

Overview RTD publications

Pyrolysis

Energy from Pyrolysis oil

Biofuels from pyrolysis oil

Gasification

Supercritical Water

Chemicals & Materials

Electrochemistry

Pyrolysis

[Back to top](#)

Results of the International Energy Agency Bioenergy Round Robin on the Analysis of Heteroatoms in Biomass Liquefaction Oils, Philip Bulsink, Ferran de Miguel Mercader, Linda Sandström, Bert van de Beld, Fernando Preto, Alan Zacher, Anja Oasmaa, Nicolaus Dahmen, Axel Funke, and Benjamin Bronson, *Energy Fuels* 2020, 34, 11123–11133

Pyrolysis of agro-digestate: nutrient distribution, E.J. Leijenhörst, in: *Biorefinery of Inorganics: Recovering Mineral Nutrients from Biomass and Organic Waste*, Editors: Erik Meers, Gerard Velthof, Evi Michels, Rene Rietra, Christian V. Stevens (Series Editor), (2020), chapter 4.3, pp 133-146.

Phosphorus fertilising potential of fly ash and effects on soil microbiota and crop, Deborah Schönegger, María Gómez-Brandóna, Thomas Mazzier, Heribert Insam, Roy Hermanns, Evert Leijenhörst, Tommaso Bardellia, Marina Fernández-Delgado Juárez, *Resources, Conservation and Recycling*, 134, (2018), pp 262-270.

Results of the International Energy Agency Round Robin on Fast Pyrolysis Bio-oil Production, Douglas C. Elliott, Dietrich Meier, Anja Oasmaa, Bert van de Beld, Anthony V. Bridgwater, and Magnus Marklund, *Energy Fuels*, 2017, 31 (5), pp 5111–5119.

Inorganic element transfer from biomass to pyrolysis oil, Evert Leijenhurst, IEA Bioenergy Task 34, PyNe 40, p4 (2017)

Inorganic element transfer from biomass to fast pyrolysis oil: review and experiments. E.J. Leijenhurst, W. Wolters, L. van de Beld, W. Prins.. 2016 Fuel Processing Technology 149;96-111.

EMPYRO: Implementation of a commercial scale fast pyrolysis plant in the Netherlands, Bert van de Beld and Gerhard Muggen, 23rd European Biomass Conference and Exhibition, Vienna-Austria (2015) 1670-1673.

Norms, Standards, and Legislation for Fast Pyrolysis Bio-oils from Lignocellulosic Biomass, Anja Oasmaa, Bert van de Beld, Pia Saari, Douglas C. Elliott, and Yrjö Solantausta, Energy Fuels 2015, 29, 2471–2484.

Update on standardization of fast pyrolysis bio-oils from lignocellulosic biomass, Anja Oasmaa, Bert van de Beld Pia Saari, Doug Elliott and Suzanne van Kruchten, Pyne Newsletter 37, July 2015;

Effect of biomass ash in catalytic fast pyrolysis of pine wood, Yildiz, Guray; Ronsse, Frederik; Venderbosch, Robbie; van Duren, Ruben; Kersten, Sascha R. A.; Prins, Wolter, Applied Catalysis, B: Environmental (2015), 168-169, 203-211.

State-of-the-art of fast pyrolysis in IEA bioenergy member countries, Dietrich Meier, Bert van de Beld, Anthony V. Bridgwater, Douglas C. Elliott, Anja Oasmaa, Fernando Preto, Renewable and Sustainable Energy Reviews, Volume 20, April 2013, pp. 619-641.

Biomass pyrolysis, Nachenius, R. W.; Ronsse, F.; Venderbosch, R. H.; Prins, W., From Advances in Chemical Engineering (2013), 42(Cheical Engineering for Renewables Conversion), 75-139.

Fast pyrolysis of biomass, Venderbosch, Robbie H.; Prins, Wolter, edited by Brown, Robert C, Thermochemical Processing of Biomass (2011), 124-156.

Fast pyrolysis of biomass for energy and chemicals: technologies at various scales, Venderbosch, R. H.; Prins, W. Edited By Harmsen, Jan; Powell, Joseph B, Sustainable Development in the Process Industries (2010), 109-155.

Fast pyrolysis technology development, RH Venderbosch, W Prins, Biofuels, Bioprod. Bioref. 4:178–208 (2010);

Characterization of hydrotreated fast pyrolysis liquids , A. Oasmaa, E. Kuoppala, A. Ardiyanti, RH Venderbosch, HJ Heeres, 2010, Energy & Fuels, 24(9), 5264-5272;

Valorisation of Jatropha curcas L. plant parts; nut shell conversion to fast pyrolysis oil, Manurung R., Wever D.A.Z., Wildschut J., Venderbosch R.H., Hidayat H., van Dam J.E.G., Leijenhurst E.J., Broekhuis A.A., Heeres H.J., 2009, Chemical Engineering Research and Design, Food and Bioproducts Processing, 87 (3), 187-196

Development of a Pre-treatment Plant for Residues from the Malaysian Palm Oil Industry, Robbie Venderbosch; Teng Kek Hup and Harold Boerrigter, PALM OIL ENGINEERING BULLETIN NO. 99, pp 49

Flash Pyrolysis of Wood for Energy and Chemicals: part 1, Venderbosch R.H., Prins W., Wagenaar B.M., 1999, NPT Procestehnologie, 6, 18-23

Flash Pyrolysis of Wood for Energy and Chemicals: part 2, RH Venderbosch, W. Prins, BM Wagenaar, 2000, NPT Procestehnologie, 1, 16-20

Energy from Pyrolysis oil

[Back to top](#)

The effect of adding ethanol on the ignition properties of fast pyrolysis oil, R. Calabria, F. Chiariello, P. Massoli, A. Frassoldati, B. van de Beld, R. Hermans, A. Oasmaa, A. Toussaint, proceedings 27th European Biomass Conference & Exhibition, Lisbon, 2019, 765-770.

The use of a FPBO-ethanol blend in diesel engines for CHP applications, Bert van de Beld, Elmar Holle, Jan Florijn, Biomass & BioEnergy, Volume 110, March 2018, Pages 114-122.

The use of fast pyrolysis bio-oil in a modified diesel engine, Bert van de Beld, Jan Florijn, Elmar Holle, PyNe 41, IEA Bioenergy Task 34, p 11 (2017)

The use of fast pyrolysis oil in diesel engines for CHP applications, Bert van de Beld, Elmar Holle, Jan Florijn, Proceedings 25th European Biomass Conference and Exhibition, 2017, Stockholm-Sweden, pp 1932-1937.

Renewable Residential Heating with Fast Pyrolysis Bio-oil: Residue2Heat, Roy Hermans, Bert van de Beld, Anja Oasmaa, IEA Bioenergy Task 34, Issue 39, p 11 (2016)

The use of pyrolysis oil and pyrolysis oil derived fuels in diesel engines for CHP applications, L. van de Beld, E. Holle, J. Florijn, Applied Energy 102 (2013) 190–197.

An experimental study on the use of pyrolysis oil in diesel engines for CHP applications, L. van de Beld, E. Holle, J. Florijn, 19th European Biomass Conference and Exhibition, 6-10 June 2011, pp. 1181-1187.

Using biomass-based fuels including pyrolysis liquids for power and CHP production, L. van de Beld, J. Vos, J. Florijn, A. Kronberg, M. Glouchenkov, M. Sprenkeler, D. Chiaramonti, AM Rizzo, V Kirillov, N. Khripach, L. Lezhnev, B. Papkin, AV Bridgwater, E. Wylde, A. Alcalá, S. Silin, , 18th European Biomass Conference and Exhibition, May 2011, Lyon.

Bio-oil as a coal substitute in a 600 MW_e Power Station, BM Wagenaar, RH Venderbosch, W Prins, F Penninks, 12th European Conference and technology Exhibition on Biomass for Energy, Industry and Climate Protection, 17-21 June 2002, Amsterdam, The Netherlands.

BioSlurryTM for co-firing and gasification, Pyrolysis and gasification of Biomass and Waste, RH Venderbosch, BM Wagenaar, E Gansekoele, J Florijn, 2002, , Strasbourg, France, 289-297

Biofuels from pyrolysis oil

[Back to top](#)

NiCuMo-SiO₂ catalyst for pyrolysis oil upgrading: Model acidic treatment study, Alekseeva (Bykova) M.V., Otyuskaya D.S., Rekhtina M.A., Bulavchenko O.A., Stonkus O.A., Kaichev V.V., Zavarukhina S.G., Thybaut J.W., Alexiadis V., Venderbosch R.H., Yakovlev V.A Applied Catalysis A: General, 2019, 5735, pp. 1-12

Hydrogen production from sucrose via aqueous-phase reforming, Lidia I.Godina, Hans Heeres, Sonia Garcia, Steve Bennett, Stephen Poulston, Dmitry Murzina, International Journal of Hydrogen Energy, Volume 44, Issue 29, 7 June 2019, 14605-14623

Co-processing of crude and hydrotreated pyrolysis liquids and VGO in a pilot scale FCC riser setup, Wang C., Venderbosch R.H., Fang Y., Fuel Processing Technology, 2018, 1811, pp. 157-165

Fast pyrolysis oil stabilization kinetics over a Ni-Cu catalyst using propionic acid as a model compound, Otyuskaya D., Thybaut J.W., Alexiadis V., Alekseeva M., Venderbosch R.H., Yakovlev V.A., Marin G.B., Applied Catalysis B: Environmental, 2018, 2335, pp. 46-57

Recent developments in the catalytic hydrotreatment of pyrolysis liquids, Yin W., Venderbosch R. H., Heeres H. J., chapter 8; Direct Thermochemical Liquefaction for Energy Applications, 2018, pp. 249-292

Hydrotreatment of the carbohydrate-rich fraction of pyrolysis liquids using bimetallic Ni based catalyst: Catalyst activity and product property relations, Yin, Wang; Venderbosch, Robertus Hendrikus; Alekseeva, Maria V.; Figueiredo, Monique Bernardes; Heeres, Hans; Khromova, Sofia A.; Yakovlev, Vadim A.; Cannilla, Catia; Bonura, Giuseppe; Frusteri, Francesco; *et al*, Fuel Processing Technology (2018), 169, 258-268.

Mono-, bi-, and tri-metallic Ni-based catalysts for the catalytic hydrotreatment of pyrolysis liquids, Yin, Wang; Venderbosch, Robbie H.; He, Songbo; Bykova, Maria V.; Khromova, Sofia A.; Yakovlev, Vadim A.; Heeres, Hero J., Biomass Conversion and Biorefinery (2017), 7(3), 361-376.

Optimizing the bio-gasoline quantity and quality in fluid catalytic cracking co-refining, Gueudre, Laurent; Chapon, Florian; Mirodatos, Claude; Schuurman, Yves; Venderbosch, Robbie; Jordan, Edgar; Wellach, Stephan; Gutierrez, Ruben Miravalles, Fuel (2017), 192, 60-70.

Catalytic hydrotreatment of fast pyrolysis liquids in batch and continuous set-ups using a bimetallic Ni-Cu catalyst with a high metal content, Yin, Wang; Kloekhorst, Arjan; Venderbosch, Robertus H.; Bykova, Maria V.; Khromova, Sofia A.; Yakovlev, Vadim A.; Heeres, Hero J., Catalysis Science & Technology (2016), 6(15), 5899-5915.

Ni-Based Catalysts for the Hydrotreatment of Fast Pyrolysis Oil, Ardiyanti, A. R.; Bykova, M. V.; Khromova, S. A.; Yin, W.; Venderbosch, R. H.; Yakovlev, V. A.; Heeres, H. J., Energy & Fuels (2016), 30(3), 1544-1554.

A Critical View on Catalytic Pyrolysis of Biomass, Venderbosch, R. H., ChemSusChem (2015), 8(8), 1306-1316.

Phase equilibrium data of hydrogen in pyrolysis oil and hydrogenated pyrolysis oil at elevated pressures, Hrcic, Masa Knez; Venderbosch, Robbie H.; Skerget, Mojca; Ilic, Ljiljana; Knez, Zeljko, Journal of Supercritical Fluids (2013), 80, 86-89.

Biomass to diesel through pyrolysis: an update, Robbie Venderbosch (BTG), Pyne Newsletter 33, June 2013;

Pyrolysis oil stabilization by catalytic hydrotreatment, Venderbosch, R. H.; Heeres, H. J., edited Aurelio dos Santos Bernardes, Marco, Biofuel's Engineering Process Technology (2011), 385-410.

Catalytic hydrotreatment of fast pyrolysis oil using bimetallic Ni-Cu catalysts on various supports, Ardiyanti, A. R.; Khromova, S. A.; Venderbosch, R. H.; Yakovlev, V. A.; Melian-Cabrera, I. V.; Heeres, H. J., Applied Catalysis, A: General (2012), 449, 121-130.

Catalytic hydrotreatment of fast-pyrolysis oil using non-sulfided bimetallic Ni-Cu catalysts on a γ -Al₂O₃ support, Ardiyanti, A. R.; Khromova, S. A.; Venderbosch, R. H.; Yakovlev, V. A.; Heeres, H. J., Applied Catalysis, B: Environmental (2012), 117-118, 105-117.

Stabilization of biomass-derived pyrolysis oils, R.H. Venderbosch, A.R. Ardiyanti, J. Wildschut, A. Oasmaa and H.J. Heeres, *J Chem Technol Biotechnol* 2010; 85: 674–686

Catalytic Hydrotreatment of Fast Pyrolysis Oil: Model Studies on Reaction Pathways for the carbohydrate Fraction, J. Wildschut, J. Arentz, C.B. Rasrendra, R.H. Venderbosch, H.J. Heeres, *Environmental Progress & Sustainable Energy*, 2009

Hydrotreatment of fast pyrolysis oil using heterogeneous noble-metal catalysts, J Wildschut., FH Mahfud, RH Venderbosch, HJ Heeres, 2009, *Industrial and Engineering Chemistry Research*, 48(23), 2009, Pages 10324-10334

Insights in the hydrotreatment of fast pyrolysis oil using a ruthenium on carbon catalyst, Wildschut J., Iqbal M.H., Melián Cabrera I.V., Venderbosch R.H., Heeres H.J., 2010, *Energy Environ. Sci.*, DOI:10.1039/b923170f

Pyrolysis oil upgrading by high pressure thermal treatment, De Miguel Mercader F., Hogendoorn J.A., Venderbosch R.H., Kersten S.R.A., Groeneveld M.J., 2010, *Fuel*, 89(10), 2829-2837.

Stabilisation of biomass derived pyrolysis oils, RH Venderbosch, AR Ardiyanti, J Wildschut, A Oasmaa, HJ Heeres, 2010, *J. Chem. Techn. Biotechn.*, 85, 674-686.

Process-product studies on pyrolysis oil upgrading by hydrotreatment with Ru/C catalysts, AR Ardiyanti, RH Venderbosch, HJ Heeres, *Proceedings of the 2009 AIChE Spring National Meeting*, Tampa, 2009

Gasification

[Back to top](#)

Entrained flow gasification of straw- and wood- derived pyrolysis oil in a pressurized oxygen blown gasifier. E.J. Leijenhurst, D. Assink, L. van de Beld, F. Weiland, H. Wiinikka, P. Carlsson, O.G.W. Öhrman. 2015 *Biomass and Bioenergy*.;79:166-76.

Staged Biomass Gasification by Autothermal Catalytic Reforming of Fast Pyrolysis Vapors. E.J. Leijenhurst, W. Wolters, L. van de Beld, W. Prins. 2015 *Energ Fuel*.;29(11):7395-407.

Autothermal catalytic reforming of pine wood derived fast pyrolysis-oil in a 1.5kg/h pilot installation: Aspects of adiabatic operation, E.J. Leijenhurst, W. Wolters, L. van de Beld, W. Prins. 2013, *Fuel Process Technol.*;115:164-73.

Autothermal Catalytic Reforming of Pine-Wood-Derived Fast Pyrolysis Oil in a 1.5 kg/h Pilot Installation: Performance of Monolithic Catalysts. E.J. Leijenhurst, W. Wolters, L. van de Beld, W. Prins. 2014 *Energ Fuel*.;28(8):5212-21.

Pressurized entrained flow gasification of pyrolysis oil, Evert Leijenhurst, Olov Öhrman, *Pyne Newsletter* 32, December 2012;

Autothermal catalytic steam reforming of pyrolysis oil, Evert Leijenhurst, *Pyne Newsletter* 31, July 2012;

Staged gasification: clean fuel through innovative coupling of existing thermochemical conversion systems, E. Leijenhurst, L. van de Beld, , 17th European biomass conference and exhibition, 29 June – 3 July, 2009, pp. 847-854.

Ash characteristics of perennial energy crops and their influence on thermal processing, M Coulson, J Dahl, E Gansekoele, AV Bridgwater, I Obernberger, L van de Beld, 2nd World Conference on Biomass for Energy, Industry and Climate Protection, 10-14 May 2004, Rome, Italy

Entrained flow gasification of bio-oil for synthesis gas, R.H. Venderbosch, L. van de Beld, W. Prins, European Bio-energy conference, Amsterdam, June 17-21, 2002

Preliminary techno-economic analysis of large-scale synthesis gas manufacturing from imported biomass, Pyrolysis and gasification of Biomass and Waste, HP Calis, JP Haan, H Boerrigter, A Van der Drift, G Peppink, R Van den Broek, A Faaij, RH Venderbosch, 2002, Strasbourg, France, 403-418

Supercritical Water

[Back to top](#)

Reforming of methanol and glycerol in supercritical water, J.G. van Bennekoma, R.H. Venderbosch, D. Assink, H.J. Heeres, J. of Supercritical Fluids 58 (2011) 99– 113

Supermethanol: reforming of crude glycerine in supercritical water to produce methanol for re-use in biodiesel plants, J.G van Bennekoma, J. Vos, R.H. Venderbosch, M.A. Paris Torres, V.A. Kirilov, H.J. Heeres, Z. Knez, M. Bork, J.M.L. Penninger, 17th European biomass conference and exhibition - Hamburg, 29 June – 3 July, 2009

Biomass gasification in near- and super-critical water: status and prospects, Matsumura, Minowa, Potic, Kersten, Prins, Van Swaaij, Van de Beld, Elliott, Neuenschwander, Kruse, Antal Jr., (2005) Biomass and Bioenergy, 29 (4). pp. 269-292.

Gasification of biomass in supercritical water, B. Potic, L.van de Beld, D. Assink, W. Prins, W.P.M. van Swaaij, Amsterdam conference, 2002

SWS process for production of hydrogen integrated with generation of clean energy, J.M.L. Penninger, B.M. Wagenaar, D. Assink, L. van de Beld, 1st European Hydrogen Conference, Grenoble France, September 2003.

Biomass and waste conversion in supercritical water for the production of renewable hydrogen, L. van de Beld, B.M. Wagenaar, D. Assink, B. Potic, S. Kersten, W. Prins, W.P.M. van Swaaij, J.M.L. Penninger, 1st European Hydrogen Conference, Grenoble France, September 2003.

Exploring new production methods of hydrogen/natural gas blends for mixing into the natural gas network of the Netherlands, L. van de Beld, I. Bouwmans, P.A.M. Claassen, K. Hemmes, H. de Wit, N. Woudstra, Th. Woudstra, J.L. Zachariah, ECOS 2003, Denmark.

Production of Biofuels via Hydrothermal Conversion, in: *Handbook of Biofuels Production: Process and Technologies*, SRA Kersten, D Knežević, RH Venderbosch, 2011, Woodhead Publishing Limited, ISBN978-1-84569-510-1

Chemicals & Materials

[back to top](#)

Catalytic Hydrotreatment of the Pyrolytic Sugar and Pyrolytic Lignin Fractions of Fast Pyrolysis Liquids Using Nickel Based Catalysts, Yin, W.; Bykova, M.; Venderbosch, R.; Yakovlev, V.; Heeres, H. J., Energies 2020, 13, 285.

Thermochemical fractionation of ligno-cellulosic biomass, H. Heeres, E Leijenhorst, R. Ongena, L. van de Beld, proceedings 27th European Biomass Conference & Exhibition, Lisbon, 2019, 1894-1898.

Valorization of Pyrolysis Liquids: Ozonation of the Pyrolytic Lignin Fraction and Model Components, Figueirêdo, M. B.; Deuss, P. J.; Venderbosch, R. H.; Heeres, H. J., ACS Sustainable Chemistry & Engineering 2019, 7 (5), 4755-4765.

Hydrotreatment of pyrolytic lignins to aromatics and phenolics using heterogeneous catalysts, Figueirêdo M. B., Jotic Z., Deuss P. J., Venderbosch R. H., Heeres H. J., Fuel Processing Technology, 2019, 18915, pp. 28-38

Efficient Depolymerization of Lignin to Biobased Chemicals Using a Two-Step Approach Involving Ozonation in a Continuous Flow Microreactor Followed by Catalytic Hydrotreatment, Figueirêdo, M. B.; Keij, F. W.; Hommes, A.; Deuss, P. J.; Venderbosch, R. H.; Yue, J.; Heeres, H. J., ACS Sustainable Chemistry & Engineering 2019, 7 (22), 18384-18394;

“Biotumen”: Roofing membranes from pyrolysis oil, Hans Heeres, Pyne Newsletter 32, December 2012;

Recovery of acetic acid from an aqueous pyrolysis oil phase by reactive extraction using tri-n-octylamine, C.B. Rasrendra, B. Girisuta, H.H. van de Bovenkamp, J.G.M. Winkelman, E.J. Leijenhorst, R.H. Venderbosch, M. Windt, D. Meier, H.J. Heeres, Chemical Engineering Journal 176–177 (2011) 244–252

Acetic Acid Recovery from Fast Pyrolysis Oil. An Exploratory Study on Liquid-Liquid Reactive Extraction using Aliphatic Tertiary Amines, FH Mahfud, F van Geel, RH Venderbosch, HJ Heeres, 2008, Separation Science and Technology, 43 (11-12), p. 3056-3074

Furfural Hydrogenation to Furfuryl Alcohol over Bimetallic Ni-Cu Sol-Gel Catalyst: A Model Reaction for Conversion of Oxygenates in Pyrolysis Liquids, Khromova, S. A.; Bykova, M. V.; Bulavchenko, O. A.; Ermakov, D. Yu.; Saraev, A. A.; Kaichev, V. V.; Venderbosch, R. H.; Yakovlev, V. A., Topics in Catalysis (2016), 59(15-16), 1413-1423.

One-Step Synthesis of C6 Sugar Alcohols from Levoglucosan and Disaccharides Using a Ru/CMK-3 Catalyst, Yin, Wang; Tang, Zhenchen; Venderbosch, Robertus Hendrikus; Zhang, Zheng; Cannilla, Catia; Bonura, Giuseppe; Frusteri, Francesco; Heeres, Hero Jan, ACS Catalysis (2016), 6(7), 4411-4422.

Catalytic upgrading of sugar fractions from pyrolysis oils in supercritical mono-alcohols over Cu doped porous metal oxide, Yin, Wang; Venderbosch, Robertus Hendrikus; Bottari, Giovanni; Krawczyk, Krzysztof K.; Barta, Katalin; Heeres, Hero Jan, Applied Catalysis, B: Environmental (2015), 166-167, 56-65.

Electrochemistry

[back to top](#)

EC2Fuels: Electro-catalytic upgrading of pyrolysis liquid, Venderbosch R.H., 2019, Pyne Newsletter, IEA Task 34: Direct Thermochemical Liquefaction.