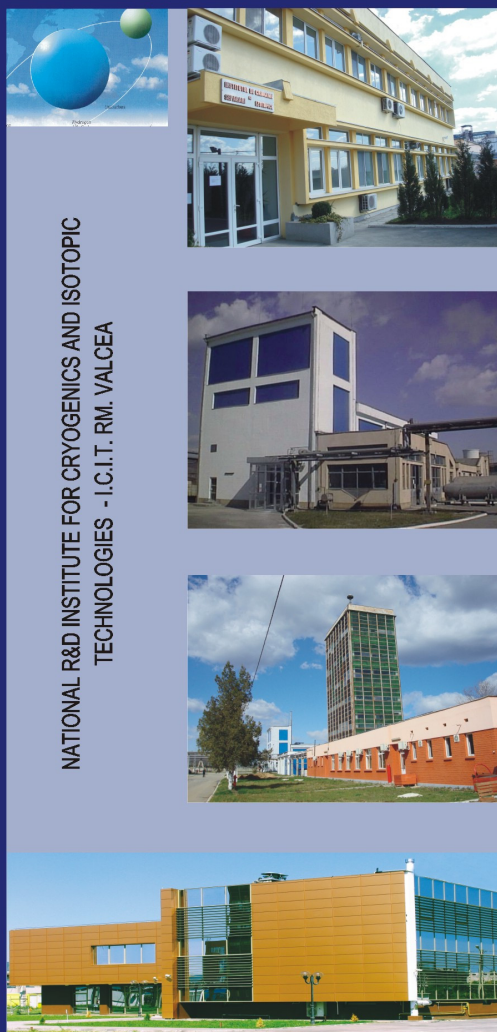


Progress of Cryogenics and Isotopes Separation

Volume 12, issues 23-24/2009

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Editura CONPHYS
Râmnicu Vâlcea

Volume 12, issues 23-24/2009

National R&D Institute for Cryogenics and Isotopic Technologies
- ICSI Rm. Valcea -

Progress of Cryogenics and Isotopes Separation

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*The papers published in **Progress of Cryogenics and Isotopes Separation** should present novel results and have either theoretical significance or practical utility or both.*

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Technical box:

Layout: Camelia Asprita

Cover: Camelia Asprita

Printed at: CONPHYS Typography Rm. Valcea

Phone no.: +40-250-731512, +40-250-733323

E-mail: conphys@conphys.ro

ISSN: 1582-2575

CNCSIS Quote: 619

Edited by:

*National R&D Institute for Cryogenics and Isotopic Technologies – ICIT Rm. Valcea
With the support of Ministry of Education, Research and Innovation – National Authority for
Scientific Research*

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- ICSI Rm. Valcea -**

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TECHNOLOGICAL REGARDINGS ON THE CASCADING OF THE WARM-COLD PROCESS OF SEPARATION H₂O – H₂S

Marius Peculea

ABSTRACT

It analyses the effect of some disturbances in functioning of a cascade's stages of isotopic separation and to find the relationship between the degree of the extraction of a single-stage device in regard to the same multiple-stage process. It suggests a method for determining of the best stages' number of a cascade of isotopic separation. For a H₂O-H₂S warm-cold isotopic separation device are analysed the cases of disturbances in functioning of the scales and separation of column stills, the behaviour of the humidifier and also of centrifugal machine (pumps and air pumps).

THE STABLE ISOTOPES IN THE HYDROLOGY STUDIES AT RAURENI-VALCEA AREA

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ABSTRACT

The hydrology and the climate studies are now and will continue to be joined by human activities. Observing differences of the stable isotopic concentration ratios informs us about certain geochemical or hydrological processes that took place. The isotopic composition of oxygen and hydrogen in rainwater varies with latitude, altitude, climate and time of the year. This methodology is an important tool in studying groundwater movement or freshwater origin.

This study demonstrated the utility of the Continuous Flow – Isotope Ratio Mass Spectrometry method for measuring natural variation of the occurring isotopes of hydrogen (²H) and oxygen (¹⁸O) in meteoric waters. We continue until now (September 2009) the last work were we measured the variation of $\delta^{18}\text{O}$ and $\delta^2\text{D}$ values from precipitation fallen in Raureni-Valcea area between May-December 2007 and September 2008-March, together with the $\delta^{18}\text{O}$ and $\delta^2\text{D}$ values from the Bistrita river (Costinel D. et al, 2009). For this area was reported the local Meteoric Water Line and the variation of $\delta^{18}\text{O}$ and $\delta^2\text{D}$ values was correlated with the temperature and humidity in the same period.

RADIOACTIVE WASTE TREATMENT STRATEGY IN POLAND – A CONTRIBUTION OF RESEARCH PERFORMED AT INSTITUTE OF NUCLEAR CHEMISTRY AND TECHNOLOGY

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ABSTRACT

First step of liquid low-level radioactive waste processing is reduction of the volume of radioactive species. Various methods for concentration of radioactive matter are studied and developed at Institute of Nuclear Chemistry and Technology (INCT). Reverse Osmosis process elaborated at INCT was implemented at Radioactive Waste Management Plant (RWMP), the utility responsible for collecting, processing, transporting, storage and disposal of solidified waste in the country. The other methods like ultrafiltration, membrane distillation, adsorption and integrated processes are studied in scope of national and international projects. In Poland radioactive waste arises from various applications of radioisotopes in industry, medicine and science, as well as from research nuclear reactors. Development of Polish Nuclear Power Program will imply necessary activities concerning the future strategy of radioactive waste treatment and development of programs for research on new methods and processes that will be feasible to treat liquid wastes coming from the operation of nuclear power station and related activities.

WATER DETRITIATION ACTIVITIES AT ICSI RM. VALCEA

M. Zamfirache^{*}, A. Bornea^{*}, I. Stefanescu^{*}, L. Stefan^{*}, A. Lazar^{*}, I. Cristescu^{}**

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ABSTRACT

Development of a water detritiation system, configuration and design of critical components is essential for installations which process tritiated water (heavy water or light water). The nuclear power plants which use CANDU reactors need to have a tritium removal facility with the aim to lower the tritium concentration in the plant systems and to maintain it at (or below) the acceptable levels.

Within ICIT there is a pilot plant for tritium and deuterium separation, which has as main purpose the elaboration of tritium separation technique from heavy water used in moderator of CANDU nuclear reactors and to certify the equipments specific for cryogenic domain and tritiated mediums.

This work is focused on the presentation of ICIT research activities related to water detritiation technologies and also to the applicability to a romanian nuclear power plant Cernavoda.

IRREVERSIBILITY ANALYSIS OF CHILLER COUPLED IN HYDROGEN ISOTOPES SEPARATION PLANT

Sorin Gherghinescu

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ABSTRACT

In real conditions the processes of refrigeration cycles, are accompanied by internal and external irreversibility, which have the effect of consumption need of work, higher than ideal for cold cycle, characterized by the absence of irreversibility. The most representative irreversibility of the refrigeration cycles are:

- External irreversibility due to heat transfer at finite temperature differences;*
- Internal irreversibility due to friction, turbulence, mixing, etc..*

As the coolant temperature is closer to ambient temperature, the cooling efficiency is higher. Another disadvantage of using refrigeration efficiency in qualitative analysis of refrigeration cycles is that not take account of irreversibility that occurs in refrigeration processes. Reasons presented below, will be considered the irreversibility and losses from them and will introduce the concept of exergetic efficiency, refrigeration cycle performance indicator that takes into account both the environmental temperature cooled, and the environment, and losses due to thermal processes manifested by irreversibility of component refrigeration cycles.

Keywords: refrigeration efficiency, irreversibility, heat transfer

MULTILAYER INSULATION WITH APPLICATIONS IN CRYOGENIC EQUIPMENTS

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ABSTRACT

It is well known the fact that the most important problem in the cryogenic systems is the heat leak and that study is about the major heat leak of the system, which is the thermal radiation.

Our purpose is to find the most suitable shielding method with Multi-Layer Insulation (MLI), using highly reflective foils of aluminium for the reflecting surfaces, interleaved with spacers to minimize conduction.

The project proposes theoretical and applied research on methods of cryogenic cooling and control of heat transfer through multilayer thermal insulation at low temperatures and very low (including liquid helium), with applications in detritiation of heavy water and cooled superconducting electromagnetic fusion facility but in general the thermal insulation industry. By bringing to the forefront of research areas of great current and impending importance for applications, making use of opportunities related to the existence of the partnership and cryogenic installations through a systematic approach to natural base of a multidisciplinary research team, to ensure optimum progress of the project.

***Keywords:** multi-layer insulation system (MLI), insulating material, thermal insulation.*

OBTAINING AND CHEMICAL ACTIVATION OF BIOMASS CHARs TO INCREASE THEIR CAPACITY FOR CO₂ CAPTURE

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ABSTRACT

Because of worldwide increasing environmental problems and sticter regulations set by governments in both industrialized and developing countries, the demand for activated carbon will continue to increase. Accordingly, in this paper, a novel thermal process of producing high-yield activated carbons from waste biomass chars is presented. Rape seed oil cakes and walnut shells as agricultural by-products are employed as raw material in this process. It used a mixture consisting of 50% rape seed oil cakes and 50% walnut shells.

Raw materials, both rape seed oil cakes and walnut shells undergo a series of pretreatments and posttreatments before forming the final products - activated carbons. Pretreatments included pyrolysis in a laboratory reactor, in which high yield carbons were obtained, and then followed by high temperature carbonization process at atmospheric pressure with nitrogen surroundings. The activated carbons were obtained by activation in temperature range 350-750°C. They were investigated to determine their adsorption properties (adsorption capacity, adsorption/desorption rate, and adsorption selectivity) and porosity (specific surface area, pore volume, and pore size distribution), as well as the effects of activation temperature and processing time. The increase in activation time resulted in a continuous steady rise of the mesopore area and volume, while the micropores and total pore area and volume reach a maximum at 3 h. The surface areas go through a maximum with increasing solid yields. The activated carbons were investigated regarding with CO₂ adsorption capacities. The CO₂ capture results did not show a linear relationship with the surface area. The sample with highest CO₂ adsorption capacity (64.5mg CO₂/g-adsorbent) was the carbon activated at 700°C for 2 h., whose surface area was only 620m²/g. Similarly, the carbon presenting the highest surface area (1070m²/g, 750°C for 3h) has a CO₂ capacity of only 42 mg CO₂/g-adsorbent. This is probably due to a relationship between microporosity and CO₂ physisorption processes, only certain size pores being effective for CO₂ adsorption.

Several surface treatment methods, including ammonium (NH₃) heat treatment and aqueous monoethanolamine (MEA) impregnation, were used to modify the surface properties of the activated carbons in an attempt to increase their CO₂ capture capacity at higher temperatures. The influence of temperature and type of chemical reagents on the porosity development was investigated and discussed. The surface treatment methods investigated change the porous structure and surface chemistry of carbon, and therefore affect their CO₂ capacities. NH₃ was found more effective than (MEA) as a chemical reagent under identical conditions in terms of both porosity development and yields of the activated carbons. The NH₃ treatment increases the surface area of the activated samples, especially at lower temperatures (600°C). The chemical impregnation with aqueous monoethanolamine (MEA) results in a decrease of the surface area of the activated carbon, probably due to pore blockage and surface coverage by (MEA). Both the NH₃ treatment and aqueous monoethanolamine impregnation can increase the CO₂ capture capacity of the activated carbons at higher adsorption temperature, due to the introduction of alkaline nitrogen groups on the surface of carbons, that are selectively to CO₂ adsorption.

Keywords: biomass char, pore structure, functional group, CO₂ adsorption.

QUANTITATIVE ANALYSIS AND METALIC COATING THICKNESS MEASUREMENTS BY X-RAY FLUORESCENCE

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ABSTRACT

This paperwork covers the use of X-ray fluorescence (XRF) for determining the concentration and the coating thickness on metallic samples. The analysis method presented here may also be applicable to other coatings, providing that the elemental nature of the coating and substrate are compatible with the technical aspects of XRF, such as the absorption coefficient of the system, primary radiation, fluorescent radiation and type of detection.

For the coating thickness measurement it was used the substrate-line attenuation method and an algorithm was made. Its advantage relies in the fact that no special calibration with standard samples having different layer thickness is needed.

The samples used for evaluation were metallic pieces of iron with zinc-nickel coatings of different thickness obtained by electrochemical deposition.

Key words: X-Ray Fluorescence, metallic coating thickness, nickel-zinc layer

PHYSICAL PROPERTIES IN RE-(FE,NI)₄SB₁₂ NANO-STRUCTURATED SKUTTERUDITE

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ABSTRACT

Rare earths filled Skutterudite are known for their improved thermoelectric properties and thus materials based on such structures are promising candidates for specific applications. Also, reduced grain size is considered a promising route to decrease the thermal conductivity of materials and therefore to improve the figure of merit of thermoelectric materials.

Here we present preliminary results concerning physical properties of RE-(Fe,Ni)₄Sb₁₂ nanostructured skutterudite (RE = Y, Ce, Yb) obtained by spark plasma sintering of nanopowders.

Keywords: Skutterudite; Yb-(Fe, Ni)₄Sb₁₂ and Er(Fe, Ni)₄Sb₁₂ compounds; Spark plasma sintering.

STUDY OF A PEM FUEL CELL FUNCTIONING PERFORMANCES USING A TEST STATION

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ABSTRACT

A PEM fuel cell performances (output power and reliability) are strongly influenced by a series of working parameters, as are cell temperature, input fuel and oxidant gases pressure and humidity. In order to enhance the fuel cell performances, the effects of all those parameters on the cell functioning must be assessed. A test stand for PEM fuel cells stacks of max. output power of 1.5 kW have been designed and built in our institute. It allows the data acquisition and control of cells temperatures, fluids pressure, flow and humidity using adequate transducers, by means of a computer, based on Labview™ software. The obtained experimental results were in good agreement with the model.

THE INFLUENCE ON PERFORMANCE OF A PEM FUEL CELL WITH CO - FLOW AND COUNTER - FLOW CHANNELS

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ABSTRACT

A three-dimensional computational fluid dynamics model of a PEM fuel cell with serpentine flow field channels that encounter co-flow and counter-flow configuration is presented in this paper. We consider that the PEM fuel cell performance is significantly influenced by the flow direction of fuel and oxidant. Starting from this point, the CFD model, used in this paper, accounts for the major transport phenomena that occur in a PEM fuel cell with co-flow and counter-flow configuration in order to will highlight the influence of flow tupe on the convective and diffusive heat and mass transfer, on the electrode kinetics and on the potential fields.

NEW APPROACH FOR DYNAMIC FLOW MANAGEMENT WITHIN THE PEMFC STACK

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Mariana Iliescu, Adrian Enache

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ABSTRACT

An adequate gas and water flow management is a key issue to reach and maintain a higher output power for a PEM fuel cell stack. One of the main aspects which could limit the performance of a PEM fuel cell stack is the weak capability for a non-uniform water distribution management within the fuel cell. The produced water could become a handicap to attain the best working performance by blocking the catalytic surfaces and by preventing the mass transport process. Usually, the excess water is removed in one cell, comparatively to others from the stack and taking into account that all the cells are supplied in parallel from a common air admission pipe, a limitation of gas flow rate within that cell is created. Consequently, this constraint will reduce further the water removal speed. This feedback process will generate finally a drastic decrease of the fuel cell stack performance. A new practical solution to this water and gas non-uniformity of distributions problem is to use a sequential purge procedure of several fuel cell groups inside the stack which could guarantee a right management of water.

An experimental setup has been built based on four fuel cell stack. Every fuel cell was connected to a single removal pipe via a solenoid valve. A computer-controlled hardware and software system has been designed and built, in order to generate a given opening-closing sequence for the automatic valve system.

THE ASSOCIATE EFFECT OF DEPLETED WATER AND MAGNETIC PARTICLES ON *Vitis vinifera* (L) ORGANOGENESIS

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ABSTRACT

The effect of depleted water (DDW) associated with Magnetic Nano Particles (MNPs) on organogenesis evolution of the *Vitis vinifera* (L) was investigated. A total of 10 cuttings of first year shoots belonging to three varieties were put into liquid medium (500 cm³ / jar) in three experimental groups and one control (C) each in four replications. The experiment was one year long being divided in two parts, laboratory and greenhouse conditions respectively. During the laboratory experiment, no nutrients were added in experimental solutions. The number of roots, sprouts and leafs were determined periodically. The capacity to perform organogenesis depended on genotype. Each of them pointed out a particular behaviour.

In lab conditions the shoot number significantly differs in each variety/liquid composition ($P \leq 0.001$). In green house condition on Burgund variety the shoot growth was very fast. At 90 from potting the shoots length varied from 7.36 ± 1.88 to 14.39 ± 4.53 cm in DDW and Negative Control (NC). The number of leafs after 3 months varied from 3.75 ± 0.41 to 7.59 ± 0.45 on Sylvania NC and Socodor TW&MNPs respectively. The largest leaves area was 20.32 ± 0.04

cm² on Burgund variety in DDW conditions. The DDW&MNPs repressed the organogenesis on Silvania and Burgund varieties. The association DDW&MNPs enhanced the leaves area. Generally the single action of DDW enhanced the plantlets traits and improved the chlorophyll content.

The single action of DDW or in association with MNPs has had a favourable influence in organogenesis, growth and synthesis of chlorophyll involved in metabolic activity. The Deuterium amount decreased in leave juice if the plantlets grew in DDW presence.

Key words: deuterium-depleted water (DDW), Magnetic Nano Particles (MNPs), organogenesis, *Vitis vinifera* (L)

AN EXPERIMENTAL STUDY OF NOISE BARRIERS IN SUBURBAN AREA

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ABSTRACT

The paper shows using experimental measurements how the noise barrier can reduce the noise level. Main contribution of noise levels in suburban areas is given today by highway traffic. The parameter used to evaluate the barrier efficiency is insertion loss.

Keywords: *Traffic noise, noise barrier, insertion loss, sound measurement*

LABORATORY METHODS FOR MONITORING THE QUALITY OF AIR. INDUSTRIAL COMPLEX STUDY

Gili Saros, Diana Florescu, Felicia Bucura, Marius Constantinescu

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ABSTRACT

Environmental pollution is a worldwide problem. Last years researches show that industrial activities of people are the principal reason for degradation of atmosphere qualities. If we want to know the real state of atmosphere qualities will must to quantify the quantity of air pollutants.

In this project we make two year air monitoring into an industrial area, thru two methods gas-chromatography and mass spectrometry and the results are: the level of pollution is still rising.

LIFE QUALITY AND HUMAN ECOLOGY - INTERFERENCES IN ACADEMIC EDUCATION AND IN SCIENTIFIC RESEARCH

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ABSTRACT

Today's language has emphasised the importance of the concepts of development and economic growth, and the complexity of contemporary life has made them evolve, in an interdisciplinary manner, along another three directions: sustainable development, life quality and social cohesion. A fourth direction, apparently long forgotten, seems to be decisively prevalent in the new, vast field of the quantifications of the continuity of progress, i.e. human ecology, which does not analyze ecological processes and phenomena proper, but rather social processes. The authors of the present paper propose an extension of human ecology through interferences towards academic education and scientific research. The new systemic approach involves new managerial attitudes, ranging from acknowledging intellectual energy to repositioning the whole of the educational system, as well as research, essential producers of the new energy. Finally, the European community governing bodies illustrate through themselves the new paradigm of human ecology, centred on the principle of subsidiarity, according to which if a state is unable to meet its own development needs, the other member states of the community are obliged to come to its assistance, which can be translated as an inference of human ecology at the level of modern communities.

Key words: *theory of systems, life quality, human ecology, sustainable development, social cohesion.*

ENVIRONMENTAL ANALYSIS INTEGRATED SYSTEM IN A ZONE INDUSTRIAL TRAFFIC

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ABSTRACT

Industrialized peri-urban areas are environmentally critical for the nearby-inhabited zones. GIS supports pollution modeling, environmental analyses and suggestive illustrations. Action plans should be initiated when environmental non-conformities are highlighted. The results of pollution mitigation scenarios could be better illustrated by the use of GIS support. The industrial platform Rm Valcea was selected for an integrated noise and air pollution analysis.

THE BASIC FRAMEWORK OF PROJECT RISK MANAGEMENT

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ABSTRACT

The basis for project risk management is the four-step process and nine tasks illustrated on this paper.

The starting point for risk management shall be the formulation of the risk management policy at the beginning of the project in order to meet the customer requirements and to cover all project domain such as management, engineering, performance, schedule and cost, taking into account the project resources such as margins in schedule, cost, performance and power. The risk management policy also define requirements for risk management and establish scoring and risk ranking criteria in order to decide and act for the treatment of individual and global risks.

Keywords: *risk, consequences, probability, threshold, risk management, risk assessment, failure scenarios*

DETERMINATION OF TRACE ELEMENTS IN AMBIENT PARTICULATE MATTER BY INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY

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ABSTRACT

Atmospheric particles are generated through a variety of physical and chemical mechanisms, and are emitted into the atmosphere from numerous sources, by combustion, industrial and natural processes. There is a general agreement that airborne particulate matter is associated with adverse effects on human health. Determination of trace element concentrations in atmospheric aerosols is important because of their toxic effects on human health, for example, high levels of lead in the body can cause motor nerve paralysis, anaemia, and, in children, inhibition of the nervous system's development. High cadmium levels can cause cardiovascular problems and bone thinning.

The aim of our study was to determine the concentration of trace elements (Pb, Cd, Ni, Co, Cr and Cu) in the PM10 fraction. Destructive analytical procedures include microwave-assisted digestion of filter-based samples, which was followed by inductively coupled plasma - mass spectrometry (ICP-MS) determinations.

The procedure was applied to filters containing PM10 particles collected in the industrial area from Valcea, Romania.

Keywords: *ambiental air, suspended particulate matter, PM10 fraction, ICP-MS*

CHROMATOGRAPHIC DETERMINATION OF SOME SECONDARY METABOLITES IN DROSERA SP

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ABSTRACT

Recent researches revealed the therapeutical potential of natural pigments, such as quinones derivatives (antitumoural, antibiotic, antimalaria, anti-inflammatory and anti-ulcer) and flavonoids (antibiotic, antioxidant and anticancer).

Quinones are substances whose molecule contains a benzoquinone, naphthoquinone, anthraquinone or phenanthrene nucleus. Flavonoids are C₁₅ compounds all of which have the structure C₆-C₃-C₆. Flavonoids may be grouped into three big classes based on their general structure. In each case, two benzene rings are linked together by a group of three carbons.

Some carnivorous plants, such as *Drosera sp.*, contain two major groups of secondary metabolites which are considered to be very important pharmaceutical substances, naphthoquinones (NQ) and flavonoids (FLAV).

Powdered plant material was extracted with a hydro-alcoholic mixture for 30 minutes at room temperature (with stirring) in order to extract the naphthoquinones. After filtration, the volume was adjusted with a solution of ethanol. Also, mixtures of alcohol and water in different ratios were applied in order to extract the flavonoids and their conjugates from plant tissues. The extraction efficiency was enhanced by the application of ultrasonication.

The HPLC profiles of extracts from *Drosera sp.* undoubtedly showed the presence both of naphthoquinones and flavonoids. This study resulted in development of a procedure for parallel extraction, identification and quantification of these pigments.

Key words: secondary metabolites, naphthoquinone, flavonoid, *Drosera*