Guest Editorial

ART J. RAGAUSKAS
TAPPI Journal
Editorial Board

KARI EBELING
Honorary Co-Editor

Forest Biorefining = ∑ Biobased Materials/ Chemicals + Biofuels + Biogas + Biopower

Editor's Note: *TAPPI would like to thank Art Ragauskas of the* TAPPI Journal *(*TJ*) Editorial Board for soliciting and organizing papers for this special Forest Biorefinery issue, as well as for future issues of* TJ*. Thanks also to the authors and peer reviewers who participated in this process.*

– Monica Shaw,
Editorial Director

Although the forest products industry has always practiced the biorefining of woody biomass to value added materials, chemicals, and power, the events of the last decade have forced various stakeholders to ask if we can do better. Starting roughly a decade ago, our community began to intensely examine what resources were not being used in final pulp products and determine if they could be recovered and used as a feedstock for green manufacturing of new products. Following these initial interests, the practice of biorefinery has grown widespread:

- Many academic programs have been retooled and renamed to reflect the focus on the fundamentals of biorefining biomass.
- Several leading forest products research centers have developed unique industry-led programs examining how woody waste streams can be used to generate new green products integrated with the existing manufacturing infrastructure.
- New pilot-plant facilities are now available to test innovative forest biorefining concepts, which in some cases have led to new commercial ventures.
- To compliment these efforts, there is a continuing evolution of established pulp grades, including dissolving grade pulps, refined fluff pulp production techniques, and the tailoring of forest resources for tissue and packaging grades.

An equally promising pathway of innovation is that the tools, equipment, and additives used in the production of pulp and paper are now being applied to the production of cellulosic ethanol from woody biomass. Furthermore, several forest products companies have entered the wood pellet industry, and news announcements continue to document the growing use of forest residues as an energy resource.

For further down the road, research studies are being directed to recover hemicelluloses and select fractions of lignin from various process streams. Woody hemicelluloses can be readily envisaged to be used as a resource for biofuels, films, gels, and foams, as well as a strength aid for kraft pulps. Recovered lignin is being examined for several applications, ranging from an additive for polymers and a resource for bio-oils production to a feedstock for carbon fiber production. The use of tailored pulp fibers is also being incorporated into composites from cement to plastics to achieve enhanced physical properties at lower weights.

All of these advances place unique demands on the research and implementation teams needed to advance these technologies. Along with the conventional expertise associated with chemical and mechanical pulping, new specialists in plant genetics, fermentation, separations, material science, and lifecycle analysis are all being recruited to accelerate the development of the next generation of forest biorefining technologies.

As illustrated in the ensuing publications in this special Forest Biorefinery issue of *TAPPI Journal*, the next decade promises to become one of the most innovative in the history of forest products. The efforts to create this special Forest Biorefinery issue yielded additional research that you will find in upcoming issues of *TJ*.

Kari Ebeling: Honorary Co-Editor

In this special Forest Biorefinery issue of *TAPPI Journal*, we would like to honor the distinguished academic and professional career of our colleague and friend Kari Ebeling, who passed away in February at his home in Espoo, Finland. Born in Helsinki in 1940, Dr. Ebeling received his M.S. degree in paper technology from Helsinki University of Technology in 1963 and a Ph.D. in 1970 from The Institute of Paper Chemistry in Appleton, WI, USA (now The Institute of Paper Science and Technology [IPST], Atlanta, GA).

At IPST, Dr. Ebeling's Ph.D. thesis on the structural behavior of paper in straining was judged best in the 1970 class, earning him The Westbrook Steele Gold Medal Award and also forming an important basis for future industry research. Upon returning home, he attended the Finnish Institute of Management in 1973. Many feel that Dr. Ebeling's experiences at IPST and exposure to U.S. management practices influenced a focus on developing and applying advanced science-based technology and a long-term management perspective in the Finnish industry.

Dr. Ebeling began his professional career as a research assistant at KCL, the Finnish Pulp and Paper Research Institute, serving from 1963 to 1965. He was manager, R&D, for Nokia Forest Industries from 1970 to 1978, after which he spent nine years in academia as professor, Paper Technology, at Helsinki University of Technology. There, he led approximately 100 M.S. engineers and 10 Ph.D. students in technology to graduation.

From 1987 to 1989, Dr. Ebeling worked as director, Corporate R&D for James River Corporation, in Neenah, WI. Afterwards, he returned to Finland to serve as director, Corporate R&D, and senior scientific advisor for Kymmene, and post-merger, UPM-Kymmene Corporation. He retired in 2004, continuing as a consultant to the industry.

During his career, Dr. Ebeling held many industry leadership positions, including those with the Finnish Engineering Society, the Finnish Academy of Engineering Sciences, and KCL. He served in similar positions with ESPRA, the Empire State Paper Research Association in New York; EIRMA, the European Industrial Research Management Association in Paris; and IPST. Dr. Ebeling was an active member of TAPPI for 25 years. In 2007, he was inducted into the Paper Industry International Hall of Fame in Appleton.

Dr. Ebeling authored or co-authored 56 publications and contributed chapters to several textbooks during his career. Among his many honors, Dr. Ebeling was a TAPPI Fellow; a recipient of the SLR I medal from the Republic of Finland and the Keller Award from the German Papiertechnische Stiftung; and an invited member of The Royal Swedish Engineering Academy. He also received the Stenback Medal from the Finnish Paper Engineers Association and the 2007 Technology Prize from the Finnish Foundation for Advancement of Technology.

Last year, UPM-Kymmene held a colloquium where industry professionals gathered to recognize Dr. Ebeling's outstanding research contributions to the industry, as well as his legendary friendliness. He will be deeply missed by the industry, friends, and most especially his family, including his wife of 50 years, Tuula, children Petri and Niina, and seven grandchildren. **TJ**

Art J. Ragauskas is a member of the TAPPI Journal *Editorial Board and a professor at the Institute of Paper Science and Technology, School of Chemistry and Biochemistry, at Georgia Institute of Technology, Atlanta, GA, USA. Email Art at arthur.ragauskas@ipst.gatech.edu.*