

FEEDSTOCKS & BIOREFINING

Each month we review the latest news and select key announcements and commentary from across the feedstock and biorefining sector.

April 2022



Your Partners for Business Insight and Market Intelligence

Providing clients with a strategic view of feedstock, technology, policy and marketing opportunity across the bioeconomy.

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Foreword

Welcome readers, to this month's Feedstocks & Biorefining News Review.

According to the IUCN, palm oil accounts for 35% of global vegetable oil, using just 10% of the land allocated to all oil crops. Further, nine times more oil per unit area can be produced via oil palm, in comparison to other oil crops. This, its associated relative low cost and wide range of applications – including in foods like cake, chocolate, and margarine, as well as cosmetics, shampoo, and cleaning products, and as a feedstock for biodiesel, has led to an increase in demand for palm oil.

According to Our World in Data, oil palm crop production increased almost four times over the 20-year period from 1998 to 2018, from 18.2 million tonnes to 71.5 million tonnes. However, with the pandemic, and rising awareness regarding unsustainable palm oil production via deforestation, causing a decline in biodiversity and native wildlife populations, and methane emissions from palm oil refinery wastewater, global production has somewhat stabilised in recent years.

Malaysia is currently the second largest producer and exporter of palm oil in the world, after Indonesia. In mid-March 2022, Malaysian palm oil futures were down almost 10% in a single day. Crude Palm Oil Futures (FCPO), traded on Bursa Malaysia Derivatives, provides a global price benchmark. In particular, contract FCPOc3 had dropped approximately £1124 per tonne, or 7.56%, after the contract had gained around 20% in the prior three weeks as speculators looked to exploit recent positions, boosted by the earlier market gains.

Various wastes and residual materials are formed in the palm oil industry, including empty fruit bunches, plant trunks, fibres, leaves, and palm kernel shells. Further, effluents from palm oil extraction contain high levels of organic and suspended matter, and oils and grease. Such wastes are potential ingredients for energy production, compost, fertiliser, and mulch, as well as biochemicals like ethanol and certain waxes. The Roundtable on Sustainable Biomaterials (RSB) Board has recently approved interim changes to two RSB Standards for palm-based agricultural processing residues. The changes relate to the fact that these agricultural residues did not previously have sustainability requirements placed on them, like non-agricultural palm industry processing residues have.

Read on for the latest news.

Policy

RSB Board approved modifications of RSB Standards for palm-based agricultural processing residues

RSB Board has approved the interim modification of two RSB Standards with updated sustainability requirements for palm-based agricultural processing residues. As a result, the RSB Global Standard for Advanced Fuels (RSB-STD-01-010) and RSB EU RED Standard for Advanced Fuels (RSB-STD-11-001-01-010) have been updated.

The sustainability requirements for palm-based agricultural processing residues were discussed at 2021's Assembly of Delegates, where concerns were raised that palm-based agricultural processing residues do not currently have sustainability requirements. This meant that a high-deforestation-risk feedstock could enter RSB supply chains without mitigation measures in place to ensure that they come from sustainable sources.

In order to align with RSB's current approach for palm industry processing residues – which are required to be certified by RSB, RSPO or equivalent, back to plantation – equivalent requirements for palm-based agricultural processing residues are now required.

As per the RSB Procedure for Development and Modification of RSB Standards, RSB Procedures and RSB Guidance (RSB-PRO-15-001), RSB Members may object to interim modifications within two weeks (fourteen days) from the publication date. In absence of objection, interim modifications will be considered approved.

Click [here](#) for more information.

Markets

Drax stops sourcing biomass from Russia



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Drax has stopped sourcing biomass from Russia in response to the invasion of Ukraine. The company said it has ceased the supply of a “very small percentage” of Russian biomass used at its power station in Yorkshire and is working with its suppliers and customers to identify any further links to Russia.

Drax also announced it is donating £280,000 to the Disasters Emergency Committee Ukraine Humanitarian Appeal to support relief efforts. The sum includes £30,000 of employee match funding from Drax's employees based in the UK, US and Canada.

Click [here](#) for more information.

Eni and the Republic of Benin signs an agreement for jointly initiatives in the agro-industrial sector

Eni and the Minister of Agriculture, Livestock and Fisheries of the Republic of Benin have signed a cooperation agreement to develop jointly initiatives on the agro-industrial chain, for biorefining use. Under the terms of the agreement, the parts will evaluate potential

opportunities in the country in the field of agriculture and vegetable raw material to develop oil crops for Eni's biorefining system.

The cooperation agreement focuses on the low ILUC (Indirect Land Use Change) crops identified in areas subject to natural and anthropic degradation, thus valorising marginal lands while not competing with the food chain.

The agreement will allow Eni to contribute to the development of new industrial models in the country, ensuring the sustainability along the whole agro-feedstock supply chain. It will play a key role in the energy transition for both Eni and the Republic of Benin, which is taking the lead on it in the region and is already a net negative CO₂ issuer. Also, it will benefit the employment market and the economic sector, capitalising on the competitiveness of a local industry with a solid agricultural vocation.

The agreement confirms a new area of activity for Eni in the country and follows the 6 agreements signed in recent months to support the decarbonisation process and promote circular economy initiatives in the African countries, by leveraging the role that agro-feedstock can play in Eni's path to achieve carbon neutrality by 2050.

Click [here](#) for more information.

Palm oil prices start to fall back



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Malaysian palm oil futures plunged as much as 9.8% on March 14th, 2022, as rival Dalian oils and crude futures dropped, and investors booked profits after the prior week's sharp gains.

The benchmark palm oil contract FCPOc3 for May delivery on the Bursa Malaysia Derivatives Exchange had dropped by 507 ringgit, or 7.56%, to 6,200 ringgit (£1124) a tonne by the midday break, extending losses to a third session. The contract had gained about 20% in the last three weeks.

Argentina has halted registration of export sales of soy oil and meal, the South American country's government said on Sunday, a move that stops sales and exports of the 2021/22 crop from the world's top exporter of processed soy products.

This is slightly bearish as traders anticipate the South American nation to raise export taxes on soy oil and meal from the current 31%, which will lower local prices.

Click [here](#) for more information.

BASF and Henkel focus on renewable raw materials in Henkel's consumer goods products

BASF and Henkel have jointly committed to replacing fossil carbon feedstock with renewable feedstock for most products in Henkel's European Laundry & Home Care and Beauty Care businesses over the next four years following a successful pilot with Henkel's cleaning and detergent brand Love Nature in 2021.

Through the cooperation, the fossil feedstock for around 110,000 tons of ingredients per year will be substituted with renewable feedstock using BASF's certified biomass balance approach. As a result, Henkel's core brands like Persil, Pril, Fa and Schauma will come with a reduced carbon footprint, avoiding around 200,000 tons of CO₂ emissions in total.

The replacement of fossil feedstock is possible through BASF's biomass balance approach: renewable resources are used in the very first steps of chemical production. The bio-based feedstock amount is then attributed to specific products by means of the certified method.

BASF has established a closed chain of custody from the renewable feedstock it uses through to the final product. TÜV Nord, an independent certification body, supports the practical implementation and confirms according to the REDCert2 certification scheme that BASF replaces the required quantities of fossil resources for the biomass balanced product with renewable feedstock.

Click [here](#) for more information.

Research & Development

Cemvita launches the Gold Hydrogen Program for subsurface biomanufacturing of hydrogen



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The Gold Hydrogen Program, a coalition of organisations seeking to support the scale-up of this clean energy resource, announced its launch — and the debut of a pilot microbial Gold Hydrogen Process — during the 2nd American Hydrogen Forum.

A joint industry partnership to commercialise clean, gold hydrogen, the program's founding members include Cemvita Factory (innovator in low-carbon microbial solutions for energy and mining resource extraction, production, and renewal), and Chart Industries, Inc. (a leader in clean energy solutions). Other collaborators include EXP and The Center for Houston's Future.

Found naturally deep in the Earth, "gold hydrogen" is an unparalleled resource that until now, has been cost-prohibitive to extract and not commercially viable. However, this could change with new subsurface biomanufacturing techniques, spearheaded by Cemvita, that hold the promise for efficient and clean extraction.

With the potential to revitalise and remediate thousands of depleted, abandoned oil and gas reservoirs around the country, the extraction techniques meld existing infrastructure with cutting-edge microbiology to scale clean energy solutions quickly while creating new revenue streams for heavy industry companies.

Through the Gold Hydrogen Program, member companies collaborate to generate gold hydrogen cleanly, efficiently, and at scale to meet rising global demand. Program members receive early access to IP at preferential rates, and participation in the group is capped at ten members.

Click [here](#) for more information.

Machine learning-informed and synthetic biology-enabled semi-continuous algal cultivation



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Algal biofuel is regarded as one of the ultimate solutions for renewable energy, but its commercialisation is hindered by growth limitations caused by mutual shading and high harvest costs. This article overcomes these challenges by advancing machine learning to inform the design of a semi-continuous algal cultivation (SAC) to sustain optimal cell growth and minimise mutual shading.

An aggregation-based sedimentation (ABS) strategy is then designed to achieve low-cost biomass harvesting and economical SAC. The ABS is achieved by engineering a fast-growing strain, *Synechococcus elongatus* UTEX 2973, to produce limonene, which increases cyanobacterial cell surface hydrophobicity and enables efficient cell aggregation and sedimentation.

SAC unleashes cyanobacterial growth potential with 0.1 g/L/hour biomass productivity and 0.2 mg/L/hour limonene productivity over a sustained period in photobioreactors. Scaling-up the SAC with an outdoor pond system achieves a biomass yield of 43.3 g/m²/day, bringing the minimum biomass selling price down to approximately £214 per ton.

Click [here](#) for more information.

Developmental lignin composition changes driven by both monolignol supply and laccase specificity

The factors controlling lignin composition remain unclear. Catechyl (C)-lignin is a homopolymer of caffeyl alcohol with unique properties as a biomaterial and precursor of industrial chemicals. The lignin synthesised in the seed coat of *Cleome hassleriana* switches from guaiacyl (G)- to C-lignin at around 12 to 14 days after pollination (DAP), associated with a rerouting of the monolignol pathway.

Lack of synthesis of caffeyl alcohol limits C-lignin formation before around 12 DAP, but coniferyl alcohol is still synthesized and highly accumulated after 14 DAP. This article proposes a model in which, during C-lignin biosynthesis, caffeyl alcohol noncompetitively inhibits oxidation of coniferyl alcohol by cell

wall laccases, a process that might limit movement of coniferyl alcohol to the apoplast.

Developmental changes in both substrate availability and laccase specificity together account for the metabolic fates of G- and C-monomignols in the Cleome seed coat.

Click [here](#) for more information.

Yield10 Bioscience announces Camelina developments for PHA bioplastic production



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Yield10 Bioscience, an agricultural bioscience company, has announced recent advances in the development of Camelina as a platform to produce PHA bioplastic directly in the seed. Field work completed during 2021 supports the Company's decision to begin seed scale up of prototype PHA spring Camelina lines at acre-scale in 2022.

They are also developing PHA winter Camelina lines and advancing research into increasing the level and type of PHA production possible in its Camelina plant varieties.

Yield10 plans to breed an optimized PHA trait into the elite herbicide and disease resistant varieties of Camelina currently advancing in its pipeline with the expectation to process PHA

Camelina to achieve the integrated economics of simultaneously producing three seed products: PHA bioplastic, feedstock oil and protein animal feed. Seed based PHA bioplastic would represent a major new market for farmers.

Click [here](#) for more information.

Wood & Crop

UK Pellet Council and FSC remove recognition for Russian and Belarus pellets

Due to the escalating situation in Ukraine, the UK Pellet Council and the Forest Stewardship Council have decided to no longer recognise wood products from Russia and Belarus. This is a move supported by the REA industry association which fully supports these decisions. A summary of the REA statement is given below:

The REA welcomes the UKPC and FSC decisions to no longer recognise wood products coming from Russia and Belarus, stopping their import for use in bioenergy systems.

The decision is expected to place pressure on biomass feedstock availability in the immediate term, especially for biomass heating systems, with total European production expected to decrease by 12-15%.

The REA will work closely with the biomass heat industry will look to ensure that supply chains are quickly diversified over the summer, in order to reinforce supply for next winter when heat demand will increase again.

Click [here](#) for more information.

The viability of South African sugarcane as feedstock for sustainable aviation fuel production



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Demand for sustainable aviation fuel (SAF) that offers not only a minimum of 50% reduction in greenhouse gas (GHG) emissions compared to conventional jet fuel, but also credible environmental and social sustainability certification, is growing globally — driven by new policy mandates, passenger demand, and industry targets.

Sugarcane — a crop grown in significant quantities in South Africa — provides a wholly viable feedstock for the production of SAF. As such, the sugarcane sector in SA should strongly consider SAF as a diversification option. However, irrigated sugarcane in SA is unfortunately still a GHG-intensive crop because of the coal-based energy mix it relies on.

The diversification of South Africa's energy mix in favour of renewables has the potential to dramatically strengthen the competitive advantage of local irrigated feedstock — including sugarcane — in the global SAF marketplace.

The RSB Standard sets out social and environmental sustainability principles for biofuel production and has been used as a framework to assess the potential

sustainability of SAF produced from South African sugarcane. RSB supports government and industry to transition to a sustainable bioeconomy by providing expertise and technical advice on best practice for sustainability.

Click [here](#) for more information.

Other Feedstocks

Honeywell introduces new technology to produce key feedstock for plastics

Honeywell has announced that it has introduced a new solution for producing renewable naphtha for petrochemical production using the commercially proven Honeywell UOP Ecofining™ technology. The new pathway can produce high yield of naphtha from sustainable feedstocks like used cooking oil and animal fats.

Naphtha is a valuable petrochemical feedstock used in the production of plastics, specifically olefins that are building blocks for other chemicals and aromatics that are used to produce polyester and other packaging materials. Naphtha is traditionally derived from crude oil and natural gas condensates but can now be produced from renewable feedstocks.

Renewable naphtha from sustainable feeds such as used cooking oil has a 50%-80% lower greenhouse gas footprint compared to petroleum feeds, depending on the feedstock.

The same Ecofining technology can be adapted to produce high yields of renewable naphtha as its predominant product, as opposed to Honeywell Green Diesel and Honeywell Green Jet fuel, reflecting the

versatility of the Ecofining design and ability to produce a range of products based on market needs. UOP currently has licensed 23 Ecofining units in eleven countries around the world, processing 12 different types of renewable feedstocks.

Click [here](#) for more information.

Biorefinery

Port of Rotterdam Authority raising land level for 'green' companies

At Maasvlakte 2, 55ha of land is being raised for companies that make renewable fuels and chemical products. Marine engineering company Van Oord has started with the project. Finnish company UPM is making plans to establish its business here, and the Port Authority wants to make space available to other companies that make products from residual materials. Concentrating these types of companies brings about a cluster of companies that can use the same infrastructure, including pipelines.

In addition to its own equipment, Van Oord also deploys a Boskalis owned trailing suction hopper dredger. Van Oord is delivering a total of 5 million m³ of sand onto the southern part of Prinses Alexiahaven. In anticipation of specific plans for the area, this part of Maasvlakte 2 had not been raised yet. The new land will be raised to six metres above New Amsterdam Water Level (NAP). Van Oord expects the work will be completed in July.

Preparation of the site followed the Finnish company UPM's recent announcement that it is now only looking at Rotterdam as a location for establishing its new biorefinery in Rotterdam. Thus, it could be the first company of the new cluster for producing renewable

fuels and chemicals. The site of this cluster is expected to measure approximately 90ha in size. UPM's decision on the new plant is not expected to be made before the end of this year.

Click [here](#) for more information.

Techno-economic evaluation of a biorefinery to produce several platform chemicals from spruce



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In this study, a biorefinery concept is presented to produce valuable platform chemicals such as γ -valerolactone (GVL), 2-methyltetrahydrofuran (2-MTHF) and 5-hydroxymethylfurfural (5-HMF) from lignocellulosic biomass via aqueous phase processing.

Process simulation models are developed using Aspen Plus and a techno-economic assessment including cost estimation, energy integration, profitability study, sensitivity analysis and Monte Carlo simulation-based uncertainty analysis is carried out for evaluating the economic potential of the proposed process.

The total investment for a plant with an annual production capacity of 35 kt of GVL, 17 kt of 2-MTHF and 5 kt of 5-HMF, is estimated as £217

million. The minimum selling prices (MSPs) of GVL, 2-MTHF and 5-HMF are estimated to be 1.61 £/kg, 1.38 £/kg, and 1.63 £/kg, respectively. The profitability study revealed that the process generates an internal rate of return of 15.90%, making it viable and profitable.

The sensitivity analysis indicated that the annual operational costs and fixed capital investment have the biggest influence on the minimum selling price of the products. Furthermore, based on the uncertainty analysis, the probability of loss is estimated as 17%. According to the market potential assessment, the most promising application of these platform chemicals is as biofuels and solvents.

Click [here](#) for more information.

Events

10th European Algae Industry Summit Reykjavik, 27th-28th April 2022

Following the success of its 9 previous editions and to mark their 10th year anniversary, ACI is hosting the next edition of the European Algae Industry Summit on the 27th & 28th April 2022 in Reykjavik, Iceland.

The conference will once again bring together key players within the algae industry including leaders from food, feed, nutraceuticals, pharmaceuticals and cosmetics across the globe to gain a deeper understanding of recent industry developments and economically viable applications and benefit from excellent networking opportunities.

Click [here](#) for more information.

EUBCE Online, 9th – 12th May 2022

The 30th edition of the European Biomass Conference and Exhibition, EUBCE 2022 will be held between 9th May and 12th May 2022. EUBCE continues to bring together the biomass community to discuss the scientific advances and innovations in biomass and bioenergy with the aim of advancing research and market uptake.

Facing climate and environmental challenges, the European Commission has taken firm commitment these global challenges, to conserve and enhance the natural capital and develop a more sustainable economy and society. Biomass is part of the solution and of our low-carbon future.

Several biomass technologies are ready now to play an important role in the decarbonisation of the economy, as part of a circular economy, in the context of sustainable development. Biomass offers now several solutions in this energy transition, through a range of technologies to produce energy, sustainable fuels and biobased materials and chemicals.

Click [here](#) for more information.

Feedstocks Prices

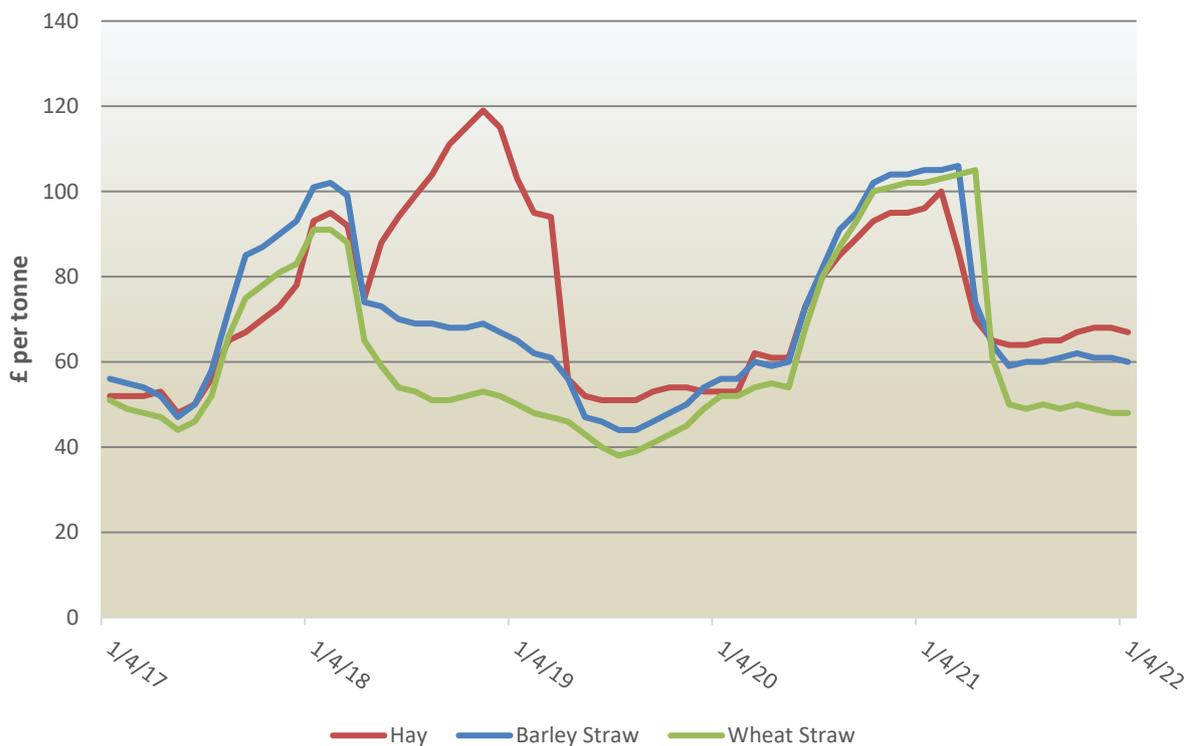
UK spot prices of bagged wood pellets, delivered. Grain and oilseed prices are across all main regions of the UK.

	Wood Pellets £/tonne, 5% VAT	Milling wheat £/tonne, ex- farm	Feed wheat £/tonne, ex- farm	Feed barley £/tonne, ex- farm	Oilseed rape £/tonne, ex- farm
High	405.13	335.00	326.50	308.25	808.00
Low	360.00	240.00	285.00	283.00	580.00
Average	376.59	292.18	299.58	297.90	784.31

For wood pellets prices we consider UK pellet traders advertised selling prices.

For details on grains and oilseed prices, see [Farmers Weekly](#).

Monthly prices of ex-farm Hay and Straw in England and Wales. Prices shown are for 5 years up to April 2022.



Source: British Hay and Straw Merchants' Association, Defra

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NNFCC is a leading international consultancy with expertise on the conversion of biomass to bioenergy, biofuels and biobased products.

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