FAST MOVING FRONTS - 2010

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Guido Zacchi talks with *ScienceWatch.com* and answers a few questions about this month's Fast Moving Fronts paper in the field of Microbiology.

Article: Bio-ethanol - the fuel of tomorrow from the residues of today
Authors: Hahn-Hagerdal, B;Galbe, M;Gorwa-Grauslund, MF;Liden, G; **Zacchi, G**
Journal: TRENDS BIOTECH, 24 (12): 549-556, DEC 2006
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SW: Why do you think your paper is highly cited?

The conversion of forest and agricultural residues to liquid fuels is of increasing interest worldwide as it provides quick and medium-term solutions to the replacement of fossil fuels in the transport sector without competing with the food supply.

This paper gives a comprehensive review of the research achievements obtained within the most important processing steps in the biomass-to-ethanol process. It also summarizes the most important research challenges remaining in order to make the process economically feasible in the future.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

It describes recent achievements, with a focus on research performed at Lund University, and, within these key processes, steps which mainly consist of conversion steps, i.e., the pretreatment of biomass, enzymatic hydrolysis, and the fermentation of both hexose and pentose sugars. It also stresses the importance of optimizing the integration of process engineering, fermentation technology, enzymatic and metabolic engineering.

SW: Would you summarize the significance of your paper in layman's terms?

The paper shows that great progress has been achieved within the development of

individual steps in the process for the production of ethanol from cellulose-containing materials, such as wood residues, straw, bagasse, etc.

It also presents the authors' ideas about what remains to be done to move from these research achievements toward a commercial process, including the verification of pilot- and demo-scale plants, and integrating ethanol production with the external fuel processes required by power plants.

"...will also speed up the transition from fossil fuels to a renewable fuel-based transportation sector, which will help diminish the impact of an increasing greenhouse effect on our climate."

SW: How did you become involved in this research and were any particular problems encountered along the way?

As a chemical engineer, I've been involved in this research for a period of almost 30 years and, due to my knowledge of distillation, which was considered a key step in achieving high energy demand, I soon realized that this was not the case, and my research instead focused on the biomass pretreatment and process integration.

To cope with all the challenges in developing a biomass-to-ethanol process requires cooperation between various disciplines, primarily including chemical engineers, microbiologists, and biochemists. This cooperation was established at Lund University around 1985 and is an ongoing process, as outlined in the list of the paper's authors.

SW: Where do you see your research leading in the future?

My team will continue to develop pretreatments for various kinds of biomasses and also intensify our research work on process integration, both within the ethanol production process and also within external processes.

The latter comprises integration with first-generation ethanol production, e.g., ethanol from wheat + wheat straw and from molasses + sugarcane bagasse, and also includes integration with heat and power production. Cooperation with other disciplines is foreseen to continue and comprises a link with various industrial partners who are running the pilot- and demo-scale plants.

SW: Do you foresee any social or political implications for your research?

I believe that research performed by my group, in collaboration with other similar research groups and industrial partners, will assist in the development of economically viable processes for the production of ethanol, resulting in heating and power production.

This will also speed up the transition from fossil fuels to a renewable fuel-based transportation sector, which will help diminish the impact of an increasing greenhouse effect on our climate.

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ZYMOMONAS-MOBILIS; ESCHERICHIA-COLI; L-ARABINOSE.

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