



Grupo de Reacção e  
Análises Químicas

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**GRAQ**

RELATÓRIO DE ACTIVIDADES

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**2007**

Janeiro de 2007 a Dezembro 2007

## RELATÓRIO CIENTÍFICO DO GRAQ

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4.	Ph.D. Maria Goreti Ferreira Sales	Professor Adjunto
5.	Ph.D. Maria Manuela Barbosa Correia	Professor Adjunto
6.	Ph.D. Simone Barreira Morais	Professor Adjunto
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3.	BS Ângela Maria de Moura Barroso	MSc student	50 % in FFUP
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5.	BEng Cláudia Marina Mendes Lima Martins	MSc student	50 % in FFUP
6.	BEng Dionisia Maria Oliveira Castro	Ph.D student	50% in LEPAE
7.	BS Elisabete S. Vieira		
8.	BS Felismina Teixeira Coelho Moreira		
9.	BSc Joana Rafaela Lara Guerreiro		
10.	BS José Alberto	MSc student	50 % in FCUP
11.	BS José Alberto Ferreira	MSc student	50 % in FCUP
12.	BS José António	MSc student	50 % in FEUP

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15.	MSc	Sofia Alexandra Alves Almeida	MSc student	50% in FFUP
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## A. DEVELOPMENT OF TRANSDUCERS

### GRAQ team in A.

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### Publications in A.

Nº Artigos	---
Nº Artigos em livro	---
Nº Conferências em que participou	-1-
Nº Teses de Doutoramento	---
Nº Teses de Mestrado	---

#### *A.1 Fiber-optic fluorescent optodes*

Technically, a sensor is a transducer coupled to a selective recognition element. Transducers are based on four general mechanisms, one of which of optical nature based in fibre optics. Sensors regarding an optical transduction are also known as optodes and constitute an increasing area in green chemistry.

The fibre-optic fluorescent optodes are constructed for single chemical species. These optodes require a beam of monochromatic light, providing from a light emission diode. This beam is focused through coupling optics into an optical fibre core. Light interacts with a sensing layer on the fiber's distal end and alters the incident light in proportion to the concentration of the chemical species being detected. Light returns through the coupling optics to the detector. The detector type employed depends on the particular technique. Charge coupled device systems are used for this purpose.

Specificity is determined by the recognition element located on the transducer, allowing only the species of interest to be measured. The sensing layer is prepared in a polymeric matrix of poly(vinyl alcohol), incorporating fluorescent sensing elements for pH measurements.

**B. QUALITY CONTROL AND AUTHENTICITY OF FOOD PRODUCTS****GRAQ team in B**

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Maria Goreti Ferreira Sales  
Maria João Dantas Ramalhosa Ferreira  
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**Publications in B.**

Nº Artigos	---
Nº Artigos em livro	-2-
Nº Conferências em que participou	-3-
Nº Teses de Doutoramento	---
Nº Teses de Mestrado	-3-
Monografias	-1-

**B.1. QUANTIFICATION OF FOOD ADDITIVES**

Food safety is becoming a matter of great concern. Partially this happens because human activity contributes to environmental changes that, in turn, may affect food composition. The intensive use of fertilizers is a useful tool for agriculture but may involve negative effects to the environment and human health.

Nitrate ion is apparently non toxic below maximum residue levels (MRL), however the possibility to be transformed to nitrite and to N-nitroso compounds, the last potent carcinogens, determines the need to

establishing and constantly revising these limits. By contrast to this traditional negative role associated to nitrate, recent studies suggest a possible beneficial role to dietary nitrate, due to its contribution in the defence against pathogenic bacteria.

To develop this study, Vila do Conde Region was chosen. It is classified as a vulnerable area due to the intensive agricultural activity of this region and probably high nitrate concentrations may be found in water and soil samples. Evaluation of nitrate and nitrite levels in horticultural products grown in this area, in order to assess their safety seems to be a challenge.

Nitrate and nitrite contents were evaluated in irrigation water, soil and vegetables (different varieties of cabbage, lettuce, spinaches, parsley and turnip) samples, using analytical methodologies based on spectrophotometric techniques. pH and phosphate values were also determined in water samples, while pH and moisture was evaluated in soil samples. 34 vegetable, 10 water and 11 soil samples were analysed and reference methods used after validation for these matrices.

In the vegetable samples, nitrate levels ranged between 54,2 and 1447 mg NO<sub>3</sub><sup>-</sup>/kg for sprouts; between 41,4 and 939 mg/kg for portuguese cabbage; between 40,9 and 1319 mg/kg for kale; between 797 and 1427 mg/kg for spinach; between 9,1 and 2441 mg/kg for parsley; and between 234 and 654 mg/kg for turnip. In the lettuce sample a level of 1156 mg/kg was present. The maximum residue levels established for nitrate in spinach and lettuce samples were not surpassed.

Regarding to nitrite values, these ranged between 1,1 and 57 mg NO<sub>2</sub><sup>-</sup>/kg for sprouts; between 0,9 and 30 mg/kg (10 mg/kg on average) for portuguese cabbage; between 1,2 and 4,4 mg/kg for kale; between 5,2 and 13,8 mg/kg for spinach; between 1,3 and 13,4 mg/kg for parsley; and between 1,1 and 1,4 mg/kg for turnip. In the lettuce sample a level of 2,6 mg/kg was present. Nitrate concentrations found in water and soil samples were generally bellow those found in the vegetable samples. This line research resulted in a MsC. Thesis.

Vila do Conde Region is classified as a vulnerable area because of the high nitrate concentrations that may be found in water and soil samples as a consequence of the intensive agricultural activity that characterizes the region. For this reason it is important to evaluate nitrate and nitrite levels in horticultural products grown in this area in order to assess their safety. These products play an important role in the population's diet being consumed in a daily basis especially in the form of soup.

In this study, the levels of nitrate and nitrite were determined in 34 vegetable samples (different varieties of cabbage, lettuce, spinaches, parsley and turnip), collected in several locations of Modivas, Vila do Conde, northern Portugal, in February 2007. Reference methods, previously described in the literature were used.

Nitrate levels ranged between 54 and 2441 mg NO<sub>3</sub><sup>-</sup>/kg, for a sprout and a parsley sample, respectively. The maximum residue levels established for nitrate in spinach and lettuce samples were not surpassed. Regarding to nitrite values, these ranged between 1.1 and 57 mg NO<sub>2</sub><sup>-</sup>/kg. Both results were obtained in sprout samples. Nitrite levels were lower than 20 mg NO<sub>2</sub><sup>-</sup>/kg in 90 % of the analysed samples.

Another topic of concern is the presence of salt in foods, specially processed foods. Excessive sodium consumption has been repeatedly linked to the development of high blood pressure and subsequent heart disease. Yet salt reduction remains a major challenge, not only in terms of taste but also formulations and preservation, as salt is a vitally important compound in food manufacturing.

Bread is a very much consumed foodstuff and an interesting source of salt. To verify the contents in bread samples commercialized in Porto Metropolitan area and Coimbra, a flow injection analysis system with potentiometric detection and double-channel was developed, validated and applied to the determination of chloride in 250 samples of different types of bread (pão de trigo, pão integral, pão de centeio, pão de mistura, broa de milho, pão sem sal, pão meio sal, pão de leite and pão de água). The samples were collected from national supermarket groups and traditional bread/bakery stores.

Regular bread samples have 110 to 1498 mg of chloride/100g. Samples without salt and medium-salt have lower contents ranging from 72 to 82 and 232 to 884mg/100g, respectively. However no correlation was found between the levels of sodium and chloride in bread. No significant differences were obtained within samples from supermarkets and traditional stores. This work resulted in an M.sC Thesis.

Glutamates are used as a flavor enhancers in a variety of foods prepared at home, in restaurants, and by food processors. Its use has become controversial after reporting adverse reactions in people who've eaten foods that contain glutamates. Research on the role of these compounds in the nervous system also has raised questions about the chemical's safety. Taking into account the referred facts we developed a methodology to determine glutamate contents in foodstuffs.

Glutamate analyses were made by voltammetric experiments. Voltammetric behaviour of glutamate at a gold electrode was studied by means of cyclic voltammetry. From 2.6 to 11.5 pH values, glutamates originated a single cathodic peak. Potential of the peak,  $E_p$ , was -0.8V, and it was independent from pH. The reduction of glutamate was found irreversible and mainly controlled by diffusion.

The electrochemical behaviour of glutamate was evaluated by cyclic voltammetry, square-wave voltammetry and differential pulse voltametry. Similar analytical features were obtained for these three techniques. Selectivity studies were conducted for mannitol, sorbitol, sucrose, barium chloride, calcium nitrate, calcium tartrate, niquel nitrate and lead nitrate. Recovery experiments of glutamate within different levels of these species were made to assess their degree of interference. This research line resulted in a MsC Thesis.

Ingestion of antioxidant species contributes to reduce the oxidative damage of cells leading to several degenerating diseases. In this context, much interest has been given to antioxidant compounds that are present in food at high levels, such as vitamins and polyphenols. Other antioxidant species may be found in food, but their reduced ingestion has not justified evaluation of their antioxidant properties. This is the case of flavours, present in food at low levels.

However, changes have been introduced in human diet after flavoured waters were marketed. Their consumption in Europe is high and enhances the human uptake of flavours. Therefore, health benefits could be achieved if the antioxidant profile of these commercial waters was known. Ingestion of waters providing a higher level of cell protection could be attained after this.

This work reports the determination of antioxidant capacity (CA) of flavoured waters, a measure of the degree of oxidative inhibition provided by these samples. Measures were conducted by means of optical methods

regarding the inhibition of free radicals in aqueous media. Results from different methods are presented and compared.

**C. ENVIRONMENTAL CONTROL AND REMEDIATION**

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**Publications in C.**

Nº Artigos	-1-
Nº Artigos em livro	-3-
Nº Conferências em que participou	-13-
Nº Teses de Doutoramento	-2-
Nº Teses de Mestrado	-2-

### **C.1. Pollutants analysis**

The popular perception is that modern life exposes us to a cocktail of anthropogenic chemicals, some of which might interact directly with one or more components of the endocrine system, thereby causing some form of malfunction and ultimately health problems.

Pesticides have been widely used in agriculture to control pest, weeds or plant diseases. Their use results not only in economic benefits with increased production yields and a decrease of postharvest spoilage, but also into health benefits due to higher production with improved quality. Despite its advantage to society, many pesticides can remain in the agricultural raw material after application and subsequently be available in the final foodstuffs. An analytical method, based on microwave-assisted extraction and liquid chromatography with diode array detection, for the extraction and determination of six carbamate and three urea pesticides in fresh and processed tomato samples was developed and applied to samples purchased from several local stores in Oporto region.

Also research is done to assess the evidence for organic pollutants and heavy metals in aquatic environment and food and the development of methodologies concerning the quantification of these compounds that exists in extremely low concentration and, in future, establish a monitoring and controlling program for them. Target analytes will be selected on the basis of their presumable presence in the water matrices and their environmental significance and include compounds of different sources of contamination: estrogens (domestic), pesticides (agriculture), heavy metals and plasticizers (industrial).

Polycyclic aromatic hydrocarbons (PAHs) are a large group of organic compounds that are mainly formed during pyrolytic processes from the incomplete combustion of organic materials such as coal, crude oil and natural gas. Also, they are originated from vehicle traffic, cooking and tobacco smoking.

Most compounds of this class are known to be carcinogenic and or mutagenic. Their existence in the environment has a direct and indirect impact on human health because of the semi-volatile properties of some PAHs that make them highly mobile throughout the environment, with deposition and re-volatilization processes distributing them between air, soil and water. Methodologies based on liquid chromatography with fluorescence detection and microwave-assisted extraction were optimized to quantify 17 PAHs in atmospheric particulate samples and in fishes.

Benzene is found in emissions from burning coal, oil and gasoline and in evaporation at gasoline service stations. Benzene is also released from tobacco smoke. These and other sources all contribute to the baseline level of benzene found in air. Air sampling was performed with activated carbon cartridges. The sampling and quantification methodologies used were approved by National Institute for Occupational Safety and Health.

Growing concerns about the contamination of wastewaters by antibiotics, due to human activities, feeding animals as growth promoters or even inefficient wastewater treatment processes, are demanding fast but sensitive analytical methodologies for screening a large number of samples. The purpose of this work was to

develop a simple methodology, using direct injection of the samples by high performance liquid chromatography with diode array detection (HPLC/DAD), for a multiresidue analysis of 5 antibiotics of different classes Amoxicillin, Metronidazole, Cefazolin, Chloramphenicol and Sulfamethoxazole. Wastewater from an urban water treatment plant was selected as model to study possible co-elution of interfering compounds.

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**Publications in C.1.**

Nº Artigos	---
Nº Artigos em livro	-2-
Nº Conferências em que participou	-9-
Nº Teses de Doutoramento	---
Nº Teses de Mestrado	-1-

### **C.2. - Waste management and toxicological evaluation**

Some work has been done to develop a methodology to solve Mixed-Integer Nonlinear Programming (MINLP) problems in the synthesis and design of chemical processes including economic and environmental objectives and also a robustness analysis. The methods used in the various steps can also be used to solve partial problems like, for example, the selection of configurations in energetic integration, the minimization of environmental impacts, etc. The environmental evaluation *per se* or integrated in an economical indicator increases the sustainability of chemical processes.

A project is being developed in definition and implementation of waste management program in ISEP with several stages: waste disposal strategy, waste characterization, chemical treatment, reuse and recycling strategies, analytical control and database management. A waste management software is being developed. Laboratory ecotoxicological evaluation of natural water quality must be faced as a complement diagnose when investigating highly polluted water. Leça river was chosen because, is one of the most polluted rivers in Portugal. It was sampled in 7 selected sampling stations and analysed in 5 different periods along the year. The physical, chemical and bacteriological characterization were complemented with ecotoxicity assays, carried out, using two different test organisms (*Vibrio fischeri* and *Chlorella Vulgaris*), as indicators of the total toxic effect.

Clusters and principal components analysis were two statistical approaches used to relate the results obtained for the different parameters and to compare the water quality of the different sampling locations.

Ecotoxicity tests were performed with some industrial and laboratorial wastewaters, using *Chlorella vulgaris* as test organis. The results show that some effluents, whose characterization according to legal regulations meets those standards, present nevertheless significant toxicity. So ecotoxicological evaluation should also be used to complete the standard characterization.

Chromated copper arsenate was a widespread chemical wood preservative used in building industry. Although on 2002, Environmental Protection Agency had limited the use of this additive, its durability between 24 to 45 years might indicate hazard to the public health.

With the purpose of assessing the acute toxicity of CCA, experiments with male mice subcutaneously injected with CCA, CrO<sub>3</sub> and As<sub>2</sub>O<sub>5</sub> were carried out during several periods. Kidneys were removed and processed for histological and quantitative analyses. In order to determine if selective accumulation of chromium occurred in kidney tissue, an accurate and precise methodology based on closed vessel microwave-assisted digestion coupled with graphite furnace atomic absorption spectrometry was developed.

#### **Equipa do GRAQ em C.2.**

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Olga Manuela Matos de Freitas  
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**Publications in C.2.**

Nº Artigos	---
Nº Artigos em livro	---
Nº Conferências em que participou	-1-
Nº Teses de Doutoramento	-1-
Nº Teses de Mestrado	-1-
Livros	---

### ***C.3. – Soils and groundwater remediation***

Trichloroethene (TCE) is a dangerous pollutant due to its high toxic properties, this compound was used extensively in the industry as a degreaser. Human activity created serious cases of environmental contamination by this and other related compounds.

Several studies with TCE are being done, one of them is to explore alternatives to rehabilitate groundwater contaminated with TCE. In the first phase, kinetics of TCE destruction by strong oxidants such as potassium permanganate and Fenton reagent were tested with promising results, leading to the construction of a pilot installation, using a pump and treat technical approach. Another rehabilitation technique is permeable reactive barriers (PREs). PREs are passive systems of groundwater treatment that remove contaminants when the water flows through an appropriate porous treatment medium, under a natural hydraulic gradient. Several studies batch studies as been done to assess the capacity of iron, as an electron donor to achieve TCE deshalogenation, and chromium removal from groundwater. These tests have been up-scaled and in the moment column tests are in progress.

Also soil contamination that becomes more frequent and dangerous due to the contamination of the site groundwater. To invert this situation and to recover these contaminated sites several remediation technologies have been used in the last decades. Soil vapour extraction (SVE) and bioremediation (BR) are two of the most used remediation technologies. The work involving SVE has as objective the study of the influence of soil properties (such as contents of water and natural organic matter) and experimental parameters (such as airflow rate) on the remediation process; and the construction of a mathematical model capable to predict the process efficiency and remediation time. There were experimented several sandy and humic soils artificially contaminated with benzene, toluene, ethylbenzene, xylene, TCE and perchloroethylene. The results obtained to this point indicate: a) a negative effect on soil water and natural organic matter contents on the remediation process and b) good accuracy in the developed model to predict process efficiency and remediation time. Specific strains with high degradation capacity of TCE and methyl tert-butyl ether (MTBE) are commonly used to enhance soil microbial community activity during BR processes. The selected bacterial cultures were inoculated singularly and in combinations, with cadmium, mercury and lead to achieve the microorganism not sensible of heavy metals in native soil. Degradation tests were monitored by sampling of the headspace of the microcosms and analysed by Gas Chromatography with a Flame ionization detector (GC-FID). The degradation rates were then calculated for each culture and for each contaminant. Even in the presence of cadmium, mercury and lead the combinations of bacterial strains showed high degradation rates of TCE and MTBE.

#### **Equipa do GRAQ em C.3.**

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**Publications in C.3.**

Nº Artigos	---
Nº Artigos em livro	---
Nº Conferências em que participou	-3-
Nº Teses de Doutorado	---
Nº Teses de Mestrado	---
Livros	---

**C.4. - Removal of toxic compounds by means of adsorption strategies**

One of the most used processes for removal of low concentration pollutants, present in industrial wastewaters has been adsorption with activated carbon, used as a final treatment. Due to the high price of the activated carbon, research has recently been directed towards alternative adsorbents, namely low cost adsorbents.

Native natural materials, renewable resources, available in huge quantities in Portugal have been studied as sorbents: cork, peanut hulls and marine algae. These materials are also natural wastes, respectively from cork industry, agriculture and pharmaceutical/cosmetic industry. Equilibrium and kinetic studies were performed and models were adjusted to the experimental results in order to compare them.

Considering the results obtained, cork's residues are an alternative that opens future perspectives of high economic interest and of significant environmental impact for pyrethroids pesticides removal. These wastes were also efficient for basic dyestuff removal.

Peanut hulls, and portuguese marine algae (*Fucus spiralis*, *Sargassum muticum*, *Pelvetia canaliculata*, *Ascophyllum nodosum*) are able to remove several heavy metals, Cd(II), Cr(III), Cu(II), Ni(II), Pb(II) and Zn(II).

The obtained results may lead, in the near future, to their application in industrial wastewaters treatment and also to valorisation of these materials.

**GRAQ team in C.4.**

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**Publications in C.4.**

Nº Artigos	-1-
Nº Artigos em livro	-1-
Nº Conferências em que participou	---
Nº Teses de Doutoramento	-1-
Nº Teses de Mestrado	---
Livros	---

## D. ANALYTICAL METHODOLOGIES

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Simone Barreira Morais

### Publications in D

Nº Artigos	-2-
Nº Artigos em livro	---
Nº Conferências em que participou	-3-
Nº Teses de Doutoramento	-1-
Nº Teses de Mestrado	---

### D.1. - *Electroanalysis*

The new generation of voltammetric instrumentation available since the last decade of twentieth century opens a new application perspective of voltammetry. For instance, the use of high square-wave frequencies decreases the interference of dissolved oxygen in the solution, enabling the inclusion of a hanging mercury drop electrode in a flow-injection system. Based on this knowledge, electroanalytical methods were developed and applied to antidepressants (citalopram, sertraline, fluvoxamine, paroxetine and fluoxetine) and statin (pravastatin and fluvastatin) control in pharmaceuticals.

A methodology for the determination of the pesticide chlorfenvinphos by microwave-assisted solvent extraction and square-wave cathodic stripping voltammetry at a mercury film ultramicroelectrode in soil samples was proposed.

Another recent area in our group is the development of biosensors. These should be suitably attached to the surface of the electroanalytical transducer. This is tried out by trapping the biomolecule (DNA, for instance) in a polymer matrix solution or including it in a conductive matrix. Electrochemical studies performed with each modified transducer regard evaluation and selection of suitable chemical (pH, concentration, temperature, substrate and reactants) and electro-analytical (scan rate, frequency, technique of operation, stripping, etc.) experimental variables. Guanine and adenine (DNA bases) immobilized on a glassy carbon electrode surface was employed as a sensitive biosensor for the voltammetric detection of antioxidant activity of flavored water samples.

Potentiometric sensors were also developed for batch and flow experiments. Sensors are prepared with ion-exchangers or neutral carriers in a polymeric environment. Plasticizing solvents of variable dielectric constant and of hydrophobic nature are used to provide suitable physical and chemical features to the membrane. The potential signal is primarily due to target ions, such as inorganic and organic compounds of environmental and pharmaceutical interest. Using potentiometric sensors, molecularly imprinted polymers were prepared for the selective recognition and determination of chlormequat.

## E. RESEARCH METRIC

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### Publications in E

Nº Artigos	---
Nº Artigos em livro	---
Nº Conferências em que participou	---
Nº Teses de Doutoramento	---
Nº Teses de Mestrado	---
Notas técnicas	-1-

#### *E.1. – Portuguese research metric*

The development of metrics to assess research outputs is recognized of increased importance worldwide. For many years, ISI (Thomson Scientific, Inc.) has provided the sole standardized set of bibliometric data that were used in all sort of studies. More recently, Elsevier has been developing an alternative database, Scopus, that promises to be a useful competitor and provide a different point of view over scientific publication. Other measures have been used in different countries, the case of the UK deserving emphasis as the plan to abandon the costly periodic Research Assessment Exercises elicited heated discussion and many serious studies. It is common that university groups develop studies that are then used by government agencies for their official studies and benchmarks of research performance. In Portugal no systematic work exists and government publications (of GPEARL under the ministry of Science and Higher Education) depend directly on data provided by Thomson Scientific. Requirnte is developing bibliometric studies of Portuguese research institutions and intends to develop other type of metrics to assess the outcomes of scientific research.

## PROJECTS

- 1. Project title** Detection and quantification of antimicrobials in fish and in waters from aquaculture.
- Reference* PTDC/AGR-AAM/68359/2006
- Main area* Ciências Agronómicas e Florestais – Agricultura e Ambiente
- Investigador responsável* Maria Goreti Ferreira Sales
- Instituição proponente* Instituto de Ciências e Tecnologias Agrárias e Agro-Alimentares - Porto
- Duração do projecto* 36 months
- Data de início do projecto* 1 of July of 2007
- Entidade Financiadora* Fundação para a Ciência e Tecnologia
- Budget* 131 553.00€
- REQUIMTE Budget 64 664€.
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- 2. Project title** Remediation of contaminated soils combining vapour extraction and biological processes: time and efficiency forecasting.
- Reference* PTDC/ECM/68056/2006
- Main area* Engenharia Civil e de Minas
- Investigador responsável* Cristina Maria Fernandes Delerue-Matos
- Instituição proponente* Instituto de Ciências e Tecnologias Agrárias e Agro-Alimentares - Porto
- Duração do projecto* 36 months
- Data de início do projecto* 1 of January 2008
- Entidade Financiadora* Fundação para a Ciência e Tecnologia
- Budget* 52.555,00 €
- REQUIMTE Budget 39 955,00 €
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- 3. Project title** Antioxidant Capacity of Flavored waters
- Reference* P06-06 IBeSa
- Investigador responsável* Goreti Sales / B. Oliveira

*Instituição proponente* Instituto de Ciências e Tecnologias Agrárias e Agro-Alimentares -  
Porto

*Duração do projecto* 12 months

*Data de início do projecto* 1 of October 2006

*Entidade Financiadora* IBESA

*Budget* only grantee to Felismina Teixeira Coelho Moreira 2500 €

REQUIMTE Budget 2500 €

**3. Project title** Antioxidant capacity of ascorbic acid in Flavored waters

*Reference* IBeSa

*Investigador responsável* Goreti Sales / B. Oliveira

*Instituição proponente* Instituto de Ciências e Tecnologias Agrárias e Agro-Alimentares -  
Porto

*Duração do projecto* 12 months

*Data de início do projecto* 1 of December 2007

*Entidade Financiadora* IBESA

*Budget* only grantee to Joana Rafaela Lara Guerreiro 2500 €

REQUIMTE Budget 2500 €

IN COLLABORATION

**1. Project title** Bioremediation of organic pollution in soil by augmentation  
with robust methylotrophic bacteria

*Referência* POCI/AMB/57353/2004

*Área disciplinar principal* Ciências e Engenharias

*Investigador responsável* Paolo De Marco

*Instituição proponente* Instituto de Biologia Molecular e Celular (IBMC/UP)

*Duração do projecto* 24 meses

*Data de início do projecto* 1 de Outubro de 2004

*Entidade Financiadora* Fundação para a Ciência e Tecnologia

*Budget* 54 238 €

REQUIMTE budget 16 675 €

**2. Project title** Experimental Protocols for Estimating the Design Parameters  
of Permeable Reactive Barriers

*Referência* POCI/ECM/59779/2004

*Área disciplinar principal* Civil and mine engineering

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<i>Investigador responsável</i>	António Fiúza
<i>Instituição proponente</i>	Faculdade de Engenharia da Universidade do Porto
<i>Duração do projecto</i>	36 meses
<i>Data de início do projecto</i>	1 de Setembro de 2005
<i>Entidade Financiadora</i>	Fundação para a Ciência e Tecnologia
<i>Budget</i>	45 000 €
<i>REQUIMTE Budget</i>	11 050 €
<b>3. Project title</b>	Respirometry of Rock Acid Drainage and the Usage of Oxygen Consuming Coatings as a Mean of Reducing Environmental Emissions from Tailings Disposals
<i>Referência</i>	POCI/ECM/60438/2004
<i>Área disciplinar principal</i>	Civil and mine engineering
<i>Investigador responsável</i>	António Fiúza
<i>Instituição proponente</i>	Faculdade de Engenharia da Universidade do Porto
<i>Duração do projecto</i>	36 meses
<i>Data de início do projecto</i>	1 de Setembro de 2005
<i>Entidade Financiadora</i>	Fundação para a Ciência e Tecnologia
<i>Budget</i>	45 000 €
<i>REQUIMTE Budget</i>	10 580 €
<b>4. Project title</b>	Previsão do tempo de remediação de solos contaminados utilizando a extracção de vapor Emissions from Tailings Disposals
<i>Referência</i>	POCI/AMB/61315/2004
<i>Área disciplinar principal</i>	Ciências e Engenharias do Ambiente
<i>Investigador responsável</i>	Maria da Conceição M. Alvim Ferraz
<i>Instituição proponente</i>	Faculdade de Engenharia da Universidade do Porto
<i>Duração do projecto</i>	36 meses
<i>Data de início do projecto</i>	1 de Janeiro de 2005
<i>Entidade Financiadora</i>	Fundação para a Ciência e Tecnologia
<i>Budget</i>	37 528 €
<i>REQUIMTE Budget</i>	0 €
<b>5. Project title</b>	SenRONS – Development of optical fiber sensors for the determination of reactive oxygen (ROS and nitrogen (RNS)) species in biological systems.
<i>Reference</i>	PTDC/QUI/71001/2006
<i>Main area</i>	<i>Química e Bioquímica</i>
<i>Investigador responsável</i>	Joaquim Carlos Gomes Esteves da Silva

## PROJECTS

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*Instituição proponente* Associação para o Desenvolvimento da Faculdade de Ciências  
*Duração do projecto* 36 months  
*Data de início do projecto* 1 January 2008  
*Entidade Financiadora* Fundação para a Ciência e Tecnologia  
*Budget* 62 184,00 €  
REQUIMTE Budget 3 900,00 €

**6. Project title** Evaluation of ochratoxin a exposure level of Portuguese population: bread consumption and urine levels.  
*Reference* PTDC/AGR-ALI/65528/2006  
*Main area* Ciências Agronómicas e Florestais – Ciência e Tecnologia dos Alimentos  
*Investigador responsável* Celeste Matos Lino  
*Instituição proponente* Universidade de Coimbra  
*Duração do projecto* 36 meses  
*Entidade Financiadora* Fundação para a Ciência e Tecnologia  
*Budget* 74 866. 00€  
REQUIMTE Budget 12 977.00€

**6. Project title** Desenvolvimento de produtos químicos e processos ecológicos para a indústria do couro –  
*Reference* PRODECO  
*Investigador responsável* António Crispim  
*Instituição proponente* ISEP  
*Duração do projecto* 15 meses  
*Entidade Financiadora* ADI  
*Budget* 86 737,98 €  
REQUIMTE budget 2.000,00 €

**7. Project title** As enzimas e a inovação na indústria do couro  
*Reference* ENZICO  
*Investigador responsável* António Crispim  
*Instituição proponente* ISEP  
*Duração do projecto* 15 meses  
*Entidade Financiadora* ADI  
*Budget* 89 127,51 €  
REQUIMTE budget 0 €

<b>6. Project title</b>	Safety of the three fish species more consumed by Portuguese population in what concerns heavy metals
<i>Investigador responsável</i>	Beatriz Oliveira
<i>Instituição proponente</i>	FFUP
<i>Duração do projecto</i>	12 meses
<i>Data de início do projecto</i>	1 of October of 2007
<i>Entidade Financiadora</i>	Universidade do Porto
<i>Budget</i>	4.000 €
<i>REQUIMTE Budget</i>	4.000 €

### EVENTS ORGANIZATION

1. “Remediação de solos – Técnicas e Aplicações Práticas” in Instituto Superior de Engenharia do Porto, from 7 to 8 of March of 2007.
2. “Ocupação Científica de Jovens nas Férias” for young students in GRAQ during July of 2007.
3. A seminar “Indicadores de Desempenho na Investigação”, in Instituto Superior de Engenharia do Porto, 16 July 2007.

**PUBLICATIONS**

**PAPERS**

**C- ENVIRONMENTAL CONTROL AND REMEDIATION**

***C.4. - Removal of toxic compounds by means of adsorption strategies***

1- Valentina F. Domingues, Giuseppe Priolo, Arminda Alves, Miguel F. Cabral, Cristina Delerue-Matos. Adsorption behavior of  $\alpha$ -cypermethrin on cork and activated carbon. Journal of Environmental Science and Health Part B, 2007, 42, 649-654

**D - ANALYTICAL METHODOLOGIES**

2- Henri P. A. Nouws, Cristina Delerue-Matos. Square-wave adsorptive-stripping voltammetric detection in the quality control of fluoxetine. Analytical Letters, 2007, 40, 1131-1146.

3- Simone Morais, Oriza Tavares, Paula Paiga, Cristina Delerue-Matos. Determination of chlorfenvinphos in soils by microwave-assisted extraction and stripping voltammetry with an ultramicroelectrodes. Analytical Letters, 2007, 40, 1085-1097

**PAPERS IN BOOKS****B - QUALITY CONTROL AND AUTHENTICITY OF FOOD PRODUCTS**

- 1- S. Casal, C. Lopes, J. Silva, B. Noronha, E. Mendes, S. Morais, C. Delerue-Matos, M. B. P. P. Oliveira. Avaliação da fracção lipídica de bolachas: estudo de mercado. 8º Encontro de Química dos Alimentos, 2007, 291-294.
- 2- C. Martins, E. Cunha, M. G. Sales, M. B. P. P. Oliveira, M. F. Barroso, C. Delerue-Matos. Determinação voltamétrica de glutamato. 8º Encontro de Química dos Alimentos, 2007, 355-358.

**C1 - Pollutants analysis**

- 3- D. Castro, M. T. Oliva-Teles, C. Delerue-Matos, M. C. Alvim-Ferraz, S. Morais, M. C. Pereira. Optimization of microwave-assisted extraction for analysis of benzo(a)pyrene in atmospheric particulate samples. 41st IUPAC World Chemistry Congress, Chemistry Protecting Health, Natural Environmental and cultural heritage, 2007, S07P48.
- 4- M. J. Ramalhosa, P. Paiga, S. Morais, M. B. P. P. Oliveira, C. Delerue-Matos. Determination of benzo(a)pyrene in horse mackerel by microwave-assisted extraction and liquid chromatography. 41st IUPAC World Chemistry Congress, Chemistry Protecting Health, Natural Environmental and cultural heritage, 2007, S07P57.

**C.4. - Removal of toxic compounds by means of adsorption strategies**

- 5- Olga Freitas, Cristina Delure-Matos, Rui Boaventura. Caracterização da alga marinha *Ascophyllum nodosum* e estudo da Eliminação de Cu (II) em solução aquosa por biossupreção. 9ª Conferência Nacional do Ambiente, volume 2, Um futuro sustentável Ambiente, sociedade e Desenvolvimento 18-20 Abril de 2007.

**COMMUNICATIONS**

**A- DEVELOPMENT OF TRANSDUCERS**

1- Abel J. Duarte, Joaquim C. G. Esteves da Silva, M. Carmo Vaz. Imobilização de indicadores de pH em PVOH para acoplamento a fibras ópticas. 6º Encontro da Divisão de Química Analítica SPQ Analítica '07, P24. Lisboa. Portugal.

**B - QUALITY CONTROL AND AUTHENTICITY OF FOOD PRODUCTS**

2- P. Paíga, S. Morais, M. Correia, C. Delerue-Matos, A. Alves. Simultaneous extraction analysis of carbamate and urea pesticide in processed tomato samples. 6º Encontro da Divisão de Química Analítica SPQ Analítica '07, P23. Lisboa. Portugal.

3- M. Goreti F. Sales, Michelle S. A. Castanheira, Rosa M. S. Ferreira, M. Carmo V. F. Vaz, Cristina Delerue-Matos. Chemically modified carbon paste electrodes for ascorbic acid determination in soft drinks by flow injection amperometric analysis. X Iberic Meeting of Electrochemistry and XIV Congresso da Sociedade Portuguesa de Electroquímica, P22. Coimbra. Portugal.

4- M. Goreti F. Sales, Michelle S. A. Castanheira, Rosa M. S. Ferreira, M. Carmo V. F. Vaz, Cristina Delerue-Matos. Monitoring food additives in soft-drinks by flow injection amperometric analysis and chemically modified carbon paste electrodes. EUROanalysis XIV, S9/S13. Antuérpia. Bélgica.

**C- ENVIRONMENTAL CONTROL AND REMEDIATION**

***C1 - Pollutants analysis***

5- S. Morais, C. Delerue-Matos. Gold ultramicroelectrodes for sensitive determination of parathion-methyl insecticide. X Iberic Meeting of Electrochemistry and XIV Congresso da Sociedade Portuguesa de Electroquímica, P8. Coimbra. Portugal.

6- Paula Paíga, Simone Morais, Manuela Correia, Cristina Delerue-Matos. Determination of pesticide residues in vegetables using microwave-assisted extraction and liquid chromatography. EUROanalysis XIV, S9/S13. Antuérpia. Bélgica.

7- Valentina Domingues, Joana Martins, Sónia Cid, Cristina Delerue-Matos. Determination of pyrethroids in teas by STIR-BAR sorptive extraction and gas chromatography with electron capture detector. EUROanalysis XIV, S16 (734). Antuérpia. Bélgica.

- 8-** D. Castro, M. T. Oliva-Teles, C. Delerue-Matos, M. C. Alvim-Ferraz, S. Morais, M. C. Pereira. Optimization of microwave-assisted extraction for analysis of benzo(a)pyrene in atmospheric particulate samples. 41st IUPAC World Chemistry Congress, Chemistry Protecting Health, Natural Environmental and cultural heritage, S07P48. Turim. Itália.
- 9-** M. J. Ramalhosa, P. Paíga, S. Morais, M. B. P. P. Oliveira, C. Delerue-Matos. Determination of benzo(a)pyrene in horse mackerel by microwave-assisted extraction and liquid chromatography. 41st IUPAC World Chemistry Congress, Chemistry Protecting Health, Natural Environmental and cultural heritage, S07P57. Turim. Itália.
- 10-** C. Mansilha, V. Domingues, T. Oliva-Teles, C. Delerue-Matos, P. Gameiro, A. Heitor. Detection and quantification of endocrine disrupters in drinking waters by solid phase extraction and gas chromatography/mass spectrometry. 5º Encontro Nacional de Cromatografia P.22. Aveiro. Portugal.
- 11-** Geoffroy Lescure, Manuela Correia, Aurora Silva, Simone Morais, Cristina Delerue-Matos. Use of solid phase microextraction and gas chromatography for the determination of three pesticides in apples and pears. 5º Encontro Nacional de Cromatografia P.51. Aveiro. Portugal.
- 12-** D. Castro, M. T. Oliva-Teles, C. Delerue-Matos, M. C. Alvim-Ferraz, S. Morais, M. C. Pereira. Development of a rapid method based on liquid chromatography with fluorescence detection for PAHs determination. 5º Encontro Nacional de Cromatografia P.80. Aveiro. Portugal.
- 13-** M. J. Ramalhosa, P. Paíga, S. Morais, M.B.P.P. Oliveira, C. Delerue-Matos. The QuEChERS approach for the analysis of pahs in horse mackerel samples. 5º Encontro Nacional de Cromatografia P.90. Aveiro. Portugal.

### ***C.2. - Waste management and toxicological evaluation***

- 14-** R. C. Matos, S. Morais, T.M. Santos, M.L. Pereira, J.P. de Jesus “Estudo Histológico e Histoquímico do CCA (Arsenato de Cobre e Crómio) no Rim de Ratinhos”, XII Encontro da Sociedade Portuguesa de Patologia Animal, 30 Março, 2007, Lisboa.

### ***C.3. - Soils and groundwater remediation***

- 15-** Virginia da Cruz Fernandes, Paolo de Marco, Teresa Oliva-Teles, Tomás Albergaria, Cristina Delerue-Matos. Analytical method for detection of TCE and MTBE biodegradation EUROanalysis XIV, S1/S17 (79). Antuérpia. Bélgica.
- 16-** Cristina Delerue-Matos, Aurora Silva, Teresa Silva, Elizabeth Vieira, António Fiúza. Trichloroethylene quantification in polluted groundwater. EUROanalysis XIV, S1/S17 (70). Antuérpia. Bélgica.

**17-** José Tomás Albergaria, Maria Conceição Alvim-Ferraz, Cristina Delerue-Matos. Partition of benzene and trichloroethylene between the different phase present in contaminated soils. EUROanalysis XIV, S9/S13. Antuérpia. Bélgica.

**D - ANALYTICAL METHODOLOGIES**

**18-** M. Goreti F. Sales, Felismina T.C. Moreira. Construction, evaluation and application of iron(II) selective electrodes. X Iberic Meeting of Electrochemistry and XIV Congresso da Sociedade Portuguesa de Electroquímica, P23. Coimbra. Portugal.

**19-** Henri P. A. Nouws, Cristina Delerue-Matos, Aquiles A. Barros, José A. Rodrigues. Voltammetric flow analysis of pharmaceuticals. EUROanalysis XIV, S20. Antuérpia. Bélgica.

**20-** M. Fátima Barroso, M. J. Ramalhosa, M. Carmo Vaz, Cristina Delerue-Matos. Electroreduction of butylate at HMDE. EUROanalysis XIV, S1/S17 (47). Antuérpia. Bélgica.

**NOTES AND MONOGRAPHYS**

**Notes**

1- H. Nouws, J.T. Albergaria, E.S. Vieira, C. Delerue-Matos, J.A.N.F. Gomes “Documentos indexados no ISI Web of Knowledge, 2000-2007”.

**Monographys**

1- F. Moreira; G. Sales; MBPP Oliveira; “*Capacidade antioxidante de águas aromatizadas*” IBeSa, Nov 2007.

2- C. Martins, “*Metodologias de análise de ácido glutâmico nos alimentos*” FFUP, **Fev 2007**

3- S. Almeida “*Determinação de cloretos em pão*”, FFUP, **Abr 2007**

4- A.C. Silva, “*Metais pesados em peixe. Metodologias de avaliação*” FFUP, **Mai 2007**

**MASTER THESIS**

**B - QUALITY CONTROL AND AUTHENTICITY OF FOOD PRODUCTS**

1 - Sofia Almeida. Determinação de cloretos em pão. MSc. Thesis, Faculdade de Farmácia da Universidade do Porto, Portugal.

2 - Ângela Maria de Moura Barroso. Nitratos e Nitritos em alimentos. MSc. Thesis, Faculdade de Farmácia da Universidade do Porto, Portugal.

3 - Cláudia Maria Soares de Oliveira Martins. Determinação de ácido glutâmico em alimentos por técnicas voltamétricas. MSc. Thesis, Faculdade de Farmácia da Universidade do Porto, Portugal.

**C- ENVIRONMENTAL CONTROL AND REMEDIATION**

***C1 - Pollutants analysis***

4 - Paula Celeste Batista Paíga. Extração assistida por microondas de pesticidas em produtos agrícolas. MSc. Thesis, Faculdade de Engenharia da Universidade do Porto, Portugal.

***C.2. - Waste management /Ecotoxicological evaluation***

5- Ana Isabel Gomes. Avaliação da Ecotoxicidade de Águas Superficiais - Aplicação à Bacia Hidrográfica do Rio Leça, MSc. Thesis, Faculdade de Engenharia da Universidade do Porto, Portugal.

**PhD THESIS**

**C- ENVIRONMENTAL CONTROL AND REMEDIATION**

***C.2. - Waste management /Ecotoxicological evaluation***

**1** – Florinda Figueiredo Martins. Simulação e Optimização de Processos Químicos com Considerações Ambientais e de Robustez. PhD. Thesis, Faculdade de Engenharia da Universidade do Porto, Portugal.

***C.4. - Removal of toxic compounds by means of adsorption strategies***

**2** – Olga Manuela Matos de Freitas. Eliminação de iões metálicos em solução aquosa por biossorção em microalgas marinhas. PhD. Thesis, Faculdade de Engenharia da Universidade do Porto, Portugal.

**D - ANALYTICAL METHODOLOGIES**

**3** - Hendrikus Petrus Antonius Nouws. Análise de antidepressivos por voltametria de redissolução com adsorção. PhD. Thesis, Faculdade de Ciências da Universidade do Porto, Portugal.