

# Newsletter

ÅBO AKADEMI  
PROCESS CHEMISTRY GROUP  
Centre of Excellence

## Åbo Akademi Process Chemistry Group

No. 4

2 / 2002

### Wise science

*Clever, advanced and intelligent science is not sufficient any more. Wise science is needed.*

The work and achievements of the Process Chemistry Group (PCG) were presented, discussed and debated during "hot days in August", at the annual meeting.

The feedback from scientific and industrial advisory boards was very positive. Our activities demonstrate that the borders between chemistry and chemical engineering are completely artificial. The numerous interdisciplinary research projects cross-linking our group defies such borders. Let me offer an example: to make nutritional compounds from wood (food from wood!), advanced chemical analysis of wood components, separation of the raw material molecules, catalytic modification of the molecules, modelling of the catalytic reaction, and a quantitative description of mass transfer effects and of flow pattern in a real reactor are all required. A narrow-minded specialist would never be able to see the full picture. To create sustainable technology we need a deep insight into hidden chemical mechanisms. The time for rough engineering is definitively passé.

Our lives are filled with bad news: chemistry is used to produce weapons, ugly and poisonous vegetation is growing in polluted waters, rivers flood, destroying homes and cultural heritages. Humankind faces a paradox: science and technology are held accountable for the deterioration



*Prof. Tapio Salmi is the leader of the Kinetics & Catalysis team within PCG.*

of the environment and at the same time expected to solve these problems and provide the means to achieve a higher standard of living!

Science is known to be clever, advanced and intelligent, but this is not enough! Science and technology must to open the avenue towards a better world, a real quality of life. With modern computerized devices, it is easy to produce huge amounts of experimental data at enormous speed. But is this reasonable? We need wisdom to select the topics and carry out research in practice. Clever, advanced and intelligent science is not sufficient anymore. Wise science is needed today. I believe that PCG provides wise science by committed people.

**Prof. Tapio Salmi**

*Member of the PCG Executive Board  
e-mail: [Tapio.Salmi@abo.fi](mailto:Tapio.Salmi@abo.fi)*

### Join the Åbo Akademi Process Chemistry Group

The European Commission has appointed the ÅA PCG to be a Marie Curie Training Site with 8 fellowship positions for young researchers pursuing doctoral studies in EU Member states in 2002-2005.

[www.abo.fi/instut/pcg](http://www.abo.fi/instut/pcg) for information about applications and scientific topics.



## Prize Winning Doctoral Thesis



Photo: Niclas Erlin

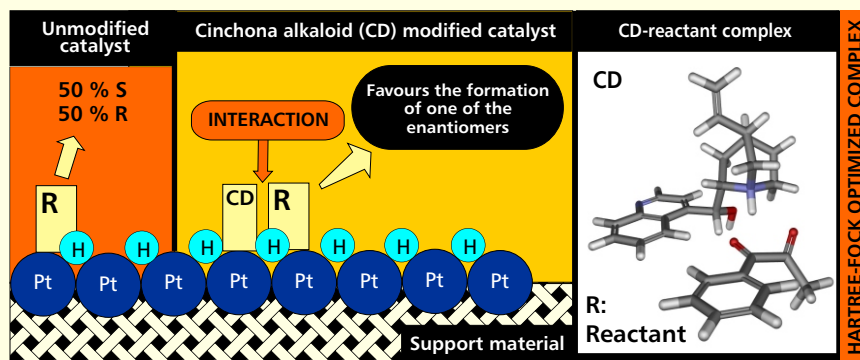
**Esa Toukoniitty has been awarded the Harry Elving Prize 2002 for his doctoral thesis.**

The annual prize is granted by Åbo Akademi University and was this year given to three outstanding doctoral thesis.

Toukoniitty's thesis deals with improved synthesis and production technology for optically pure compounds. He has studied the modification of a conventional heterogeneous Pt-catalyst with a cinchona alkaloid. The surface complex between the catalyst and the cinchona alkaloid favours the formation of one of the product enantiomers. The new method

developed in the thesis work can be applied in the production of pharmaceuticals.

The catalyst preparation, its optimisation and kinetics, quantum chemical studies and new continuous reactor technologies were also studied in this research. The award is also accompanied by a 5000 euro monetary gift.



## New PCG Projects

- **Development of gasification technology for recycled fuels**, 1.12.2001 - 31.12.2004, financed by Tekes (National Technology Agency). Research part: VTT Processes, Helsinki University of Technology. Project co-ordinator: VTT Processes/ Information: Jukka.Konttinen@abo.fi
- **Optimisation of the components in the membrane of chemical sensors**, 1.8.2002 - 31.7.2004, financed by Tekes (National Technology Agency), Outokumpu Research Centre, Kemira Chemicals and Leiras Fine Chemicals. Research part: University of Oulu. Project co-ordinator: PCG/ Information: Ari.Ivaska@abo.fi / Johan.Bobacka@abo.fi

## PCG Annual Seminar

The Annual PCG Seminar was arranged August 15th at the Åbo Akademi University campus. During the warm late summer day, several hot topics of the PCG group and its future strategies were discussed by 170 PCG associates. After intense discussions and poster presentations the participants enjoyed a very nice evening program including a short cruise aboard the s/s Ukko Pekka to Loistokari island, situated in the beautiful archipelago just outside Turku. The photos below and on the next page can also be viewed and downloaded from the PCG home page - enjoy them!

Photos: Tom Lindfors



A young scientist giving a presentation.

PCG members at the annual seminar.

Coffee break!

PCG leaving Turku aboard the s/s Ukko Pekka.

Prof. Salmi is making a philosophical manifesto.

Pleased young scientists...

...and professors...

...together with the rest of the scientific crew on board.



# Knots In Trees

## A New Rich Source of Lignans and Other Antioxidants

**S**cientists in the PCG group have recently discovered that wood knots in trees contain extraordinarily high concentrations of lignans and other polyphenolic antioxidants.

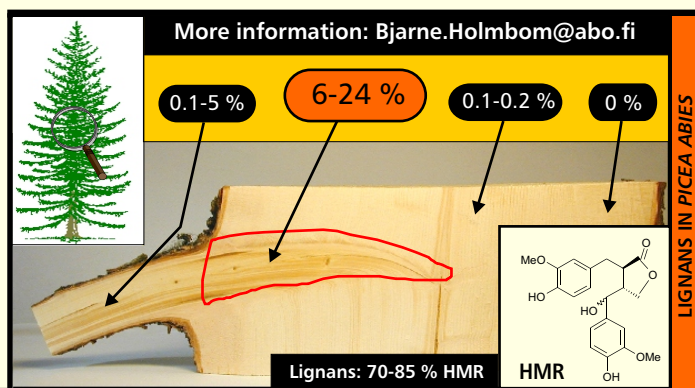
In Stefan Willför's doctoral thesis presented in September, it was documented that Norway spruce knots contain as much as 6-24% lignans. Hydroxymatairesinol (HMR) constitute 70-85% of the lignans. Scots pine knots were found to contain 1-7% stilbenes and 0.4-3% of a lignan identified to be nortrachelogenin.

Recent, unpublished research has shown that knots of other softwood species commonly contain 5-10% lignans. Firs and larches contain different main lignans in their knots than spruces. Pines also contain some lignans, as well as stilbenes and flavonoids. Even knots of some hardwoods contain high concentrations of certain flavonoids.

Wood knots are detrimental to pulp and paper

production and should preferably be removed from the chips before pulping. The PCG researchers have therefore developed a new method to accomplish this. The "ChipSep" process has been tested with good results on pilot plant scale.

Wood knots in trees are the richest source of lignans and other antioxidants in all of nature. Antioxidants could be produced in large scale from knots at pulp and paper mills. Antioxidants are of interest not only as active components in health-promoting foods and pharmaceuticals but also as natural protective agents in various industrial products. *Text by Bjarne Holmbom*



## PCG co-operates with the Chinese Academy of Sciences

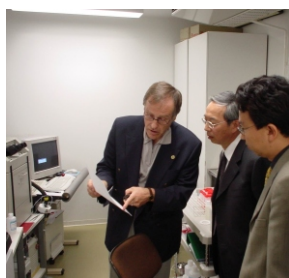


Photo: Li Niu  
Prof. Ari Ivaska (left), Prof. Zu Daoben and Dr. Lu Ronkai

PCG will co-operate with the State Key Laboratory of Electroanalytical Chemistry from the Chanchung Institute of Applied Chemistry (Chinese Academy of Sciences) on the project "Materials for electrochemical sensors: synthesis and characterization of well-defined membranes and applications for sensors".

Prof. Zu Daoben, Vice President of the National Natural Science Foundation of China (NNSF), and Dr. Lu Ronkai, director of the NNSF, visited PCG in June together with Dr. Ulla Elmen (Academy of Finland) and Gurli-Maria Gardberg (Åbo Akademi University). The activities of PCG were presented by Prof. Ari Ivaska and Dr. Johan Bobacka.



Docking at tiny Loistokari island.



View over Loistokari island.



At 9 p.m.



Finnish summer at its best.



Enjoying the lovely summer evening.



Discussing new ideas and projects...



Shake it baby, shake it - PCG goes rock'n roll!



Silence.

## Visitors

- Dr. Pedro Fardim, *Universidade Estadual de Campinas, Brazil*, from 1.3.2000
- Dr. Nicolas Leroy, *EFPG, Grenoble, France*, from 15.3.2002
- Dr. Li Niu, *Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China*, from 1.2.1999
- Dr. Tomasz Sokalski, *Warsaw University, Poland*, from 1.2.2000

## Recent Doctoral Theses

- Mikael Bergelin: "The Impinging-Jet Flow-Cell as a Measurement Tool in Interfacial Electrochemistry"
- Ari Itälä: "Enhancing the Bioactivity of Porous Bioactive Glass by Surface Microroughening", University of Turku, in co-operation with PCG.
- Rose-Marie Latonen: "Electrochemical Synthesis of a Copolymer from Biphenyl and 3-octylhiophene Characterization by Electrochemical and Spectroelectrochemical Techniques"
- Kristoffer Sandelin: "Chemical Equilibrium Studies on Trace Elements and on Two Process Problems in Solid Fuel Combustion"
- Stefan Willför: "Water-soluble Polysaccharides and Phenolic Compounds in Norway Spruce and Scots Pine Stemwood and Knots"
- Edgardo Coda Zabetta: "Modeling of Nitrogen Oxides in Combustion at Atmospheric and Elevated Pressures: Application to Biomass and Oil-Derived Gaseous Fuels"

Please check our website for M.Sc. and Licentiate Theses: [www.abo.fi/instut/pcg](http://www.abo.fi/instut/pcg)

## PCG Scientific and Industrial Advisory Boards

**SAB** Thomas W. Joyce, Western Michigan University  
Albert Renken, Swiss Federal Institute of Technology

J.W. Niemantsverdriet, Eindhoven University of Technology

**IAB** Karl Ahlblad, AGA  
Kari Ebeling, UPM-Kymmene  
Håkan Gros, Danisco  
Lars Gädda, M-real

Kaj Henricson, Lappeenranta Univ. of Techn.  
Markku Karlsson, Metso  
Timo Kenakkala, Kemira  
Jyrki Kettunen, M-real

Kari Knuutila, Outokumpu  
Lars Peter Lindfors, Dynea Chemicals  
Kari Nurmi, Raisio  
Bill Östman, Thermo Clinical LabSystems

## PCG Facts and Mission

The Åbo Akademi Process Chemistry Group (ÅA-PCG) studies physico-chemical processes at the molecular level in environments of industrial importance, in order to meet the needs of tomorrow's process and product development. Our particular focus on the understanding of complex process chemistry we call

### *Molecular Process Technology*

The Group consists of four research teams at the Chemical Engineering Faculty of Åbo Akademi University: *Combustion & Materials Chemistry* (Prof. Hupa), *Kinetics & Catalysis* (Prof. Salmi), *Process Analytical Chemistry* (Prof. Ivaska) and *Wood & Papermaking Chemistry* (Academy Prof. Holmbom). In the year 2001, about 170 people (including 40 senior researchers) took part in the PCG activities within 90 research projects with a total funding of approximately 4.9 Million €.

Editor-in-Chief ..... Prof. Mikko Hupa, e-mail: [Mikko.Hupa@abo.fi](mailto:Mikko.Hupa@abo.fi)

Editor ..... Dr. Tom Lindfors, e-mail: [Tom.Lindfors@abo.fi](mailto:Tom.Lindfors@abo.fi)

### PCG Executive Board

Academy Prof. Bjarne Holmbom, e-mail: [Bjarne.Holmbom@abo.fi](mailto:Bjarne.Holmbom@abo.fi)  
Prof. Mikko Hupa, e-mail: [Mikko.Hupa@abo.fi](mailto:Mikko.Hupa@abo.fi)  
Prof. Ari Ivaska, e-mail: [Ari.Ivaska@abo.fi](mailto:Ari.Ivaska@abo.fi)  
Prof. Tapio Salmi, e-mail: [Tapio.Salmi@abo.fi](mailto:Tapio.Salmi@abo.fi)

Coordinating assistant: Maria Ljung, e-mail: [pcg@abo.fi](mailto:pcg@abo.fi)  
Biskopsgatan 8, 20500 Turku/Åbo, Finland

Layout ..... Tom Lindfors

