SPECIAL SYMPOSIUM ISSUE OF LENZINGER BERICHTE
„ADVANCES IN WOOD CHEMISTRY“ –
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This special issue of Lenzinger Berichte encompasses selected contributions to the symposium „Advances in Wood Chemistry“ which was held at the University of Agricultural Sciences in Vienna on May 31, 1999. As the research director of Lenzing AG, I am very pleased to have the opportunity to present an opening address to this journal volume of Lenzinger Berichte.

The International Symposium „Advances in Wood Chemistry“ had been planned as a special opportunity to advance scientific efforts in the field of wood and cellulose chemistry, to present new research activities and discuss novel scientific ideas, but also, on the occasion of his 70th birthday, as a celebration of Prof. Dr. Josef S. Gratzl, a well-known and important figure in this field who has been influencing wood chemistry by his scientific contributions for a long time.

The Symposium was organized by the new Christian-Doppler Laboratory for “Pulp Reactivity” at the Institute of Chemistry of the University of Agricultural Sciences in Vienna as its introduction to the scientific world and was financially supported by the Austrian Ministry of Science and Transport (BMWV), the Lenzing AG and the österreichische Bundesforste AG, besides several minor industrial, commercial and private contributors. According to newsprint releases and the unanimous judgement of the participants, the symposium „Advances in Wood Chemistry“ ranked among other top wood chemistry congresses with about 150 registered participants from 15 countries.

Joe Gratzl to whom the symposium was dedicated is the only one of the fathers of Austrian wood chemistry who is still active. Although most of his work was done in the USA at the North Carolina State University, Raleigh, Prof. Gratzl’s academic career started at the Vienna University at a time when Austria still had a high reputation in this field. It was with the retirement of Prof. Karl Kratzl at Vienna and that of Prof. Kratky and Prof. Schurz at Graz, that almost all R&D activities at Austrian universities in the field of wood chemistry have unfortunately died down, despite the importance of the cellulose industry for the Austrian economy. At the same time, more and more of the related industries have also stopped most of their own R&D activities.

„Knowledge“ in Research and Development.
The topic discussed with the biggest emphasis and concern in recent meetings of Research Directors of major European companies, is „knowledge management“ in the field of R&D in today’s business environment. Everybody agrees that knowledge is a key asset of a company, even though it seems very difficult to be managed. This might be taken as an entry to the following thoughts.

First, „knowledge“ has to be generated, and it is obvious that it represents much more than just „data“ or „information“. The biggest data bases and the best information will not lead to decisions or actions unless they are understood and transformed into applicable knowledge. Only R&D persons „who know“ can contribute to this process by finding solutions for current problems, by generating new and better products, optimized processes, thereby significantly contributing to business success.

Second, efficient knowledge management must therefore always care about renewal of knowledge by generating knowledgeable persons and about preventing their loss. Old-fashioned terms, such as „tradition within a
group" and "continuity" are preconditions for an efficient renewal of knowledge. This is a very difficult task for a medium-sized company in today’s business environment. For us in Lenzing it was, among others, Prof. Joe Gratzi who as a consultant for many years helped to bridge the gap and to maintain a certain minimum amount of research activities in the field of cellulose chemistry over the last couple of years. That is why, not too long ago, we could start over to dig out the potential which lies in improving the processes and the quality of our dissolving pulp. Only recently we realized again, how much can be done by taking benefit from the integration of pulp and fiber manufacturing in one manufacturing site like Lenzing: it offers an enormous potential for optimization. But we realized also, how little in fact we know about our most important raw material.

Lenzing’s strategies to manage the new thrust in its R&D activities.

1) We try to maintain and enlarge our basis of competence by participating in co-operative projects and by selling R&D services to those in our industry who already have given up their own R&D. By carrying out projects for other parties we get them to share the costs for developing and maintaining our expensive methods and sophisticated pilot plants. In addition, we participate in a process of cross-fertilization between different industries and come across new ways to think about our own core business.

Lenzing has an exceptionally large scope of industrial activities relating to cellulose, starting from the conversion of wood into pulp and various fine chemicals, producing cellulose derivatives, cellulose solutions, and finally various manmade cellulosic products. We are therefore in a good position to offer partners and customers a singularly attractive and unusually large field of expertise.

- We are producing dissolving pulps in both, a magnesium bisulphite and a prehydrolysis kraft mill. The "Visbatch" process was developed in our laboratories and then implemented in 1995 with the start-up of Bacell, our new 120,000 tpa prehydrolysis kraft mill in Brazil. All R&D work was done with 10 liter pilot reactors originally developed for our sulphite process in Austria. The successful up-scaling is a proof of the quality and sophistication of this equipment.

- Lenzing was the first company world-wide who introduced Totally Chlorine Free (TCF) Bleaching for their dissolving pulps. Already in the late eighties we developed and implemented such the process for our beech pulp in our bisulphite mill here in Austria. We also managed later a TCF process for Eucalyptus dissolving pulps for our kraft mill in Brazil which was already implemented at the start-up of this plant. One of the key elements of this process was our own, patented medium consistency reactor.

- We are one of the very few pulp producers who started concentrating on a recovery of substances other than cellulose from wood. In order to cope with steadily tightening environmental regulations in Austria we were compelled to find solutions to generate additional income from our raw material. We started this process by extracting acetic acid and furfural from the vapor condensates of the spent cooking liquor. Just recently, this focus has led us into a co-operation with a Finnish partner who is separating xylene from our spent liquor after installing a 60 million US$ facility next to our plant. As a consequence of a systematic study of our process we have been able to increase the xylene concentration from originally below 10 to presently above 15%. Everybody who is familiar with separation processes can imagine the commercial implications of this improvement.

- Given the challenges of our new Bacell process it is to our own surprise that the quality of the pulp can be developed towards high-grade applications, such as cellulose acetate or cellulose ethers. Suddenly our need for the characterization of pulps was not only confined to the traditional viscose area and to the NMMO process, but we had to gain new experience with lab methods for those other applications and processes.

- Last but not least we developed our own Lyocell Technology and implemented a
commercial plant for the production of manmade cellulosic fiber in Heiligenkreuz, Austria. The direct route to dissolve pulp in an organic solvent without prior derivatization presents many new challenges and a lot of additional needs to characterize cellulosic substrates. But it offers also an enormous scope for other products based on that cellulose solution.

Partners cooperating with us in their R&D projects or contracting our services are very often in completely different businesses, but have similar upstream processes. Several companies from the pulp and paper industry are among our customers. Our cooperation with UCB, the leading manufacturer of cellophane, is just one example for a partnership in which we are working on the development of a new cellulosic film on the basis of our Lyocell process.

2) The second strategy deals with improving the general situation for research in the field of cellulose and wood chemistry in our public research institutions here in Austria. As mentioned above, almost all chemical R&D activities at our universities in the field of wood chemistry have come to an end. This neglect is all the more inexplicable when the major economic significance of the sector is taken into account. The amount of foreign exchange earned from wood and its downstream products is number one in Austria – even bigger than tourism! Once more almost 90% of this amount results from chemical processing of wood: pulp, paper, paperboard, and more than 15% solely from Lenzing’s textile fibers and their downstream products.

A discussion on “sustainable industries based on renewable resources” has been going on in Austria for the last several years. For some inexplicable reasons, however, wood has been mentioned very little in this context. In contrast, peripheral economic subjects with only limited developmental potential even in the long term, such as hemp, linseed oil, etc., have attracted a disproportionately great amount of public and governmental attention and support. And if wood is mentioned at all, the focus has been placed either on its combustion as a replacement of petrochemical fuels in the context with the Kyoto Targets or on its use as a construction material.

It was highly alarming when we realized that the Austrian infrastructure of R&D in the whole field of wood chemistry has virtually broken down. The implications for Lenzing are much more serious than meaning just a lack of support of our own projects. Lenzing AG, which uses 95% of the industrial beach wood harvested in Austria for its products, altogether depends on a well-functioning domestic wood industry for its survival. And we surely know from our own corporate experience that the most important factor for the sustainability of our industry is a continuous improvement of our efficiency by innovation in our processes and products.

New ways to advance Austrian research activities in wood chemistry.

As it is clear that no commercial enterprise of Lenzing’s size can finance the required long-term and basic research on its own, we had to find ways for a continuous and high-quality support of our in-house innovation process. So we started activities to implant cellulose chemistry again at one of the Austrian universities. This resulted finally in a partnership with the University of Agricultural Sciences Vienna (Universität für Bodenkultur Wien – BOKU) and in founding the „Christian-Doppler-Laboratory for Pulp Reactivity“ (Christian-Doppler-Labor für Zellstoffreaktivität). Its presentation to the scientific world in the symposium was another reason for celebration today. In this context, I would like to repeat my sincere thanks to Rektor März and Professor Kögerler for their active support, and to Professor Kosma for all his efforts to establish the laboratory and to start off the research activities so promptly; without them the laboratory could never have come into existence. With the CD lab, wood and cellulose chemistry has finally become a subject for R&D at an Austrian university again. The importance of this first step for the whole value chain can also be seen from the active participation of the Österreichische Bundesforste AG, the biggest Austrian forest estate, as a partner in this laboratory.
Scientific work at the CD lab has started at an incredible pace and even results with clear practical applications - most important for the industrial partners - have started to flow. In recent decades, progress in polymer chemistry was mainly achieved in the field of fully synthetic polymers. It now appears that cellulose chemistry can benefit from this progress and is able to generate results rather quickly in a manner also aimed at actual applications. An increasing academic interest in cellulose can be observed and a network of different groups at several universities in Austria is developing around the CD lab. A couple of students have started work for their diploma or their Ph.D. theses and we are already looking forward to the innovative contributions of scientists and students from the Universität für Bodenkultur also as future employees and cooperation partners of Lenzing.

**Future prospects.**

Although initial progress has been made, it soon becomes clear that a second step is needed for the industry in Austria. Apart from cellulose chemistry - most important to producers and users of dissolving pulp like Lenzing - also a focus on other topics of wood chemistry is urgently needed in Austria. Subjects like wood cooking, wood components isolation and utilization, wood surface reactions, such as activation, gluing and derivatization to name but a few, and wood composites formation are not sufficiently covered. Also in this field the traditions at our universities have been more or less discontinued and will have to be revived. Given the widespread need for renewal, particularly at the majority of older sulfite mills in the Austrian pulp and paper business, also industry appears ready very soon to head in a new direction that will involve new cellulose production processes.

I would like to conclude with a summary of what seems to be a turning point for the importance of cellulose and wood chemistry altogether. The industry dealing with cellulose is facing a new situation with undreamed technological potentials coming suddenly within grasp. The importance of wood as a renewable raw material is becoming increasingly important.

- For more than a decade, the industry has been focusing on resolving its environmental protection problems and creating self-contained systems. This process has now been brought to a successful conclusion.
- The competitiveness of the pulping industry in Europe in relation to producers in more favored climates can be greatly improved by expanding the material utilization of other wood constituents.
- We are about to take a quantum leap forward in the utilization of cellulosic substrates thanks to the new direct dissolution process which was established for the first time on a large commercial scale.
- The industry is experiencing a renaissance in existing cellulosic products. There are ample chances for a veritable surge in development of new cellulosic products for many different applications.
- Cellulosic products are already now of great ecological significance. Increased material utilization of wood as a renewable resource has extended the natural CO₂ cycle and significantly lightened the burden on the environment in several respects. The use of fossil materials and fuels has been reduced significantly together with the amount of CO₂ released into the atmosphere; biodegradability enables a reduction in the waste disposal in landfills and incinerators.

These facts emphasize once more the importance of active research in cellulose and wood chemistry. The various cooperations and R&D activities of Lenzing as well as the institutionalization of the Christian-Doppler laboratory mark a forceful beginning in the long process of re-establishing a wood chemistry research program in Austria. The symposium “Advances in Wood Chemistry” demonstrates exemplary that this approach has found wide acceptance, also in the international scientific community.