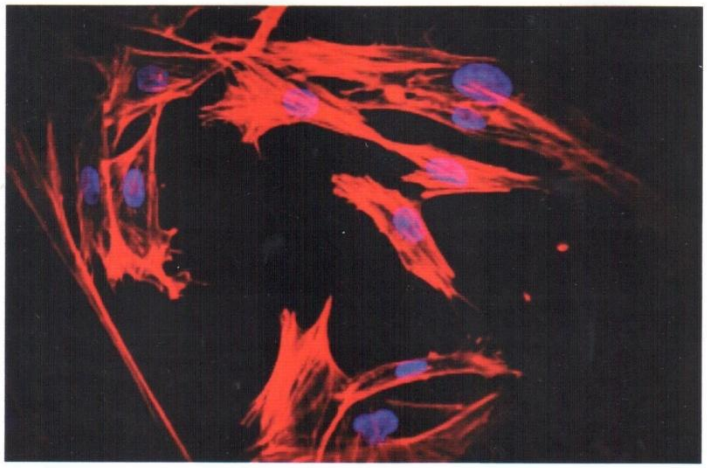
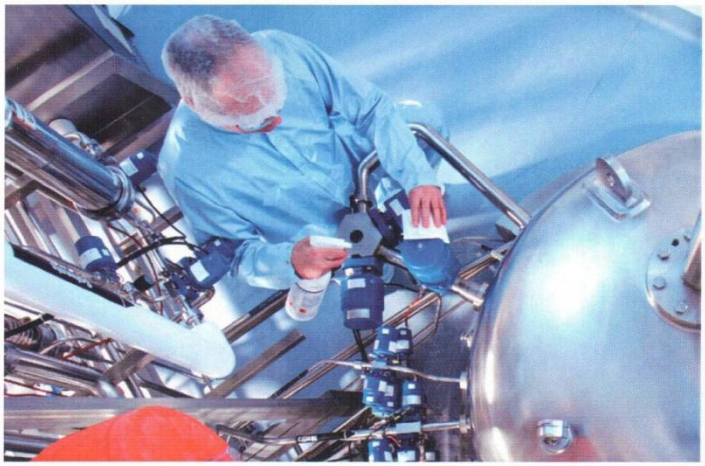
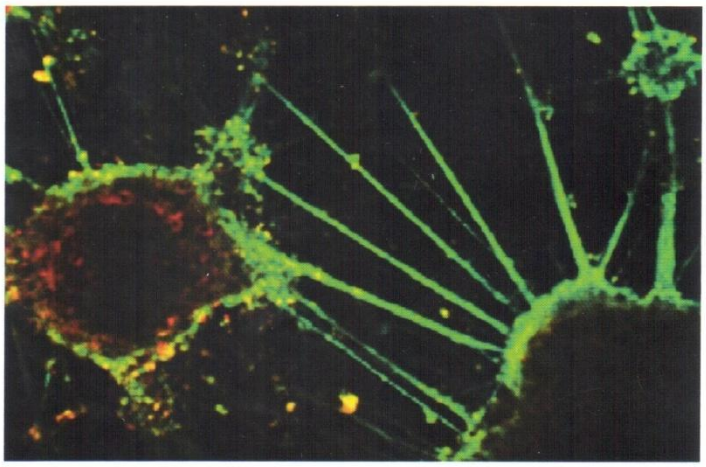
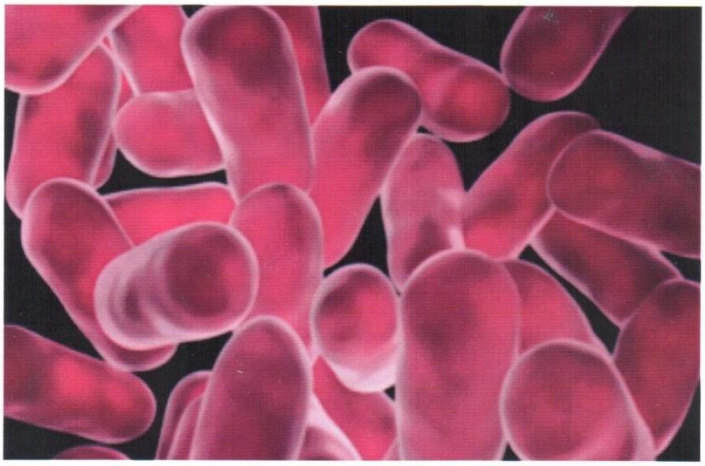












# Biochemical Engineering

## Special Interest Group Newsletter

Issue 107, November 2012

IChemE
Biochemical Engineering
Special Interest Group

# Biochemical Engineering

## Special Interest Group Newsletter

Issue 161. May 2026, Web: www.icheme.org/besig

Editor: Bill Thompson, email: bill.thompson@rotherwood.co.uk

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*Front Cover – Image courtesy of Fujifilm Diosynth Biotechnologies and others*

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# ANNOUNCEMENTS

## BESIG Bursaries

We have had a quite startling response to our recent call for bursary application with twelve applications being received in total. We are pleased to announce that four of these have been awarded a grant and we look forward to receiving their event reports: the next issue should be a bumper one! We still have funds available to award more bursaries so please send in your forms which are available on the BESIG website (www.icheme.org/besig).

## Forthcoming Events

23rd June 2026. 10:00 to 16:30. Novel Technologies in Bioprocessing.

Bioprocessing is an integral part of the manufacturing process of any products. With the introduction of novel applications and newly developing industries, as well as current world challenges such as climate change affecting all aspects of manufacturing, the bioprocessing tools, technologies and strategies currently available are becoming less effective, less suitable and unsustainable.

This one-day conference will explore the newest developments in bioprocessing tools, technologies and strategies with sustainability in mind, covering a range of different applications including biopharmaceuticals, foods, cosmetics, detergents and others. We welcome anyone with an interest in bioprocessing.

- IChemE member and ISPE member: £80.00
- IChemE student member: £20.00
- Non-member: £150.00
- Non-member student: £50.00
- Guest speakers and organisers: Free

See https://www.icheme.org/membership/communities/special-interest-groups/biochemical-engineering/events/ for all BESIG events.

# BUSINESS NEWS

Valneva is planning to shrink its headcount by up to 15% as the French vaccine developer continues to seek ways to cut costs. The company—whose vaccines include the Japanese encephalitis shot Ixiaro and the cholera vaccine Dukoral—saw first-quarter 2026 revenue drop to 30.9 million euros ($36.2 million) from 49.2 million euros ($57.6 million) for the same period a year ago. Source: Fierce Biotech 13/5/2026

* * *

Cell and Gene Therapy Catapult (CGT Catapult) will provide investment to Lir Therapeutics (Lir) from the Innovate UK Cross Catapult Investment Pilot, to accelerate the development of nAAVigator, its AI-driven AAV capsid design platform. The investment will support Lir in advancing the biological validation of the platform and building the evidence base needed to engage pharma partners and biotech investors. Source: BIA 12/5/2026

* * *

A further $4.5 billion commitment to manufacturing in Lebanon, Indiana, adds to the scale of Eli Lilly's ongoing effort to expand domestic pharmaceutical production capacity, the company has announced. This investment will expand the Lebanon Advanced Therapies facility and the Lebanon API site, which is now under construction.[1] One facility is intended for therapies targeting disease at the genetic level, while the other is designed to support high-volume production of established and emerging metabolic medicines. Source: PharmTech 7/6/2026

* * *

GSK is paying $55 million upfront to China's SiranBio for a phase 1-stage therapy aimed at metabolic and vascular disease. The drug, dubbed SA030, targets activin receptor-like kinase 7 (ALK7), a protein that is believed to have a role in the holy grail of obesity treatment: reducing abdominal fat while preserving lean mass. Source: Fierce Biotech 6/5/2026

* * *

Amgen said on Monday it was investing an additional $300 million in Puerto Rico to expand its U.S. manufacturing network. Amgen said the investment will expand its Juncos, Puerto Rico-based biologics manufacturing facility, which distributes medicines to more than 60 countries. Source: Reuters 4/5/2026

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UCB has struck a deal to acquire Candid Therapeutics for $2 billion upfront, hijacking a planned reverse merger with Rallybio to challenge Gilead for an emerging opportunity for T-cell engagers (TCEs). Candid represented a bet that TCEs could replicate the encouraging clinical data on CAR-Ts in autoimmune diseases, while supporting outpatient dosing with off-the-shelf medicines. Source: Fierce Biotech 4/5/2026

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BioOrbit, the pioneering in-space drug manufacturing company founded by Dr Katie King and Co-Founder Oncology Researcher Dr Leonor Teles, has raised £9.8m ($13.2m) in seed funding. BioOrbit's solution enables the usage of microgravity to develop crystals of biological drugs at scale that will transform how life-saving treatments reach patients worldwide. Source: BIA 30/4/2026

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AstraZeneca will resume a 300 million pound investment program in the U.K. seven months after freezing the plans in frustration at national government drug pricing negotiations. AstraZeneca's change of heart means a planned 200-million-pound construction project in the company's hometown of Cambridge, England, is now back on track. The six-story block of offices and conference rooms at Cambridge Biomedical Campus was first announced in 2024 and is due to be named after English scientist and Cambridge University alumna Rosalind Franklin, Ph.D. Source: Fierce Biotech 29/4/2026

* * *

GSK has finally called time on its pact with Mersana Therapeutics despite sinking $100 million to secure an option for an antibody-drug conjugate (ADC). That deal, signed back in 2022, centred on XMT-2056, an immunosynthen STING-agonist ADC aimed at treating a range of HER-2 cancers. The company also revealed that it has paused work on an mRNA vaccine for bird flu called GSK5536522. Fierce understands that this decision was made to prioritize GSK's mRNA vaccine for seasonal flu, dubbed GSK4382276, which is currently in phase 2 development. Source: Fierce Biotech 29/4/2026

* * *

Stratosvir, a pioneering UK-based biotechnology firm dedicated to developing innovative anticancer therapeutics, is thrilled to announce support from Cell and Gene Therapy Catapult (CGT Catapult), including investment from the Cross Catapult Investment Pilot. Stratosvir's platform, which is currently in preclinical development, is designed to avoid being injected directly into the tumour and deliver medicines intravenously, with the therapy travelling in the body to the tumour, where it stimulates the immune system to attack the cancer. Source: BIA 28/4/2026

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The £552 million raised by British biotechs in the first quarter of the year has been hailed as a "sign of recovery," although an anticipated resurgence of IPOs across the nation has yet to materialize. The combined amount raised for the first three months of the year marks an increase on the £466 million ($631 million) accrued in the fourth quarter of 2025, according to the BioIndustry Association (BIA). Source: Fierce Biotech 27/4/2026

* * *

GERMAN chemical giant Evonik is investing €80m (US$94m) to expand its biotechnology capabilities at its Fermas site in Slovakia. Located in Slovenská Ľupča, the site specialises in downstream processing, particularly biofermentation. The latest investment will expand fermentation technology to support the company's drug substances business. Source: The Chemical Engineer 22/4/2026

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AstraZeneca's chronic obstructive pulmonary disease (COPD) candidate has served up a third phase 3 win this year, offering further evidence the Big Pharma may have cracked the anti-IL-33 code. The latest late-phase study, dubbed Miranda, evaluated 300 mg tozorakimab or placebo dosed every two weeks for a year in 1,451 patients with COPD. The study demonstrated a statistically significant reduction in the annualized rate of moderate-to-severe COPD exacerbations in both former smokers and in the overall population. Source: Fierce Biotech 20/4/2026

* * *

After a recent streak of buyouts by some of Big Pharma's serial acquirers, Belgium's UCB is getting in on the action with a Friday acquisition potentially worth more than $1 billion. Building on its established foothold in epilepsy, UCB has agreed to purchase cell therapy biotech Neurona Therapeutics and its lead candidate NRTX-1001, currently being tested in phase I/II clinical trials for drug-resistant mesial temporal lobe epilepsy. Source: Fierce Biotech 17/4/2026

* * *

After its bet on a rare eye disease gene therapy ended in a phase 3 fail last year, Johnson & Johnson is now returning the asset to sender as MeiraGTx buys back full rights to botaretigene sparoparvovec (bota-vec) for just $25 million upfront. MeiraGTx said it will seek out a speedy filing in the U.S. and E.U., with a launch planned for 2027 should it gain approval. Source: Fierce Biotech 16/4/2026

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Fermtech, the biotech company pioneering fermentation technology to unlock more value from existing crops, has raised £2.5 million in seed funding to scale production of its Koji Cocoa™, a sustainable cocoa alternative made from cocoa shells. The product delivers 25%-33% cost savings in chocolate and baked goods and achieves up to 98% lower carbon emissions. Source: BIA 7/4/2026

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BioNTech is set to shut its manufacturing facility in Singapore by the end of February 2027, the company confirmed. The decision marks the latest in a series of capacity reductions as the German biotechnology firm grapples with a steep drop in Covid-19 vaccine revenue, including recently pausing one of its vaccine study's due to low patient enrolment. Source: Biopharm International 6/4/2026

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Scottish bio-based chemical manufacturer Celtic Renewables is collaborating on a three-month project with Aberdeen-based microbiology company NCIMB. Celtic converts waste and by-products like potatoes and residues from whisky distillation into bio-based chemicals. NCIMB will work with Celtic Renewables on an initial 12-week project to assess candidate microbial performance using a range of feedstocks identified by the company, supporting the scale-up of their process. Source: BIA 6/4/2026

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Biorecycling startup Epoch Biodesign announced that it has raised $12 million in a new funding round, aimed at accelerating the commercialisation of its recycled nylon technology. Founded in 2019, London-based Epoch uses AI, biochemistry, materials science, and process engineering to develop enzymes capable of breaking down materials such as PET, nylon, and polyester at low temperatures. The funding round brings Epoch Biodesign's total capital raised to more than $50 million. Source: BIA 26/3/2026

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Mestag Therapeutics today announced the closing of a $40 million financing supported by leading life science investors. The financing will support the Phase 1 STARLYS clinical study of MST-0312, a novel FAP-targeted bispecific antibody directed to lymphotoxin-β receptor (LTBR) to induce the formation of tertiary lymphoid structures (TLS) and high endothelial venules (HEV) within solid tumours. Source: BIA 26/3/2026

* * *

AZ entered the "off-the-shelf" cell therapy space a year ago when it acquired Belgium-based EsoBiotec and its lentiviral vector platform for $425 million upfront. On Wednesday, data from a Chinese phase 1 study of EsoBiotec's in vivo BCMA CAR-T candidate ESO-T01 in multiple myeloma demonstrated preliminary antimyeloma activity, with four of the five patients achieving objective responses, including three stringent complete remissions by day 60 although one patient developed grade 1 immune effector cell-associated neurotoxicity (ICANS) and died 19 days after receiving ESO-T01. Source: Fierce Biotech 27/3/2026

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In the UK, CropEnergies AG, Mannheim, Germany, welcomes the UK Government's decision to provide substantial financial support to CropEnergies' British subsidiary Ensus UK Ltd, Wilton, UK. The UK Government has agreed a funding package worth around GBP 100 million (ca. EUR 115 million) to keep the plant in a ready to operate standby mode, ensuring long term stability of the country's supply of biogenic $CO_2$, renewable ethanol for fuel applications and proteins. The plant had suspended production in September 2025 due to economic pressures. Source: Biofuels Digest 26/3/26

* * *

Clean Food Group (CFG) today announces the launch of CLEANOil™, its biotechnology-derived ingredient platform for the beauty industry. Developed using CFG's proprietary fermentation technology and circular feedstocks such as surplus bread, CLEANOil™ addresses multi-industry demand for high-performance ingredients with reduced environmental impact. The ingredient delivers the sensorial quality and functionality associated with premium oils - rich, silky, and naturally high in Omega 6 and 7 - while achieving a >95% reduction in greenhouse gas emissions compared to conventional agricultural oils. Source: Clean Food Group press release 25/3/2026

* * *

ScaleUp Bio Pte. Ltd. today announced that Fusionopolis Ventures Pte. Ltd., a subsidiary of Economic Development Innovations Singapore Pte. Ltd., will join ADM as a shareholder in ScaleUp Bio, supporting the company's next phase of growth as a precision fermentation contract development and manufacturing organisation (CDMO) in Asia. As Singapore's first and largest precision fermentation CDMO, ScaleUp Bio supports innovators in scaling from development through pilot and into commercial production. Source: PR Newswire 26/3/2026

* * *

Pfizer and Valneva have blamed "fewer than anticipated" Lyme disease cases for the failure of their phase 3 trial to hit its key goal. But the companies still plan to file the vaccine with regulators. The study's primary endpoint assessed the vaccine's efficacy in reducing the rate of Lyme 28 days after the fourth and final dose. While the study demonstrated efficacy of 73.2% at this point, the lower bound of the 95% confidence interval was only 15.8%—below the required 20% threshold. Source: Fierce Biotech 23/3/2026

* * *

AstraZeneca on Thursday unveiled plans to build a commercial cell therapy manufacturing base and an innovation centre dedicated to the modality in Shanghai. The move positions the British drugmaker as the first multinational pharmaceutical company to boast end-to-end cell therapy capabilities in China, spanning early-stage research to large-scale commercial production, AZ said in an announcement. Source: Fierce Pharma 19/3/2026

* * *

Bicycle Therapeutics is letting more air out of its operations, with plans to deflate its employee count by about 30% and shelve its lead anti-cancer drug conjugate. The reprioritization is meant to cut yearly operating costs by around 50%, Bicycle announced in its 2025 financial results on March 17. Regulators have told Bicycle that the

open-label phase 2/3 Duravelo-2 trial is no longer considered appropriate to support approval in advanced or metastatic urothelial cancer (mUC), the biotech said. Source: Fierce Biotech 17/3/2027

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Outpost Bio, a company decoding the hidden interactions that drive human biology, today announced a $3.5 million pre-seed funding round co-led by Merantix Capital and Seedcamp, with participation from OpenSeed VC, Defined and strategic family offices and angel investors. Source: Biosolutions 4/3/2026

* * *

Theolytics, a clinical-stage biotechnology company developing next-generation oncolytic immunotherapies, has been awarded, pending final negotiation, €8 million in non-dilutive grant funding from Horizon Europe 2025, the European Union's flagship research and innovation funding programme. The grant to Theolytics will advance the company's Phase 2 OCTOPOD-IV clinical trial evaluating THEO-260, its novel therapeutic candidate designed to address unmet needs in patients with advanced ovarian cancer. Source: Theolytics press release 4/3/2026

* * *

UCB has entered the red-hot T-cell engager (TCE) space by paying $80 million for the rights to a Chinese biotech's preclinical autoimmune candidate. At the centre of the deal is ATG-201, a CD19/CD3 bispecific TCE that Shanghai-based Antengene has been lining up to enter phase 1 trials on both its home turf of China as well as in Australia before the end of the month. Source: Fierce Biotech 4/3/2026

* * *

Sartorius is addressing the requirement for more rapid cell line development (CLD) with a new rational-design CHO host cell line. Developed through proteomic profiling and targeted genome editing, this engineered host has demonstrated the ability to increase productivity by up to three-fold and protein expression titres by two-fold compared to original wild-type CHO hosts. Source: Biopharm International 3/3/2026

* * *

Novo Nordisk announced a €432 million ($506 Million) investment to expand their tableting facility in Athlone, Ireland. The expansion is designed to provide essential manufacturing capacity for current and future GLP-1 treatments. The project underscores the industrial scale and infrastructure required to produce oral GLP-1s effectively for a global market. Source: PharmTech.com 2/3/2026

# *NEWS FROM MALAYSIA*

## Field Trip Report: Cultivating a Greener Future with ATOZ Carbon Cycle



On April 21, 2026, the BESIG Malaysia Chapter organised an insightful field trip to the ATOZ Carbon Cycle Agricultural Base in Selangor. This visit provided participants with a firsthand look at a pioneering "Negative Carbon" circular-economy model that integrates microalgae cultivation, organic waste management, and regenerative agriculture.

The session began with a series of technical presentations introducing ATOZ's core technologies. Participants were introduced to their sophisticated microalgae cultivation system, which captures carbon dioxide while producing nutrient-rich biomass. A key highlight was learning how the company processes this microalgae into regenerative soil conditioners, which help restore soil health and enhance crop yields. Additionally, the seminar covered the role of Black Soldier Fly (BSF) biotechnology in decomposing food waste, effectively turning organic refuse into high-protein larvae for animal feed and nutrient-dense frass for

fertiliser. The introductory session concluded with a briefing on the emerging market of carbon credits, illustrating how biological sequestration can be quantified into environmental assets.



During the site tour, participants visited the microalgae farm to observe the scale of production and the precision required for optimal growth. This was followed by a visit to the BSF facility, where the bioconversion process was demonstrated. The tour culminated at the agricultural plots, where participants observed various vegetables grown using regenerative soil derived from microalgae-treated water. Seeing the lush, healthy produce served as a powerful testament to the efficacy of closing the nutrient loop.

The field trip to ATOZ Carbon Cycle Agricultural Base highlighted the vital intersection of biochemistry and climate-smart agriculture. By witnessing these technologies in practice, participants gained a deeper understanding of how integrated biotechnological systems can drive carbon neutrality and food security in the industrial sector.

# LETTER FROM THE MID-WEST USA



*Lessons Learned from Large Scale Fermenter Design Part 1*

I've been fortunate during my career to have worked on many shapes and sizes of bioreactors and fermenters ranging from liters-scale cell and gene therapy production systems through to a half-million liter CSTR for citric acid fermentation and a fifty meters tall airlift fermenter for a novel mycelial food product.

Just recently I'm back again in the world of larger scale fermenter design and construction so thought I'd share some lessons learned and reminders that might be helpful to others.

*Sweating Over Heat Transfer*

Cooling loads for a fermenter need first to consider metabolic heat as cells grow and associated heat of agitation, which is likely to be the worst case for design for most microbial fermentations. Typical total heat removal rates of 20 to 30 W/L are typical in the absence of real data. However, don't neglect cooling requirements after sterilization especially if a media batch is sterilized in situ and needs to be cooled fairly quickly.

Somewhere between 5000 and 25000 L of total vessel volume, it is likely that a cooling jacket, alone, will not be sufficient to remove this amount of heat. Typically, you will have about 55-65% of bottom dished head area, and 75-85% of cylindrical shell area, available to specify for an external cooling jacket, depending on complexity of nozzles, instrument alcoves and so on. It's worthwhile to jacket the bottom head only if you have a top-mounted agitator system.

If this external area is inadequate, supplemental internal cooling will also be required, and you can consider the options of helical coils or vertical cooling baffles comprising a number of pipes, or a hollow baffle design.

Bear in mind that fed batch fermentations may start with the vessel only half filled, and so some of your heat transfer area may be above the starting liquid level and unavailable , even accounting for 'lift' as air sparging begins. Keep an eye on the volume changes over the duration of a fed batch fermentation to ensure adequate cooling during cell growth and metabolite production phases.

Don't forget to consider both lowest expected fermentation temperature, and highest cooling water inlet and outlet temperatures (think peak summer time), that won't upset your utilities design colleagues, and cooling water pressure drop. Establishing these parameters as soon as possible is essential to avoid over- or under-sizing your heat transfer set up, or driving you to need a process chilled water system rather than tower water. Jackets, coils and baffles may all need to be divided into multiple sections to achieve an acceptable pressure drop, typically 10 to 15 psi or 0.7 to 1.0 bar.

Table 1 below is taken from a Slovakian learned society paper[1] and provides a useful starting point for estimating overall heat transfer coefficients, and thus heat transfer areas, which I've found to be consistent with my experience and other published data. Typically these are appropriate for internal and external cooling applications. If possible, try to find real heat transfer data for your process.

*Keep Your Head(s)*

Once you have determined the need for any internal cooling provision, the overall dimensions of the fermenter can be confirmed. It can be surprising how much volume is displaced by an internal helical cooling coil, and once you have also allowed for baffles, agitator and impellers, and possibly a steady bearing, several hundred liters of volume can be 'lost'.

**Table 1.** The overall heat transfer coefficient across the wall in well-stirred pilot and industrial bioreactors[1]

| type of ferm. broth | $h_i$ (W/m$^2$K) | U (W/m$^2$K) | *Example* |
|---|---|---|---|
| low viscosity | 2000–3000 | 800–1100 | anaerobic water treatment |
| slightly non-Newtonian low viscosity | 1100–1500 | 600–800 | Bacitracin |
| low to medium viscosity non-Newtonian, with filamentous biomass | 600–1000 | 300–700 | salinomycin oxyteracyclin |
| viscous highly non-Newtonian | 100–300 | 100–200 | Xantane |

Working volume, both gassed and un-gassed, need to be corrected once the displacement caused by internal fixtures is factored in. These parameters should be very clearly specified so everyone is clear and working on the same basis. The working volume typically includes the bottom head and a proportion of the cylindrical shell height (typically 70 to 80%), depending on the amount of 'lift' during air sparging and propensity for foaming.

To confirm working volume accurately, you will need to specify the type and geometry of bottom and top heads. In my world ASME flanged and dished (F&D) type is most common, with ASME 2:1 semi-ellipsoidal not unknown. These two head types have comparatively shallow and deep profiles: for F&D heads volume (V) can be approximated from the internal diameter (D) using the formula $V = 0.0809\ D^3$ . For a 2:1 head, use the formula $V = 0.1309\ D^3$ . But don't mix these up as one is 40% more volume than the other, significant enough for a very large fermenter vessel to add a few inches to diameter or height. For more detailed calculations work with a vessel fabricator to confirm precise dimensions.

*Now Chill….*

I hope the content above is helpful, and may avoid some sleepless nights and rework during design development. Mass transfer is rightly prioritized in fermenter vessel and agitator design to achieve desired oxygen uptake and cell growth rates, but only by specifying adequate cooling capacity can those performance targets be achieved. Next time, I'll delve into the mysteries of cleaning in place for large scale, complex vessels and share some lessons learned around this facet of fermenter design.

References:

1. Van der Merwe, Minarik, Berovic and Herakovic, Acta Chim. Slov. 2010, 57, 150-156 (from which Table 1 is reproduced, with thanks to the authors)

*Phil Bowles is a biochemical engineering consultant with 40 years of industry experience, originally from the UK but currently based in Minneapolis, Minnesota. The views expressed by the author are solely his own. You can contact Phil via LinkedIn.*

# FOOD AND BIOPRODUCTS PROCESSING

Extracts from issue 157 (May 2026)

## Economic and environmental performances of bio-based chemicals produced with green hydrogen as a reagent in a sugarcane biorefinery

Author: S. Gamor, E.S.A. Dogbe, J.F. Görgens

Abstract

While sugarcane biorefineries are extensively studied, their integration with green hydrogen ($GH_2$) for high-value biochemical production remains unexplored. This study presents the first comprehensive technoeconomic and environmental assessment of sugarcane biorefineries supplied with external $GH_2$, evaluating the impacts of hydrogen demand, cost, and emission factors. Lignin obtained via Reductive Catalytic Fractionation (RCF) was converted into cyclohexanol, cyclohexanone, phenol, and phenolic oligomers, while the cellulose-rich fraction was pyrolyzed to levoglucosenone and subsequently converted into dihydrolevoglucosenone (Cyrene™) or 1,6-hexanediol (1,6-HDO). Isomalt was produced from A-molasses via enzymatic biotransformation. All pathways were integrated with a sugarcane mill to ensure energy self-sufficiency. Economic feasibility was assessed using minimum selling prices (MSPs) at a 20% internal rate of return and a $GH_2$ price of $8/kg. MSPs for 1,6-HDO ($4021/ton), phenol ($1286/ton), phenolic oligomers ($1391/ton), isomalt ($1180–1330/ton), and Cyrene™ ($927/ton) were competitive with market prices, whereas cyclohexanone ($2476/ton) and cyclohexanol ($2886/ton) exceeded them due to $GH_2$ and downstream processing costs. High-pressure reactors accounted for 25–77% of equipment costs, and $GH_2$ represented 3–63% of operating costs; sensitivity analysis indicates that reducing $GH_2$ prices to $2–3/kg would improve competitiveness. Life-cycle carbon emissions for all bioproducts (0.82–3.01 kg $CO_2$-eq/$kg_{product}$) were lower than fossil-based counterparts (3.11–4.15 kg $CO_2$-eq/$kg_{product}$). Lignin-derived products had higher emissions due to solvent use, while sugar-derived pathways benefited from water- or solvent-free processes. Hydrogen-intensive biorefineries were sensitive to hydrogen inputs, causing variability in emissions and costs. These results demonstrate that integrating green hydrogen enables economically viable sugarcane biorefineries with substantially reduced carbon footprints, even at current $GH_2$ prices.

## Monitoring of tepache fermentation by means of the dielectric permittivity at 2.45 GHz

Author: Edel-Serafin Hernandez-Gomez, Jose-Luis Olvera-Cervantes, David-Ernesto Troncoso-Romero, Elizabeta Hernandez-Dominguez

Abstract

Tepache has been a widely consumed fermented Mexican beverage since the pre-Hispanic era, and its consumption has been linked to benefits such as improved intestinal balance, protection against potentially pathogenic bacteria, and a reduction in the occurrence of gastrointestinal diseases. Commonly used methods for monitoring fermentation, such as hydrometers, use considerable sample volumes, and are destructive, as the case of liquid chromatography. In this work, the physicochemical characteristics of tepache (titratable acidity, pH, brix degree, alcohol by volume, glucose and moisture) are presented, as well as its dielectric properties at the frequency of 2.45 GHz by the cylindrical resonant cavity method on days 0, 1, 2, 3, 4 and 5 of fermentation. Titratable acidity, pH, brix degree, alcohol by volume, glucose and the imaginary part of the permittivity did not show significant daily changes. The real part of the permittivity decreased from 83.54 to 80.41 with increasing fermentation time. These small differences in the real part of permittivity were detected because of the high-quality factor of the cavity which was of 7252.9. The penetration depth indicated that the electromagnetic wave associated with the measurement of dielectric properties completely penetrates the tepache samples, evaluating their entirety. This parameter had a range from 8.99 to 9.62 mm. The information presented in this work can be used for the design and manufacture of microwave sensors that can monitor the tepache fermentation process nondestructively, in real time, and that also use smaller sample volumes than conventional methods.

# Unlocking efficiency: Investigating optimal co-digestion mixtures for enhanced biogas production in small-scale rural settings

Author: Cornelis Bumharter, Isabel Amez, Blanca Castells-Somoza, David Bolonio, María Jesús García Martínez, Marcelo F. Ortega

Biogas production is traditionally limited to large-scale industries due to economic and logistical limitations. This study evaluates the anaerobic co-digestion of swine manure, food waste and agricultural organic waste using both laboratory biochemical methane potential tests and pilot-scale low-cost digester ramp-up analysis. Optimization at laboratory scale identified an optimal mixture containing 100 g of fresh swine manure with 0.5 g (VS) of dried meadow grass, yielding a methane production of 135 ± 5 mL $CH_4$/g VS. When transferring to pilot scale, the system produced biogas at with a methane content of 67%, whilst maintaining stability under ambient winter climate characteristics, thus confirming the feasibility of scaling up low-cost digesters for rural applications. Key scale-up insights to be mentioned are the requirement for pH control and monitoring, buffering capacity additions, and design considerations to improve thermal insulation and process stability for multiple feedstock mixtures.

# DIARY

| Date | Event | Location |
|---|---|---|
| 25-26 May 2026 | International Conference on Chemical and Biochemical Engineering (ICCBE - 2026). See https://iserd.co/Conference/23014/ICCBE/ | Paris, France |
| 7-10 Jun 2026 | 29th ESACT Meeting 2026. See https://esact2026.com/ | Salzburg, Austria |
| 15-18 Jun 2026 | 2026 Synthetic Biology: Engineering, Evolution and Design. See https://synbioconference.org/2026 | Denver, USA |
| 28 Jun – 1 Jul 2026 | European Congress of Biotechnology. See https://www.efbiotechnology.org/sections/events | Antwerp, Belgium |
| 29 Jun – 1 Jul 2026 | Directing Biosynthesis VIII. See https://www.rsc.org/events/detail/81633/directing-biosynthesis-viii | Manchester, UK |
| 19-23 Jul 2026 | Biochemical and Molecular Engineering XXIV. See https://engconf.us/conferences/biotechnology/biochemical-and-molecular-engineering-xxiv/ | Puerto Rico |
| 23-27 Aug 2026 | ACS Fall 2026. See https://www.acs.org/meetings/acs-meetings/future-meetings.html | Chicago, USA |
| 15-17 Sep 2026 | Gene Editing and RNA Technologies. See https://www.aiche.org/sbe/conferences/gene-editing-and-rna-technologies-gear/2026 | Boston, USA |
| 22 Sep 2026 | Netherlands Biotechnology Congress. See https://nbc.kncv.nl/ | Utrecht, Netherlands |
| 22-24 Sep 2026 | 8th Commercialising Industrial Biotechnology. See https://www.aiche.org/sbe/conferences/commercializing-industrial-biotechnology/2026 | Chicago, USA |
| 24-26 Sep 2026 | 17th OGMBT Annual Meeting. See https://oegmbt.at/events/annual-meeting | Innsbruck, Austria |
| 12-15 Oct 2026 | Single Use Technologies VIII. See https://engconf.us/conferences/biotechnology/single-use-technologies-viii/ | Montreal, Canada |
| 18-22 Oct 2026 | Metabolic Engineering Summit. See https://mes2026.scimeeting.cn/ | Dalian, China |
| 25-30 Oct 2026 | Biological, Pharmaceutical and Cosmetic Complex Fluids IV. See https://engconf.us/conferences/biotechnology/biological-pharmaceutical-and-cosmetic-complex-fluids-iv/ | Calabria, Italy |
| 3-4 Nov 2026 | Microbiology Society Annual Meeting in Ireland 2026. See https://microbiologysociety.org/event/society-events-and-meetings/microbiology-society-annual-meeting-in-ireland-2026.html?_gl=1*mx7l0m*_up*MQ..*_ga*MTQzNzM0ODg2Mi4xNzc3OTA5Mzc2*_ga_KJR7LS80P1*czE3Nzc5MDkzNzUkbzEkZzEkdDE3Nzc5MDkzODYkajQ5JGwwJGgw | |
| 4-6 Nov 2026 | 8th Applied Synthetic Biology in Europe. See https://www.efbiotechnology.org/synthetic_biology | Manchester, UK |
| 8-12 Nov 2026 | AIChE Annual Meeting 2025. See https://www.aiche.org/conferences/aiche-annual-meeting/2026 | Minneapolis, USA |
| 10-12 Nov 2026 | European Summitt of Industrial Biotechnology. See https://www.esib.at/ | Graz, Austria |
| 29 Nov – 2 Dec 2026 | ESBES Symposium 2026. See https://esbes2026.org/ | Delft, Netherlands |
| 14-18 Feb 2027 | Microbial Engineering IV. See https://engconf.us/conferences/biotechnology/microbial-engineering-iv/ | Malta |
| 21-25 Mar 2027 | ACS Spring 2027. See https://www.acs.org/meetings/acs-meetings/future-meetings.html | New Orleans, USA |
| 1-7 May 2027 | Cell Culture Engineering XX. See https://engconf.us/conferences/biotechnology/cell-culture-engineering-xx/ | Quebec City, Canada |
| May 2027 | Bio-Char V. See https://engconf.us/conferences/biotechnology/ | Giardini Naxos, Sicily |
| 20-24 Jun 2027 | Metabolic Engineering 17. See https://www.aiche.org/imes/conferences/metabolic-engineering-conference/2027 | Toronto, Canada |
| 22-26 Aug 2027 | ACS Fall 2027. See https://www.acs.org/meetings/acs-meetings/future-meetings.html | San Diego, USA |
| 31 Oct -1 Nov 2027 | 2027 AIChE Annual Conference. See https://www.aiche.org/conferences/aiche-annual-meeting/2027 | San Diego, USA |

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Contributions to be submitted by the end of the month prior to publication