

NEWSLETTER

FEBRUARY 2013



DIBANET



ABOUT DIBANET

DIBANET (www.dibanet.org), the Development of Integrated Biomass Approaches Network, is a 45 month, € 3.73 m research project that is funded by the EU's Seventh Framework Program. It is coordinated by the Carbolea Research Group at the University of Limerick (www.carbolea.ul.ie) in Ireland, and builds on the key, complementary, strengths of European and Latin American researchers and industries to advance the development of second generation biofuels. It focuses on the conversion, by non-biological means, of the residues and wastes of Europe and Latin America. DIBANET offers the possibility of converting agricultural residues and wastes into sustainable biofuels and additional value added products. This work will contribute to the development of the green economy and will help to secure jobs into the future.

This edition of the newsletter provides you with summary of the achievement within the DIBANET projects. The last project meeting was combined with a Networking event in Thessaloniki where they key results and future plans were presented. Several promising results have been achieved in the last years starting from rapid analytical tools to predict composition of biomass to chemical databases. You can find brief descriptions of the key results in this newsletter. Further information is available on the project website:

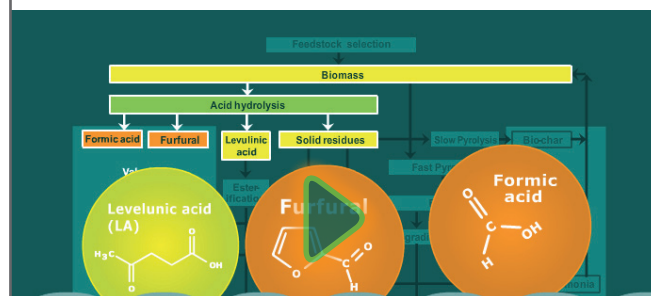
www.dibanet.org

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DIBANET VIDEO

with further details on the project [here](#)



A reactor system will be created and optimised to convert key selected biomass feedstocks from organic wastes and residues to levulinic acid with acid hydrolysis.



RECENT NEWS

DIBANET & SMART CHP NETWORKING EVENT IN 2012

Thessaloniki, GREECE, 31 October 2012



The DIBANET research consortium presented the "Diesel miscible fuels from wastes, residues and non-food crops of Latin America & Europe" Networking event that was held on 31 October 2012 at CERTH, in Thessaloniki, Greece. The aim of the event was to bring together key players in scientific communities and industry to discuss how Europe and Latin America can work together to produce diesel fuels sustainably and cheaply. The Dibanet processes and the key results of the project were presented.

The Networking event was co-organised with the LIFE project „SMART - CHP Demonstration of a Small scale Mobile Agricultural Residue gasification unit for decentralized Combined Heat and Power production”: <http://smartchp.eng.auth.gr/en>

The Networking event was followed by "UBIOCHEM-III: Sustainable production of fuels/energy, materials & chemicals from biomass", the third International Workshop of COST Action CM0903 held in Thessaloniki, Greece on 1-3 November 2012: <http://www.ubiochem3.certh.gr>

Presentations and videos are available!

The presentations and posters are available in the [Agenda](#) and [Poster](#) session. You can find photos from the event in the [Gallery](#).

13:30 - 14:00 OPENING AND WELCOME



Dr. Angelos Lappas, CERTH, Greece



Prof. Michael H. B. Hayes, University of Limerick, Ireland



Assoc. Prof. Anastasia Zabaniotou, Aristotle University, Greece

14:00 - 16:15 DIBANET SCIENTIFIC INTRODUCTION

(chairman J.J. Leahy, University of Limerick, Ireland)



Levulinic Acid Reactor and Process Development

Dr. Donncha Haverty, University of Limerick, Ireland



Feedstock evaluation and development of rapid analytical methods

Dr. Daniel Hayes, University of Limerick, Ireland



Solid acid catalysts for biomass transformations

Prof. Victor Teixeira da Silva, Federal University of Rio de Janeiro, Brazil



Thermal processing of biomass and residues

Prof. A.V. Bridgwater, Aston University, the United Kingdom

16:45 - 18:00 SMART CHP SCIENTIFIC INTRODUCTION

(chairman Prof Z. Samaras, AUTH)



A microalgae integration biorefinery technology for sustainable production of biofuels and high added products

Prof. Costas Kiparissides, Aristotle University of Thessaloniki



Transport biofuels: Environmental concern in EU and the potential of South Europe for Sustainable and cheaper biofuels

Emeritus Prof. Spyros Kyritsis, Agricultural University of Athens



An assessment of a mobile gasification agro-biomass conversion system for CHP production

Assoc. Prof. Anastasia Zabaniotou, Aristotle University of Thessaloniki



Biomass Gasification activities in Thessaly Region

Bellis Vasileios, Chemical Engineer, ANKA

18:00 -

POSTER SESSION WITH RECEPTION



PETROBRAS BECOMES A DIBANET PARTNER






We are pleased to announce that PETROBRAS has joined the DIABNET consortium. PETROBRAS, a major Brazilian energy corporation that produces enough oil to meet the needs of Brazil, has shown increasing interest in recent years in the production of sustainable biofuels and chemicals. The Company, which has been collaborating with Prof. Victor Teixeira da Silva, a researcher at DIBANET partner UFRJ, for some time, became interested in the DIBANET project during the Summer School and Networking Event, organised by Prof. Teixeira for the project, in Rio de Janeiro in 2010. DIBANET project leader Prof. Michael Hayes, from the Carbolea Biomass Research Group at the University of Limerick, remarked that: "The addition of PETROBRAS to the DIBANET consortium is a significant event and a great reflection of the progress that has been achieved in the project. PETROBRAS will be of immense help in allowing us to determine the most appropriate ways to advance towards the commercialisation of the advanced processes that we have developed over the past three years".



DIBANET FEEDSTOCK REVIEW DOCUMENT AVAILABLE ONLINE

A report discussing the analytical results obtained for European and Latin American biomass feedstocks can now be downloaded from the DIBANET website. This report also contains some guidelines of best practice for biomass producers. It is a useful companion to the Chemical Database, which can also be downloaded from DIBANET. The report is available in full length (150 pages) and also in abridged form (16 pages). The files can be downloaded from the "Chemical Database" page or from the "Downloads and Links" page.

AVAILABLE DIBANET REPORTS

-  • **Report with Analysis of DMBs produced (2012)**
 - **Review of Biomass Feedstocks and Guidelines of Best Practice**
 -  Short Version (2012)
 -  Full Version (2012)
-  • **Report with an Optimized Catalytic Pyrolysis and Gasification Process Scheme (2012)**
-  • **Report with Catalyst evaluation results (2012)**

PILOT-SCALE PRETREATMENT REACTOR CONSTRUCTED

A pilot-scale reactor system has been constructed and tested at the Carbolea Biomass Research Group of the University of Limerick. This employs the patented pretreatment technology, developed as part of the DIBANET project, for the separation of biomass into its lignin, hemicellulose and cellulose components. It has been shown that the pretreatment process can allow for higher yields of levulinic acid and furfural in the DIBANET hydrolysis process and the lignin fraction is also recoverable and of high value. The system is housed in an industrial state in Nenagh, close to the University of Limerick, where the continuous pilot-scale DIBANET hydrolysis reactor system is also located.



DIBANET SERVICES

1. CHEMICAL DATABASE

The DIBANET Chemical Database provides information on the lignocellulosic, elemental and moisture contents of selected energy crops (e.g. Miscanthus), agricultural residues (e.g. from sugarcane, coffee, banana and coconut) and wastes of Europe and Latin America as well as on their predicted yields from biorefining technologies.

These technologies consist of, for instance, dilute acid and enzymatic hydrolysis of biomass, synthesis of mixed alcohols via catalytic processing of syngas derived from gasification of biomass, and Fischer-Tropsch synthesis of mixed range of linear hydrocarbons from biomass-derived syngas.

<http://www.dibanet.org/chemicaldatabase.php>

2. DIBANET E-LEARNING

The DIBANET project offers two e-learning courses on diesel production from wastes and residues, free-of-charge. The courses are available (after registration) to everyone interested in second generation diesel production.

Further information:

<http://www.dibanet.org/elearning.php>



FUTURE PLANS OF DIBANET RESEARCHERS

SPIN-OUT ANALYTICAL COMPANY



DIBANET researchers have made great advances in the analysis of lignocellulosic biomass. In particular, highly accurate models have been developed to predict the composition of biomass based solely on the near infrared (NIR) spectra of the sample.

Importantly, in contrast to most previous research in this area, such models have been developed for biomass containing significant amounts of water. That means that the samples do not need to be dried prior to the spectroscopic analysis, which enables NIR to be a truly rapid analytical tool.

Based on the analytical advances made in the project, The University of Limerick is planning to launch a spin-out company, provisionally titled BACI ("Biomass Analysis Centre of Ireland"). It will offer analytical services, both wet-chemical and NIR-based, for biorefinery feedstocks. For further information on this company please contact Dr Daniel Hayes.

SPIN-OUT BIOREFINING COMPANY

It is planned in the coming months to launch another spin-out company from the University of Limerick. This company will hold all of the important intellectual-property (relating to biomass processing) that was developed during the project at the Carbolea research group of the University of Limerick, as well as the pilot-scale biorefining equipment that has been manufactured. It is considered that this offers the best avenue for advancing the commercial prospects of the DIBANET hydrolysis process. Carbolea researchers are currently examining options for funding a demonstration-scale facility, employing the patented pretreatment and novel acid-hydrolysis processes developed, for the production of the valuable platform chemicals levulinic acid and furfural as well as their biofuel derivatives.

AWARDS FOR RESEARCHERS WORKING ON DIBANET

CARBOLEA RESEARCHER AWARDED PHD

Fergus Melligan, a member of the Carbolea Research Group at the University of Limerick, was recently awarded his PhD degree. His thesis is entitled "Pyrolysis of Biomass and Biorefinery Residual Materials for the Production of Advanced Biofuels". His involvement in DIBANET has been in producing and characterising biochar and bio-oil from the acid hydrolysis residues. He has also carried out pot-trials to determine the effects that the addition of this biochar to soil may have on plant growth.

AWARD FOR THE SCIENTIFIC AND TECHNOLOGICAL OUTSTANDING ACADEMIC IN RESEARCH



Dr. Gustavo Romanelli, a researcher of DIBANET research team, recently received from the University of La Plata (Argentina) the "Award for the scientific and technological outstanding academic in research".

He was honored for the contributions made in science and technology, the production of new knowledge for the consolidation of higher education and human resource training.

PREVIOUS AWARDS:

Prof. Tony Bridgwater from ASTON University wins Clean Energy Award



Tony Bridgwater, Professor of Chemical Engineering at ASTON University, working on the Dibanet project, has been awarded the 'UK Environmental Capital Peterborough Clean Energy' Award. This award recognises outstanding contributions to the development, implementation and promotion of clean energy technologies.

Tony Bridgwater has been pioneering the development of thermal biomass conversion and second generation biofuel technologies for over 30 years. Professor Bridgwater's name has been closely attached to 'Fast Pyrolysis', a new technology to transform biomass to liquid through thermochemical conversion.

DIBANET's research student wins the Young Scientist Presidential Award



Prof. Victor Teixeira da Silva (UFRJ), Mr. Luiz Antonio Rodrigues Elias (Minister of Science and Technology), Mr. Leandro Alves de Sousa, pictured at the award ceremony

Mr. Leandro Alves de Sousa, a PhD student working in the DIBANET research team under the supervision of Prof. Victor Teixeira da Silva at the Federal University of Rio de Janeiro, recently received the Young Scientist Presidential Award in Brazil for his catalysis work which is a major theme of DIBANET research.

NEW PAPERS

Girisuta B., Dussan K., Leahy J. J., Hayes M. H. B. (2012)

A Kinetic Study of Acid Catalysed Hydrolysis of Sugar Cane Bagasse to Levulinic Acid

Chemical Engineering Journal

<http://dx.doi.org/10.1016/j.cej.2012.11.094>

ABSTRACT

There is a significant research effort worldwide to identify attractive chemical conversion routes for lignocellulosic biomass to organic (bulk-) chemicals. This study has focussed on the acid-catalysed hydrolysis of sugar cane bagasse for the production of levulinic acid (LA), a platform chemical used for the synthesis of a variety of materials for applications such as fuel additives and polymer and resin precursors. The objectives of this study were to develop a broadly applicable kinetic model for the acid-catalysed hydrolysis of sugar cane bagasse to LA and to determine the optimum reaction conditions for its production. Systematic kinetic experiments were carried out by varying the reaction temperature between 150 and 200°C, and the sulphuric acid concentration between 0.11 and 0.55 M. The highest LA yield was obtained at 150°C and 0.55 M H₂SO₄ at 63 mol%, which equates to the production of 194 kg of LA from 1 dry tonne of sugar cane bagasse. The kinetic model developed was in good agreement with the experimental data and also with the previous kinetic models developed for cellulose and sugar cane bagasse. Our kinetic model, though developed for the sugar cane bagasse, can be applied over a wide range of hydrolysis reaction conditions for lignocellulosic biomass. Based on the optimisation study carried out using our kinetic model, an empirical equation is proposed to predict the LA yield at a particular temperature and acid concentration.

Girisuta B., Kalogiannis K. G., Dussan K., Leahy J. J., Hayes M. H. B., Stefanidis S. D., Michailof C. M., Lappas A. A. (2012)

An integrated process for the production of platform chemicals and diesel miscible fuels by acid-catalyzed hydrolysis and downstream upgrading of the acid hydrolysis residues with thermal and catalytic pyrolysis

Bioresource Technology, 126

<http://dx.doi.org/10.1016/j.biortech.2012.09.013>

ABSTRACT

This study evaluates an integrated process for the production of platform chemicals and diesel miscible biofuels. An energy crop (*Miscanthus*) was treated hydrothermally to produce levulinic acid (LA). Temperatures ranging between 150 and 200°C, sulfuric acid concentrations 1-5wt.% and treatment times 1-12 h were applied to give different combined severity factors. Temperatures of 175 and 200°C and acid concentration of 5wt.% were found to be necessary to achieve good yield (17wt.%) and selectivities of LA while treatment time did not have an effect. The acid hydrolysis residues were characterized for their elemental, cellulose, hemicellulose and lignin contents, and then tested in a small-scale pyrolyzer using silica sand and a commercial ZSM-5 catalyst. Milder pretreatment yielded more oil (43wt.%) and oil O(2) (37%) while harsher pretreatment and catalysis led to more coke production (up to 58wt.%), less oil (12wt.%) and less oil O(2) (18wt.%).

Hayes D. J. M. (2012)

Second-generation biofuels: why they are taking so long

Wiley Interdisciplinary Reviews: Energy and Environment, 10.1002/wene.59

ABSTRACT

There has been a significant degree of hype regarding the commercial potential of second-generation biofuels (2GBs; biofuels sourced from lignocellulosic materials). In 2007, ambitious targets for the mass substitution of fossil-fuel-derived transport fuels by 2GBs were put forward in the United States and similar targets exist for other countries. However, as of May 2012, no commercial-scale 2GB facilities are currently operating. The technical and financial obstacles that have delayed the deployment of these facilities are discussed, as are recent advancements in research that may help to overcome some of these. There are six commercial-scale facilities currently (May, 2012) in construction and many more are planned in the near term. The prospects for 2GBs are more promising now than in the past but the delays in getting to this point mean that the ambitious targets of several years ago are unlikely to be reached in the near term.

PREVIOUS PUBLICATIONS

Papers resulting fully or partly from the project: <http://www.dibanet.org/publication.php>

- **Autothermal, single-stage, performic acid pretreatment of *Miscanthus x giganteus* for the rapid fractionation of its biomass components into a lignin/hemicellulose-rich liquor and a cellulase-digestible pulp**, Donncha Haverty, Karla Dussan, Anna V. Piterina, J.J. Leahy, M.H.B. Hayes, *Bioresource Technology* 109 (2012) 173–177
- **Pressurised Pyrolysis of *Miscanthus* using a Fixed Bed Reactor. *Bioresource Technology***, Melligan, F; Auccaise, R; Novotny, EH; Leahy, JJ; Hayes, MHB; Kwapinski, W. 2011. v. 102, p. 3466-3470.
- Melligan, F; Dussan, K; Auccaise, R; Novotny, EH; Leahy, JJ; Hayes, MHB; Kwapinski, W. (2012) **Characterisation of the products from pyrolysis of residues after acid hydrolysis of *Miscanthus***. *Bioresource Technology*, 108, 258–263.
- **Biochar and soil nitrous oxide emissions**, Alho, CFBV; Cardoso, AS; Alves, Bruno JR; Novotny, EH. (2012) *Pesquisa Agropecuária Brasileira*, 47, 722-725.
- **Reproducing the organic matter model of anthropogenic dark earth of Amazonia and testing the ecotoxicity of functionalized charcoal compounds**, Linhares, CR; Lemke, J; Auccaise, R; Duó, DA; Zioli, RL; Kwapinski, W; Novotny, EH. (2012) *Pesquisa Agropecuária Brasileira*. 47, 693-698.
- **Context and importance of biochar research**, Madari, BE; Maia, CMBF; Novotny, EH. (2012) *Pesquisa Agropecuária Brasileira*. 47, i-ii.
- **Advances in Biochar Research in Brazil**, Maia, CMBF; Madari, BE; Novotny, EH. (2011) *Dynamic Soil, Dynamic Plant*, 5 (Special Issue 1). 53-58.
- University of ASTON, together with University of Buenos Aires presented some results from bio-oil esterification experiments during the 19th International Symposium on Analytical and Applied Pyrolysis Linz, Austria 21-25th May 2012. The title of the poster was: **Esterification of fast pyrolysis bio-oil using heteropoly acid catalyst with Wells–Dawson structure** Authors: D. J. Nowakowski (presenting author), G.T. Baronetti, A.V. Bridgwater, G. Romanelli and P. Vazquez

RECENT PRESENTATIONS

An integrated approach for making the best use of biomass Hayes, D. J. M. (2012)

Ist Iberoamerican Congress on Biorefineries
Los Cabos, Mexico
24-26 October

Collaboration in Biorefinery Research Between Europe and Latin America, Hayes, D. J. M. (2012)

III Latin American Congress Biorefineries
Pucon, Chile
19-21 November