N. Nazareth, H. Cidade, M.P. Neves, E. Fernandes, M. Pinto, N. M.F.S.A. Cerqueira, N. Brás, "Synthesis of N-aryl-5-amino-4-cyanopyrazole derivatives as potent xanthine oxidase inhibitors", Eur.J.Med.Chem. 2008, 48, 771-780. (IF 2.301).

HC5/AA7- A.M.F. Oliveira-Campos, A. Sivasubramanian, L.M. Rodrigues, J.A. Seijas, M.P. Vázquez-Tato, F. Peixoto, C.G. Abreu, H. Cidade, A.E. Oliveira, M. Pinto, "Substituted Pyrazolo[3,4-d]pyrimidines: Microwave Assisted, Solvent Free Synthesis and Biological Evaluation", Helv.Chim.Acta 2008, 91 (7), 1336-1345 (IF 1.515).

HC6/AA8- A. Eduardo, N.M.B. Neto, L.T. Ueno, L.F. Paula, D.M.S. Araújo, R. Paula, P.L. Franzen, S.C Zilio, A.M.F. Oliveira-Campos, A.M. Fonseca, L.M. Rodrigues, P.O. Nkeonye, R. Hrdina, "Study of spectroscopic properties and first hyperpolarizability of disperse azo dyes derived from 2-amino-5-nitrothiazole", J. Photochem. Photobiol.A: Chem. 2008, 199 (1), 23-33 (IF 1.911).

HC7/AA9- F. Peixoto, A. Sivasubramanian, L. M. Rodrigues, C. G.Abreu and A. M. F. Oliveira-Campos, "Antifungal evaluation of substituted pyrazolo[3,4-d]pyrimidines", Acta Hort. (ISHS), 2008, 784, 193-196.

HC8/AA10- A.M. Salaheldin, A.M.F. Oliveira-Campos, L.M. Rodrigues, "3-Aminopyrroles and their application in the Synthesis of Pyrrolo[3,2-d]pyrimidine (9 Deazapurine) Derivative", ARKIVOC 2008 (xiv) 180-190. (IF 1.253).

HC9/AA11- L. M. Rodrigues, C.S. Francisco, A.M.F. Oliveira-Campos, A.M. Salaheldin "Synthesis of tacrine analogues derived from n-aryl-5-amino-4-cyanopyrazoles " Synthetic Communications, 2008, 38 (24), 4369-4378. (IF 0.977).

HC10/AA12- M.-J. R.P. Queiroz, E. M.S. Castanheira, M. S. D. Carvalho, A. S. Abreu, P. M.T. Ferreira, H. Karadeniz, A. Erdem "New tetracyclic heteroaromatic compounds based on dehydroamino acids. Photophysical and electrochemical studies of interaction with DNA" Tetrahedron 2008, 64, 382-391 (IF 2.869).

HC11/AA13- M.-J.R.P. Queiroz, A.S. Abreu, R.C. Calhelha, M.S.D. Carvalho, P.M.T. Ferreira "New strategies for the synthesis of heteroannulated 2-pyridinones, substituted 2-quinolinones and coumarins from dehydroamino acid derivatives" Tetrahedron 2008, 64, 5139-5146. (IF 2.869).

Group Productivity

HC12/AA14 - M.-J.R.P. Queiroz, A.S. Abreu, M.S.D. Carvalho, P.M.T. Ferreira, N. Nazareth, M.S.- J. Nascimento "Synthesis of new heteroaryl and heteroannulated indoles from dehydrophenylalanines. Antitumor evaluation" Bioorg. Med. Chem. 2008, 16, 5584-5589. (IF 2.662).

HC13- E. Pinto, M.-J.R.P. Queiroz, L.A. Vale-Silva, J.F. Oliveira, A. Begouin, J.-M. Begouin, G. Kirsch "Antifungal activity of synthetic di(hetero)arylamines based on the benzo[b]thiophene moiety" Bioorg. Med. Chem., 2008, 16, 8171-8174. (IF 2.662).

HC14/AA15- M.-J.R.P. Queiroz, A. Begouin, G. Pereira, P.M.T. Ferreira "New synthesis of methyl 5-aryl or heteroaryl pyrrole-2-carboxylates by a tandem Sonogashira coupling / 5-endo-dig-cyclization from beta-iododehydroamino acid esters and terminal alkynes" Tetrahedron, 2008, 64, 10714-10720. (IF 2.869).

HC15/AA16 - A.S. Abreu, E.M.S. Castanheira, P.M.T. Ferreira, L.S. Monteiro, G. Pereira, M.-J.R.P. Queiroz "Pyrenylamino acids: Synthesis, photophysical and electrochemical studies" Eur.J.Org.Chem. 2008, 5697-5703 (IF 2.914).

HC16 - J.E. Rodriguez-Borges, M.L.C. Vale, F.R. Aguiar, M.J. Alves, X. García-Mera "Synthesis of Polyhydroxylated Pyrrolidines and Aziridinopyrrolidines from [4pi+2 pi] Cycloadducts of Cyclopentadiene and Imines / 2H-Azirines", Synthesis, 2008, 6, 971-977 (IF 2.333).

HC17/AA17 - V.H.J. Frade, M.J. Sousa, J.C.V.P. Moura, M.S.T. Gonçalves, "Synthesis of naphtho[2,3-a]phenoxazinium chlorides. "Structure-activity relationships of these heterocycles and benzo[a]phenoxazinium chlorides as new antimicrobials", Bioorg. Med. Chem. 2008, 16, 3274-3282 (IF 2.662).

HC18/EE1- H. Figueiredo, B. Silva, M.M.M. Raposo, A.M. Fonseca, I.C. Neves, C. Quintelas, T. Tavares, "Immobilization of Fe(III) complexes of pyridazine derivatives prepared from biosorbents supported on zeolites", Microporous Mesoporous Mater. 2008, 109(1-3),163-171 (IF 2.210).

HC19- M.M.M. Raposo, A.M.F.P. Ferreira, M. Belsley, J.C.V.P. Moura "5´-Alkoxy-2,2´-bithiophene azo dyes: a novel promising series of NLO chromophores", Tetrahedron 2008, 6 (25), 5878-5884. (IF 2.869).

HC20/AA18- R.M.F. Batista, S.P.G. Costa, C. Lodeiro, M. Belsley, M.M.M. Raposo, "Synthesis and characterization of novel (oligo)thienyl-imidazo-phenanthrolines as versatile pi-conjugated heterocyclic systems for several optical applications nonlinear optical (NLO) chromophores", Tetrahedron 2008, 64(39), 9230-9238. (IF 2.869).

HC21/AA19- S.P.G. Costa, E. Oliveira, C. Lodeiro, M.M.M. Raposo, "Hetaromatic alanine derivatives bearing (oligo)thiophene units: synthesis and photophysical properties" Tet. Lett. 2008, 49(36), 5258-5261 (IF 2.615).

HC22/AA20- S.P.G. Costa, R.M.F. Batista, M.M.M. Raposo "Synthesis and photophysical characterization of new fluorescent bis-amino acids bearing a heterocyclic bridge containing benzoxazole and thiophene" Tetrahedron 2008, 64(41), 9733-9737 (IF 2.869).

HC23/AA21- R.M.F. Batista, E. Oliveira, S.P.G. Costa, C. Lodeiro, M.M.M. Raposo, "Synthesis and evaluation of bipendent-armed (oligo)thiophene crown ether derivatives as new chemical sensors", Tet.Lett., 2008, 49(46), 6575-6578. (IF 2.615).

HC24/EE2 - A.P. Esteves, C.S. Neves, M.J. Medeiros, D.Pletcher, "Organic cyclisations of propargyl and allyl bromoesteres in microemulsions catalysed by electrogenerated nickel(I) tetramethylcyclam", J. Electroanal. Chem., 2008, 614, 131-138 (IF 2.580).

HC25/EE3 - A.L. Santos, R.M. Takeuchi, N.R. Stradiotto, A.P. Esteves, M.J. Medeiros, "Study of the Electrochemical Reduction of Amoebicide Teclozan and its Amperometric Determination in Pharmaceutical Formulations", J. Braz. Chem. Soc. 2008, 19, 1144-1152 (IF 1.539).

HC26/EE4- C.P.P. Teixeira, M.A. Carvalho, A.M. Fonseca, I.C. Neves, "Host(beta zeolite)–guest (copper(II)–methyladenine complex) nanomaterials: synthesis and characterization", New J.Chem. 2008, 32, 2263–2269. (IF 2.651).

Other publications International

Book chapters

M.J. Alves, N.G. Azoia," Stereoselective Methods towards the Synthesis of Iminosugars", in Stereochemistry Research Trends, Editor M.A. Horvat and J.H. Golob, Nova Science Publishers, pg 1-50, 2008.

Proceedings

IV International Materials Symposium/XIII Encontro da Sociedade Portuguesa de Materiais, Faculdade de Engenharia da Universidade do Porto:A.T. Marques, A.F. Silva, A.P.M. Batista, C. Sá, F.J.L. Alves, L.F. Malheiros, M. Vieira (Eds), Porto, Portugal, 1-4 de Abril de 2007, Adv. Mater. Sci. Forum, 2008, 587-588:

-HC1/AA4- R.M.F. Batista, S.P.G. Costa, C. Lodeiro, M. Belsley, E. de Matos Gomes, M.M.M. Raposo, "New oligothiophene-imidazo-phenanthroline chromophores for NLO applications" pp 263-267.

-HC2/AA5- M.M.M. Raposo, A.M. Ferreira, M. Belsley, E. de Matos Gomes, J.C.V.P. Moura, "5-arylazo-2,2´-bithiophenes: a novel promising serie of NLO chromophores" pp. 268-272.

-HC3/AA6 E. Duñach, A.P. Esteves, C.S.S. Neves, M.J. Medeiros, "Synthesis of Heterocyclic Compounds by Radical Electrochemical Approach in Environmentally Friendly Media", ECS Transactions, 2008, 13, 49-55.

Master and Ph.D. thesis completed

MSc theses:

- Francisco Fernandes (supervisors: HC/Maria Fernanda Proença, EE/Carlos Jorge Silva) "Synthesis and functionalization of carbon nanostructures for the treatment of industrial effluents".

- Ana Isabel N. Rodrigues (supervisors: HC/Ana Paula Esteves, AA/Lígia M. Rodrigues) "Synthesis of fluorescent N-Glycopeptides".

- Rita C.S. Forte de Sá (supervisor: Maria José Alves) "Diels-Alder reactions using 2H.azirines and nucleophilic dienes".

Internationalization

The work on synthetic heterocyclic chemistry developed by most members of this group is complemented with the collaboration of international experts, in particular to study the biological and physical properties of the new compounds.

Research on anti-tubercular agents has the collaboration of the Tuberculosis Antimicrobial Acquisition & Coordinating Facility (TAACF-USA) for screening the new compounds against Mtb strain H37Rv.

Group Productivity

The search for new CNS active drugs has the collaboration of members of the Faculty of Pharmacy-Univ. Santiago Compostela, Spain.

New functionalized heterocyclic materials are tested as solvatochromic and fluorescence probes, for non-linear optics (NLO) and as sensors of cations and anions at the University of Valencia-Spain.

Electrochemical studies of the interaction of some heteroaromatic compounds with DNA were done at Fac. Pharmacy, Edge Univ.-Turkey.