

# Bio-based Material Quarterly Newsletter

Q2 2023

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# Bio-based Materials Quarterly Newsletter



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## Headline

The Measures for the Administration of the Use and Reporting of Disposable Plastic Products by Business Operators in the Commercial Sector was jointly published by the MOFCOM and the NDRC on 16 May, 2023, which went into effect on 20 June, 2023. Non-degradable plastic bags and other disposable plastic items are not allowed and their use is strictly regulated.

Kingfa reported revenue growth slowdown, which was up merely by 0.53% in 2022 and 2.39% in Q1 2023. Its subsidiary Liaoning Kingfa set start construction works for the 50,000 t/a L-lactic acid project and the 10,000 t/a bio-based 1,4-butanediol (bio-BDO) project in early June.

On 27 May, Huaheng Biotech proposed to raise up to USD237.94 million (RMB1,688 million) of funds for the development of "the 50,000 t/a bio-based succinic acid (SA) and bio-based materials production base construction project" and the "50,000 t/a bio-based malic acid (MA) production construction project".

On 24 May, Sulzer signed an agreement to provide its licensed PLA technology for the production of polylactic acid (PLA) of Jindan New Biomaterials.

In Q2, there are updates on the polylactic acid (PLA)-related projects of Changchun Institute of Applied Chemistry (CIAC), Ma'anshan Tong-Jie-Liang Biomaterials, Shandong Guyu, and Guangdong Sisan.

Weiqi Biotech announced the start of constructing the 30,000 t/a polyhydroxyalkanoates (PHA) production base in Yichang City of Hubei Province on 3 June; the environmental impact assessment of the project was accepted on 16 May.

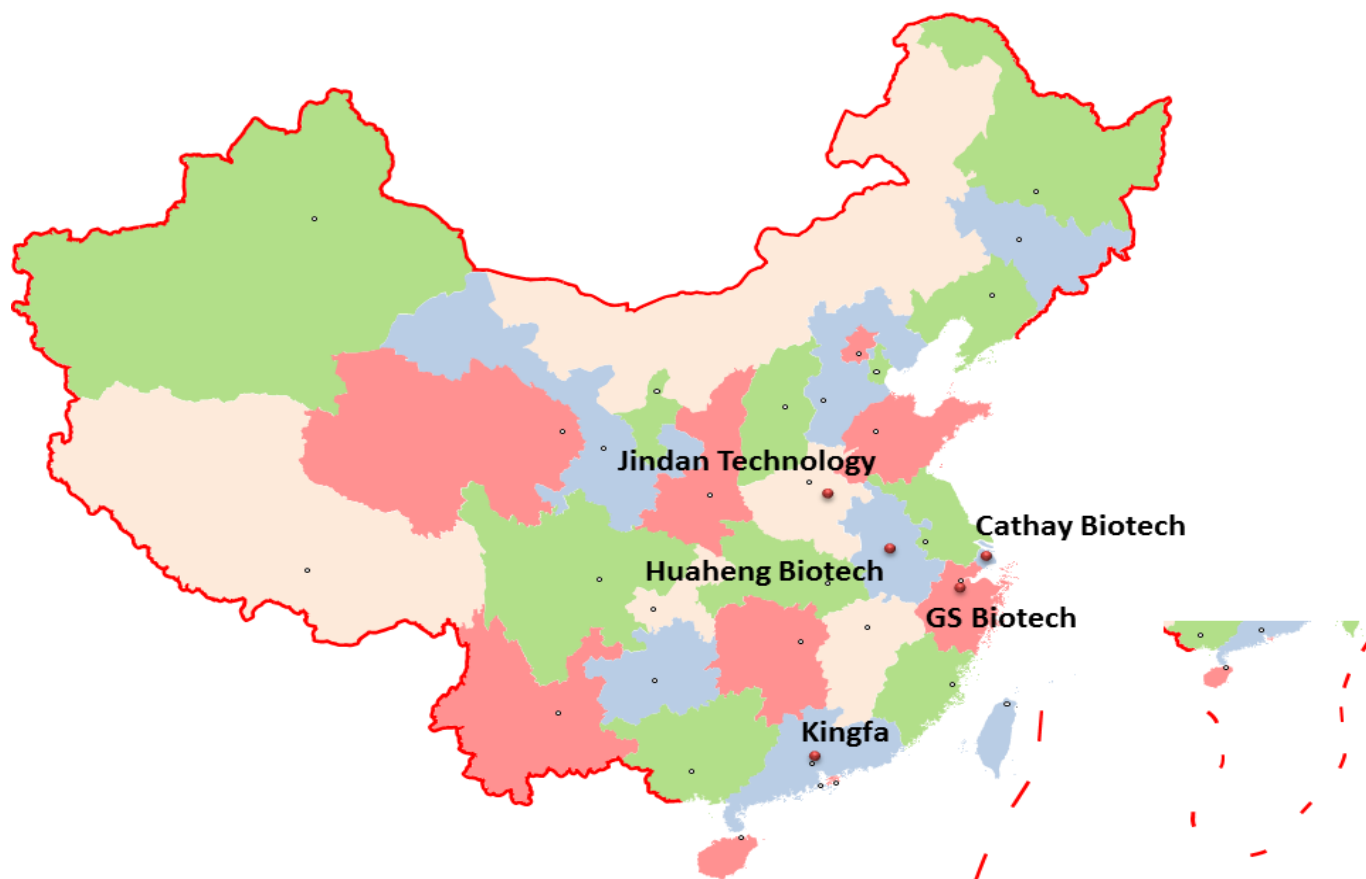
On 26 May, Jiangsu Jinghong's 55,000 t/a polylactic acid (PLA) and the related equipment manufacturing project was approved.

On 8 July, Zhongke Guosheng (Taixing), a wholly-owned subsidiary of GS Biotech, had its bio-based degradable materials production project approved on the environmental issue.

In May, the environmental impact assessment report of Taixing Lianxin's 25,000 t/a carbon dioxide-based biodegradable plastics project was approved.

In Q2, Leaf Biotech closed a RMB200 million series B financing round for developing 2,5-furandicarboxylic acid (FDCA) industrial production, Suzhou CellUranics' proposed bio-based polymer material development project was given a go-ahead, and Panjin Sanli's 300 t/a bio-based furans pilot-scale experiment project was disclosed.







## Editor's Note

Welcome to the Bio-based Material Quarterly Newsletter Q2 2023.

### Policy

China launched the *Measures for the Administration of the Use and Reporting of Disposable Plastic Products by Business Operators in the Commercial Sector*, effective as of 20 June, 2023, to ban or strictly regulate the uses of non-degradable plastic bags and other disposable plastic items.

### Market dynamics & company performance

In the quarter, Kingfa's 50,000 t/a L-lactic acid project and the 10,000 t/a bio-based 1,4-butanediol (BDO) project broke ground; Sulzer and Jindan New Biomaterials started cooperation in polylactic acid (PLA); Cathay Biotech, East China University of Science and Technology and Lund University jointly published breakthrough study on lignocellulose-derived D-lactide production; and progresses have been made of the PLA-related projects of Changchun Institute of Applied Chemistry (CIAC), Ma'anshan Tong-Jie-Liang Biomaterials, Shandong Guyu and Guangdong Sisan.

In furans area, GS Biotech's bio-based degradable materials production project was approved on the environmental issue; Leaf Biotech's 2,5-furandicarboxylic acid (FDCA) industrial production project received funding from two RMB200 million series B rounds; CTA and Sugar Energy started to co-develop bio-based PEF synthesis; CellUranics' and Panjin Sanli's FDCA R&D projects were also posted with further details.

More are included: Weiqi Biotech's 30,000 t/a PHA production base project started construction; Bluepha and TotalEnergies Corbion started cooperation in PLA and PHA application development; Huaheng Biotech proposed financing to build capacities of 50,000 t/a bio-based succinic acid (SA) and 50,000 t/a bio-based malic acid (MA); Taixing Lianxin's 25,000 t/a carbon-based biodegradable plastics project was approved for construction; Liangyungang Juwei Yuanchuang raised plan to set up 12,000 t/a SA capacity; Suzhou Sipeng Technology's biosynthesis and biomaterials application project was accepted; Homelink proposed financing to build 100,000 t/a sugarcane bagasse-derived material capacity; Xinxiang Chemical's 5,000 t/a Juncao-derived fibre pilot-scale experiment was approved.

### Price

In the period of Q2, there was a general decline in the PLA prices, while the PHA prices have remained flat.

The USD/CNY exchange rate in this newsletter is USD1.00=CNY7.0965 on 1 June, 2023, sourced from the People's Bank of China.

Unless otherwise specified, all the prices mentioned in this newsletter will include the VAT.





## Governmental Direction

### Administrative measures for business use and reporting of disposable plastics

Summary: The *Measures for the Administration of the Use and Reporting of Disposable Plastic Products by Business Operators in the Commercial Sector* was jointly published by the MOFCOM and the NDRC on 16 May, 2023, which went into effect on 20 June, 2023. Non-degradable plastic bags and other disposable plastic items are not allowed and their use is strictly regulated.

On 16 May, the Ministry of Commerce (MOFCOM) and the National Development and Reform Commission (NDRC) jointly issued the *Measures for the Administration of the Use and Reporting of Disposable Plastic Products by Business Operators in the Commercial Sector (Measures)*. The *Measures*, which was put into force on 20 June, 2023, place restrictions on and outright ban the use of non-degradable plastic bags and other disposable plastic products. China has taken a significant step forward in plastic regulation with the introduction of the *Measures*, and sectors that employ more plastic products are now faced with a dilemma.

#### Background

Over the years, the Party Central Committee and the State Council have placed a high priority on the treatment of plastic pollution. In Jan. 2020, the Central Comprehensively Deepening Reforms Commission adopted the *Opinions on Further Strengthening the Treatment of Plastic Pollution*, setting the industry-by-industry, phase-by-phase, and region-by-region restrictions and prohibitions on some plastic product manufacture, sale, and usage as the work objective. Three months later, in April 2020, the *Law on the Prevention and Control of Environment Pollution Caused by Solid Wastes* was added a special provision on the control of plastic pollution in the commercial sector by the Standing Committee of the 13th National People's Congress. The *Action Plan for the Plastic Pollution Control of the 14th Five-Year Plan* was issued in Sept. 2021 and provides specific instructions on how to actively promote the reduction of plastic production and use at source, accelerate standardised recycling and disposal of plastic wastes, and vigorously carry out clean-up and rectification of plastic wastes in strategic locations.

The *Measures* state that enterprises in the retail, e-commerce, catering, accommodation, and exhibition sectors are forbidden and restricted from providing consumers manufactured plastic goods that are not intended for reuse in their business activities. The usage and recycling of disposable plastic items must be reported to the appropriate authorities every six months by retail outlets, e-commerce companies, food delivery services, etc. The MOFCOM will set a deadline for correction if the linked regulations have been broken, failing which a punishment of not less than RMB10,000 but not more than RMB100,000 may be imposed.

#### Normative requirements

- Commodity retailers shall provide consumers paid plastic bags and reduce the use of disposable plastic products by installing alternative product vending machines and renting out shopping baskets and carts
- E-commerce operators shall prioritise the use of reusable and easily recyclable packaging, and promote original direct shipping of e-commerce express shipments
- E-commerce platforms shall develop platform rules that encourage platform users to use fewer disposable plastics in express packaging and takeaway links
- Catering operators shall reasonably choose alternative products or compliant disposable plastic products when providing packaging





or takeout services

- Lodging providers, in accordance with national laws banning and restricting the use of some plastic products, shall not actively provide disposable plastic products to consumers
- Through the exhibition event organisers, exhibition hall managers shall notify exhibitors of relevant national regulations that forbid and restrict the use of certain plastic products
- Market players in the business sector shall prominently post, place, or set up signs or links to national regulations banning and restricting the use of plastic products on their business premises or websites. Additionally, consumers must be encouraged to switch to alternate products and use fewer disposable plastic products

It was mandated that non-degradable plastic packaging, disposable plastic woven bags, and plastic tape not be used by postal and express delivery outlets by the end of 2025 in documents issued in May by Guangdong, Shanxi, Jilin, Heilongjiang provinces, Tianjin Municipality, and many other locations. Henan Province released a draft *Ban on Non-degradable Disposable Plastic Products Regulations of Henan Province* on 17 May; it is expected to be implemented within this year. In June, the *Management Measures of Chongqing Municipality for the Disposable Goods Catalogue List* was issued by Chongqing Municipality and is about to come into effect on 1 Aug., 2023. This aims to encourage the use of easily degradable, recyclable, green, and environmentally friendly products. These types of rules are frequently introduced across the nation, which implies that as China's economy grows, the rate of policy implementation for things like carbon reduction, environmental protection, and plastic pollution management will quicken. It is foreseeable that the sectors associated to degradable plastic will develop rapidly, stimulated by the plastic prohibition legislation and driven by industrial policy.





## Market Analysis

### Kingfa's growths in 2022 and Q1 2023 slow down

Summary: Kingfa reported revenue growth slowdown, which was up merely by 0.53% in 2022 and 2.39% in Q1 2023. Its subsidiary Liaoning Kingfa set start construction works for the 50,000 t/a L-lactic acid project and the 10,000 t/a bio-based 1,4-butanediol (bio-BDO) project in early June.

On 25 April, Kingfa Sci. & Tech. Co., Ltd. (Kingfa) released its financial reports for 2022 and Q1 2023, with key data as follows:

#### Full 2022:

- Revenue: USD5.69 billion (RMB40.41 billion), up merely 0.53% YoY
- Net profit attributable to equity shareholders of the listed company: USD280.70 million (RMB1.99 billion), up 19.89% YoY
- New materials: Sales improved to USD409.07 million (RMB2.90 billion), up 9.37% YoY, with a gross margin of 18.30%, down 15.6 percentage points; output totalled 173,800 tonnes and sales volume at 122,800 tonnes in 2022.
  - Fully biodegradable plastics: Capacity was ramped up to 210,000 t/a, of which the utilisation rate averaged at 64%; output was 134,600 tonnes, up 26.11%; sales volume was 98,500 tonnes, up 23.57%; year-end inventory was 7,700 tonnes, down 29.58% on a yearly basis

#### Q1 2023:

- Revenue: USD1.36 billion (RMB9.68 billion), up 2.39% YoY
- Net profit attributable to equity shareholders of the listed company: USD42.08 million (RMB298.63 million), down 29.07% YoY

Kingfa cited that the demand for degradable plastics shrank noticeably in 2022 compared with the previous year, affecting its sales results, in the face of price swings of chemical monomers, overall economic downturn and other market factors. Meanwhile, the disordered competitions in the sector eroded the company's profitability from degradable plastics products as its new capacity gradually put into operation in the year.

By the end of 2022, Kingfa's 30,000 t/a polylactic acid (PLA) continuous polymerisation production line has entered stable operation after a successful trial run—the project produces differentiated PLA products, deemed as a complementary line to PBAT products (installed capacity: 180,000 t/a) to meet different market needs.

In innovation, it developed China's first food-grade PBS product, supercharging its product's competitiveness. To diversify its biodegradable resin catalogue, it set up capacities for PBAT/PBS/PLA-based products of film blowing grade, extrusion grade, injection mould grade and casting grade. Application development of biodegradable agricultural film, bags for shopping, courier and packing purposes, and other modified materials for special uses, was emphasised and saw progressive results.







TABLE 1: Kingfa's 2022 revenue by product category, million USD

| Product category                | Revenue  | YoY change | Operating costs | YoY change | Gross profit margin | YoY change                   |
|---------------------------------|----------|------------|-----------------|------------|---------------------|------------------------------|
| Modified plastics               | 3,614.03 | 1.26%      | 2,845.96        | -0.67%     | 21.25%              | up 1.53 percentage points    |
| New materials                   | 409.01   | 9.37%      | 334.16          | 35.17%     | 18.30%              | down 15.6 percentage points  |
| Green petrochemical products    | 532.72   | -5.83%     | 605.65          | 15.62%     | -13.69%             | down 21.09 percentage points |
| Medical and healthcare products | 210.61   | -2.12%     | 132.91          | -27.08%    | 36.89%              | up 21.6 percentage points    |
| Trade goods                     | 861.97   | 0.40%      | 859.44          | 2.09%      | 0.29%               | down 1.65 percentage points  |

Note:1. Modified plastic products include original modified plastics and environmentally-friendly high-performance recycled plastics;

2. New materials products include fully biodegradable plastics, specialty engineering plastics, carbon fibre and composite materials;

3. Green petrochemical products include propylene, isooctane, methyl ethyl ketone and liquefied gas

Source:Kingfa

In May 2022, Kingfa founded Liaoning Kingfa Biomaterial Co., Ltd. (Liaoning Kingfa), to continue technological research and industrialisation of bio-based monomers and materials. In early June of 2023, Liaoning Kingfa's 50,000 t/a L-lactic acid project and the 10,000 t/a bio-based 1,4-butanediol (Bi-BDO) project broke ground.

#### Overview of the 10,000 t/a bio-BDO project:

- Construction nature: New construction
- Total investment: USD42.27 million (RMB300 million), 6.15% (=USD2.60 million/RMB18.46 million) of which for environmental protection
- Location: Panjin Liaobin Coastal Economic and Technological Development Area, Liaoning Province,
- Site & plant floor areas: 35,333 m<sup>2</sup> & 493,155 m<sup>2</sup>
- Construction content: One bio-BDO production line, and the supporting equipment
- Designed capacity: 10,000 t/a Bio-BDO and 336 t/a tetrahydrofuran (by-product)
- Production technique: The project will adopt the biological process which resembles the maleic anhydride (MA) production and features low costs, low "three wastes" (waste gas, waste water, waste residue) and high level of safety. In comparison with the MA production technology, the biological production uses renewable feedstocks (succinic acid and corn starch) and thus achieves reduction of carbon emission. At the moment, biological production technology has gained promising results from the lab-scale experiment, showing esterification rate of over 99.7% and product purity of above 99.5%.
- Planned time to start operation: End of 2023

#### Overview of the 50,000 t/a L-lactic acid project:

- Construction nature: New construction
- Total investment: USD70.58 million (RMB500.87 million), 9.29% (=USD6.56 million/RMB46.54 million) of which for environmental protection
- Location: Panjin Liaobin Coastal Economic and Technological Development Area, Liaoning Province,
- Site & plant floor areas: 64,768.79 m<sup>2</sup> & 493155 m<sup>2</sup>
- Construction content: Biotechnological production equipment and supporting facility for 50,000 t/a L-Lactic acid
- Construction duration: 24 months





Kingfa added that it would enhance its market competitiveness in the fully biodegradable plastics area by consistent improvement and innovation of production technology and product.

### **Huaheng Biotech calls for USD237.94 million funding for bio-based product projects**

Summary: On 27 May, Huaheng Biotech proposed to raise up to USD237.94 million (RMB1,688 million) of funds for the development of "the 50,000 t/a bio-based succinic acid (SA) and bio-based materials production base construction project" and the "50,000 t/a bio-based malic acid (MA) production construction project".

On 27 May, Anhui Huaheng Biotechnology Co., Ltd. (Huaheng Biotech) issued the prospectus for fund raising via private placement of A-shares. According to the prospectus, Huaheng Biotech plans to raise up USD237.94 million (RMB1,688 million) of funds for the development of the "50,000 t/a bio-based succinic acid and bio-based materials production base construction project" (hereinafter referred to as the 50,000 t/a SA project) and the "50,000 t/a bio-based malic acid production construction project" (hereinafter referred to as the 50,000 t/a MA project), and for replenishing its working capital.

The investing projects with designed capacities for bio-based SA and MA will adopt fermentation process instead of the traditional chemical synthesis process that causes heavy pollution, and build recycling technological system to extend the application of biological technologies in chemicals, materials, food and other fields, helping to promote the alternative application of bio-based products. The projects are of strategic importance and of great developmental potential according to the statement.

#### **Overview of the 50,000 t/a SA project:**

- Construction nature: Expansion and retrofitting
- Total investment: USD119.71 million (RMB849.51 million), of which USD106.75 million (RMB757.54 million) will come from raised fund and the rest from the self-raised
- Executive entity: Chifeng Huaheng Synthetic Biotechnology Co., Ltd. (Chifeng Huaheng)
- Location: Ganggangyingzi Village, Tianyi Town, Ningcheng County, Chifeng City, Inner Mongolia Autonomous Region
- Main construction & production plan: Retrofit acquired equipment and facilities (from Ningcheng Jingdu Starch Co., Ltd.), reconstruct the original 300,000 t/a corn deep-processing project, and build a bio-synthetic SA workshop consuming 600,000 t/a of corn
- Designed capacity:
  - 420,000 t/a Corn starch—71,500 t/a of which to be used in the production of SA and 172,000 t/a for glucose and the rest 176,500 t/a for sale
  - 50,000 t/a SA—1,500 t/a of which to be used in the production of disodium succinate hexahydrate;
  - 160,000 t/a Glucose
- Construction duration: 30 months from Nov. 2022 to April 2025
- Working system: 759 people working for 300 days per year

Chifeng Huaheng was founded in Sept. 2022 with a registered capital of RMB5 million. It is a biomanufacturing firm focusing on synthetic biotechnology and wholly-owned by Huaheng Biotech. The company's collaboration with universities and research institutes has exploited





synthetic biotechnology and constructed high-performing SA fermentation strains which have been proved a success in the lab-scale experiment producing SA from bio-raw materials to end product. Previously in Oct. 2022, Chifeng Huaheng bought out Ningcheng Jingdu Starch Co., Ltd. to support the 50,000 t/a SA project.

#### Overview of the 50,000 t/a MA project

- Construction nature: New construction
- Total investment: USD96.43 million (RMB684.35 million), of which USD94.35 million (RMB669.53 million) will come from raised fund and the rest from the self-raised
- Executive entity: Qinhuangdao Huaheng Bioengineering Co., Ltd. (Qinhuangdao Huaheng)
- Location: Shanhaiguan Lingang Industrial Zone, Qinhuangdao City, Hebei Province
- Main construction content: Built a workshop for bio-based MA and its derivatives and other supporting equipment and facilities
- Designed capacity: 50,000 t/a bio-based MA, composed of 30,000 t/a L-malic acid and 20,000 t/a DL-Malic acid
- Construction duration: 30 months

Qinhuangdao Huaheng was established in Jan. 2011 with a registered capital of RMB30 million. It is a bioengineering firm focusing on amino acid series products and wholly-owned by Huaheng Biotech, with capacities for L-alanine (24,300 t/a of industrial grade and 1,500 t/a of food grade), DL-alanine (1,500 t/a), and  $\beta$ -alanine (1,000 t/a), D-pantoic acid (20 t/a), D-calcium pantothenate (50 t/a), amino acid-based surfactants (50 t/a), D-aspartic acid (50 t/a), pyruvic acid (50 t/a), and glucose syrup (40,000 t/a).

#### Sulzer signs PLA technology supply agreement with Jindan New Biomaterials

Summary: On 24 May, Sulzer signed an agreement to provide its licensed PLA technology for the production of polylactic acid (PLA) of Jindan New Biomaterials.

On 24 May, Sulzer, a global leader in fluid engineering and chemical processing applications, announced signing of the agreement with Jindan Biological New Materials Co., Ltd. (Jindan New Biomaterials) to carry out the production of the bio-based plastic polylactic acid (PLA). Jindan New Biomaterials will be supported with Sulzer's licensed PLA technology to produce up to 75,000 tonnes of PLA per year, mainly to be used for food packaging, moulded goods and fibres production. To enable the Jindan New Biomaterials' transition towards more sustainable, circular practices, Sulzer Chemtech Ltd. will design and supply its key proprietary PLA technology, while further providing extensive engineering and technical support and field services during the product manufacturing.

Jindan New Biomaterials was co-founded by Henan Jindan Lactic Acid Technology Co., Ltd. (Jindan Technology) and Nanjing University Science Park Development Co., Ltd., the former one holding 70% of shares and the latter with 30%. Thanks to the cooperation with Nanjing University, Jindan New Biomaterials has now possessed the core technology and capacity to operate the front-end manufacturing of PLA which includes production of "lactic acid to lactide" via "Two Steps" (microwave heating and conventional heating in the ring-opening polymerization (ROP) of lactide). Meanwhile, the company has run industrial production and sale of lactide products and been working on technology R&D and accumulation of the back-end manufacturing process for PLA. Jindan New Biomaterials and Sulzer cooperation includes the provision of the back-end process to prop up the realisation of PLA mass production. Mr. Shi Congliang, President of Jindan New Biomaterial, said: "By investing in Sulzer's PLA solutions, we are taking key, strategic steps to advance our





competitiveness in the booming biopolymer industry and drive the use of greener plastics."

According to the 2022 Annual Financial Report of Jindan Technology disclosed on 21 April 2023, the company has settled the technical agreement and key equipment purchase contract for its 75,000 t/a PLA biodegradable new material project, due to start operation by H2 2024. On 23 March 2023, the proposed issuance of corporate bonds up to USD98.64 million (RMB700 million) was approved, following the expiry of the six-year period from the date of issuance. The proceeds from this issuance will be used in the 75,000 t/a PLA project and to supplement working capital.

On top of that, Jindan Technology has a 10,000 t/a lactide continuous industrial production project, producing products of higher-quality than the industrial average and is ready to ramp up production level based on the market status. Its 60,000 t/a polybutylene adipate-co-terephthalate (PBAT) biodegradable polyester and the related products project has completed groundwork construction and equipment installation, slated to start commissioning in H1 2023.

In 2022, Jindan Technology achieved revenue of USD216.25 million (RMB1.53 billion), an increase of 6.41% YoY; the net profit attributable to equity holders of the parent company was USD18.63 million (RMB132.23 million), an increase of 2.36% YoY; and the total assets amounted to USD353.18 million (RMB2.51 billion) up by 14.95% YoY. The company attributed the increases in revenue and net income attributable to shareholders to an increase in the selling prices of lactic acid and corn by-products in 2022. However, the net profit attributable to equity holders grew slower due to the price rises of materials and other elements.

**TABLE 2: Revenue, cost and gross margin by product, 2022**

| Product  | Revenue            |            | Cost               |            | Gross margin |            |
|--|--------------------|------------|--------------------|------------|--------------|------------|
|  | Value, million USD | YoY change | Value, million USD | YoY change | Value        | YoY change |
| Lactic acid  | 135.71             | 0.32%      | 109.21             | -4.13%     | 19.53%       | 3.73%      |
| Lactates   | 46.84              | 25.68%     | 35.64              | 23.27%     | 23.91%       | 1.48%      |
| Corn by-products                                   | 30.25              | 4.12%      | 18.24              | 4.86%      | 39.68%       | -0.43%     |
| Others (degradable material, gypsum powder, steam) | 28.83              | 13.20%     | 28.12              | 19.04%     | 2.48%        | -4.78%     |

Source: Jindan Technology's Annual Report for 2022





TABLE 3: Key construction projects in progress

| Project   | Budget, million RMB | Invested amount / investment budget, % | Construction progress |
|---|---------------------|--|-----------------------|
| 50,000 t/a Refined Lactic Acid Expansion and Transformation Engineering Project | 41                  | 94.89%                                 | 100%                  |
| 60,000 t/a Biodegradable polyester and the related products project             | 466                 | 65.74%                                 | 70%                   |
| 10,000 t/a L-lactic acid project  | 151                 | 121.90%                                | 100%                  |
| 75,000 t/a Polylactic acid (PLA) biodegradable new material project             | 882                 | 1.70%                                  | 5%                    |

Source: Jindan Technology's Annual Report for 2022

### Updates of China's PLA projects in Q2

Summary: In Q2, there are updates on the polylactic acid (PLA)-related projects of Changchun Institute of Applied Chemistry (CIAC), Ma'anshan Tong-Jie-Liang Biomaterials, Shandong Guyu, and Guangdong Sisan.

In Q2, there are polylactic acid (PLA)-related projects seeing progresses in China, as detailed as follow.

#### Changchun Institute of Applied Chemistry (CIAC)

On 11 May, CIAC's PLA industrialisation technology development and innovation centre project gained acceptance on the environmental protection monitoring report on the completed construction.

Project overview:

- Construction nature: Transformation and expansion
- Total investment: USD2.99 million (RMB21.20 million), 1.42% (=USD40,000/RMB300,000) of which for environmental protection
- Location: North Area of the Hi-Tech Industrial Development Zone of Changchun, Jilin Province
- Site area: 3,569.82 m<sup>2</sup>
- Main construction content: Adopt new production process for 3,000 t/a PLA industrial synthesis in lieu of the original process at 300 t/a scale. Here the 3,000 t/a process is the result of researches on direct fabrication of lactide from lactic acid, catalyst system, and polymerisation technique to shorten production schedule and mass produce 3,000 t/a PLA.
- Testing capacity: 8 tests per year, each to produce 63 tonnes of PLA products, summing up to 504 tonnes per year
- Construction period: Jan. 2022–March 2023
- Site acceptance test: 28 May–29 May, 2023

CIAC was established in Dec. 1984 and has cooperated with Zhejiang Hisun Biomaterials Co., Ltd. (Hisun Biomaterials, Stock code: 688203.SH) since 2000, committed to the R&D and industrialisation of biodegradable PLA materials. In 2021, CIAC co-founded Pliith Biotechnology Co., Ltd. (Pliith Biotechnology) with Orinko Advanced Plastics Co., Ltd. (Orinko, Stock code: 688219.SH) to develop a 350,000 t/a PLA project.

#### Ma'anshan Tong-Jie-Liang Biomaterials Co., Ltd. (Ma'anshan Tong-Jie-Liang Biomaterials)





On 6 June, Ma'anshan Tong-Jie-Liang Biomaterials notified the operation start-up of its 10,000 t/a PLA chip technological upgrading project. This project producing fibre-grade PLA chips is installed with self-developed production processes and equipment. According to its latest statement on homepage, the company has closed two financing rounds led respectively by China Capital Investment Group and Sequoia Capital, the proceeds of which are for two-year construction of an integrated production line with capacities of 50,000 t/a PLA fibre, 100,000 t/a PLA and 150,000 t/a lactic acid.

Ma'anshan Tong-Jie-Liang Biomaterials was founded in Jan. 2010 with a registered capital of RMB64.54 million. It now has 10,000 t/a PLA capacity.

#### **Shandong Guyu Biotechnology Co., Ltd. (Shandong Guyu)**

On 26 June, Shandong Guyu completed registration for its new project to construct production capacities of 30,000 t/a PLA, 60,000 t/a L-lactic acid, 100,000 t/a sorbitol, 100,000 t/a maltodextrin and 230,000 t/a glucose, as well as 150,000 tonnes of storage.

Shandong Guyu was registered in May 2022 with a capital of RMB100 million. On 13 May 2022, it had registered for the project of 20,000 t/a allulose, 30,000 t/a PLA, 60,000 t/a L-lactic acid, 100,000 t/a maltodextrin, 200,000 t/a fructose and 200,000 t/a maltose with proposed investment of USD387.51 million (RMB2.75 billion). This project's 650,000 t/a starch deep-processing line is under construction.

#### **Guangdong Sisan Biotechnology Co., Ltd. (Guangdong Sisan)**

On 29 June, Guangdong Sisan's PLA biodegradable material construction project was accepted on the environmental impact assessment report.

Project overview:

- Construction nature: New construction
- Total investment: USD14.09 million (RMB100 million)
- Site & floor areas: 2,300 m<sup>2</sup> & 2,300 m<sup>2</sup>
- Main construction content: one PLA synthesis workshop; and one the south side of the PLA workshop, a rectification system, a vacuum system, a cooling system and other supporting devices
- Designed capacity: PLA (main product) – 5,000 t/a; lactide (intermediate) – 5,016.55 t/a
- Working system: 50 people in three 8-hour shifts for 330 days a year
- Planned time to start operation: July 2023

Guangdong Sisan was set up in May 2022 with a registered capital of RMB10 million and is the wholly-owned subsidiary of Shenzhen Sisan Technology Co., Ltd. It is in partnership with a US-based PLA research institute centre.





## Company Dynamics

### WeiQi Biotech breaks ground on 30,000 t/a PHA production base

Summary: WeiQi Biotech announced the start of constructing the 30,000 t/a polyhydroxyalkanoates (PHA) production base in Yichang City of Hubei Province on 3 June; the environmental impact assessment of the project was accepted on 16 May.

Hubei WeiQi Biotechnology Co., Ltd. (WeiQi Biotech)'s 30,000 t/a polyhydroxyalkanoates (PHA) biodegradable materials smart manufacturing project started construction works on 3 June; the environmental impact assessment document of the project was accepted by the Ecology and Environment Bureau of Yichang City of Hubei Province on 16 May.

#### Project overview:

- Construction nature: New construction
- Total investment: USD147.96 million (RMB1.05 billion)
- Location: Angel Biotechnology Industrial Park, Xiaoting District, Yichang City
- Site & floor areas: 13.33 ha (200 mu) & 34,516 m<sup>2</sup>
- Main construction content: Build workshops for fermentation, extraction and drying, warehouses for raw materials and finished products, and public utilities and R&D building complex
- Designed capacity (over two phases): PHA products (10,000 t/a to be built in phase I and 20,000 in phase II), composed of poly(3-hydroxybutyric) (PHB) and poly (3-hydroxybutyrate-co-4-hydroxybutyrate) (P34HB), representing a proportion of 1:2 in each phase
- Main process: Produce PHA products, using glucose as carbon source with additions of other nutrient salts in slant strain culture, and through steps of washing, enzymatic hydrolysis, secondary washing, drying and packaging.
- Working system: 100 workers in three 8-hour shifts for 300 days or 7,920 hours a year
- Construction schedule (20 months in total):
  - Phase I: 12-month construction and operation start in June 2024
  - Phase II: 8-month construction (breaking ground in Nov. 2024) and operation start in June 2025

This project is projected to be China's largest PHA production plant by capacity scale for a wide range of products, equipped with the world's biggest bio-synthesis production lines. Multiple non-grain carbon sources such as non-grain biomass and organic wastes will be the inputs of the plant's production of degradable PHA materials applicable to value-added lines of medical treatment, aesthetic medicines, daily necessities, bio-fibres, and more. In this way, it will push the low-carbon sustainable development of the biopolymer material industry.

Founded in Sept. 2022, WeiQi Biotech is a joint venture of Angel Yeast Co., Ltd. (Angel Yeast) and Beijing Phabuilder Biotechnology Co., Ltd. (Phabuilder, formerly known as Beijing Weigou Workshop Biotechnology Co., Ltd. or Weigou Workshop).

Angel Yeast is a publicly listed company specialised in yeast, yeast derivatives and the related bio-products. It is the world's biggest supplier of yeast extracts and the 2nd-largest supplier of yeast powder. Phabuilder is a pioneer in the synthetic biotechnology, dedicated to reconstructing and engineering halophiles for applications and to the R&D and production of value-added products, such as biodegradable PHA materials, ectoine (pharmaceutical intermediate), pentamethylene diamine (PDA, a nylon 56 precursor), aided by the advanced "Next Generation Industrial Biotechnology (NGIB)" platform proprietary to the company. NGIB won the recognition of the





International Metabolic Engineering Award (IMES) in March 2023. The technical strengths of Phabuilder (including the NGIB platform) and the production and fermentation capabilities of Angel Yeast will be consolidated in this plant.

Last year, Weiqi Biotech and Phabuilder had seen major progresses in production operation:

- On 30 Sept., 2022, Weiqi Biotech signed cooperation agreement with the local government of Xiaoting District to develop a PHA biodegradable materials smart manufacturing project.
- In Oct. 2022, Phabuilder's 1,000 t/a PHA smart manufacturing demonstration line started operation.
- On 24 Nov., 2022, Weiqi Biotech completed the process verification of a 10,000 t/a PHA production line and announced the launch of its first PHA products to domestic and overseas markets.

### Jiangsu Jinghong to found 55,000 t/a PLA capacity

Summary: On 26 May, Jiangsu Jinghong's 55,000 t/a polylactic acid (PLA) and the related equipment manufacturing project was approved.

On 26 May, the local government of Suyu District of Suqian City, Jiangsu Province approved and publicised the pre-construction environmental impact assessment of the 55,000 t/a polylactic acid (PLA) and related equipment manufacturing project of Jiangsu Jinghong New Materials Technology Co., Ltd. (Jiangsu Jinghong).

#### Project overview:

- Construction nature: New construction
- Total investment: USD84.55 million (RMB600 million), 5.06% (=USD4.28 million/RMB30.35 million) of which for environmental protection
- Location: Hi-Tech Industrial Development Zone of Suqian City, Jiangsu Province
- Site area: approx. 9.52 ha (142.75 mu)
- Construction capacity (over two phases):
  - Phase I: one 5,000 t/a PLA production line
  - Phase II: one 50,000 t/a PLA production line
- Working system: 55 workers (20 in phase I and 35 in phase II) rotating in three 12-hour shifts for 300 days or 7,200 hours per year
- Construction schedule:
  - Phase I: Kick off construction in June 2023 and enter production operation in Dec. 2023
  - Phase II: Break ground in Jan. 2024 and start operation in June 2025
- Production process: "Two Steps" (microwave heating and conventional heating in the ring-opening polymerization (ROP) of lactide)—in detail, dehydrate lactic acid via decompression and heating, generate lactide (PLA intermediate) by adding initiator or catalyst, and then extract PLA after purification and polymerisation of lactide.
- Source of production techniques: Jiangsu Jinghong has worked on biodegradable materials since 2018, such as polybutylene adipate-co-terephthalate (PBAT), lactide, lactic acid and starch composite materials; it filed application for patent of Stannous Salt Complex Catalyst and a Method for Producing L-Lactide in China and under the Patent Cooperation Treaty in Dec. 2020.

Prior to this publication, this 55,000 t/a PLA Project was disclosed for the first time in Dec. 2021 under the name of Jiangsu Shengpuli New Material Technology Co., Ltd. (Jiangsu Shengpuli, with 84% of shares owned by Jiangsu Jinghong). On the other hand, Jiangsu Jinghong's 20,000 t/a PBAT resin and 40,000 t/a fully biodegradable modified polyester film project that started construction work in 2021,







has been in operation.

Jiangsu Jinghong was established in Aug. 2001 with a registered capital of RMB50 million. It is a specialised producer of PET chips, polyethylene terephthalate glycol (PETG) shrinkable films for food & beverage, labelling materials, Li-ion battery separators. In 2009, it partnered with Nanjing University and founded the Suqian Joint Laboratory of Advanced Materials of Nanjing University and the Jiangsu Province Polymer-based Nanocomposite Engineering Technology Center, which later on serve as strong technical support and guarantee for the company's product innovation. Statistics of the China Battery Industry Association showed that Jiangsu Jinghong's PETG battery label and shrinkable film products ranked first in the global market with share of 50.9% in 2022.

### GS Biotech's recent development of bio-based furans projects

Summary: On 8 July, Zhongke Guosheng (Taixing), a wholly-owned subsidiary of GS Biotech, had its bio-based degradable materials production project approved on the environmental issue.

On 8 July, the environmental impact assessment report of the bio-based degradable materials production project of Zhongke Guosheng (Taixing) New Material Technology Co., Ltd. (Zhongke Guosheng (Taixing)), a wholly-owned subsidiary of GS Biotech, was approved.

#### Project overview:

- Construction nature: New construction
- Total investment: USD80.32 million (RMB570.00 million), USD3.12 million (RMB22.15 million) of which for environmental protection
- Location: Economic Development Zone of Taixing (county-level) City, Taizhou City, Jiangsu Province
- Site area: 36,000 m<sup>2</sup>
- Main construction content: Build complex building, production workshop, tank field; and purchase reaction kettle, stirring reactor, rectification tower, centrifugation machine
- Product scheme:
  - Main input: fructose and oxalic acid
  - Main product: 5-Hydroxymethylfurfural (HMF), 2,5-Furandicarboxylic acid (FCDA), 2,5-Bishydroxymethyl tetrahydrofuran (THFDM), Poly(2-ethyl-2-oxazoline) (PEOX), polyethylene 2,5-furandicarboxylate (PEF)
- Working system: Four 8-hour shifts and three running systems, for 300 days or 7,200 hours per year
- Construction duration: 10 months
- Preliminary work: GS Biotech's tech team has joined hands with Dalian Institute of Chemical Physics, Chinese Academy of Sciences and made out a low-cost continuous production process for HMF along with the matching system for the catalysts. These joint achievements underwent lab-scale experiment and were further applied in a larger-scale production. Meanwhile, they co-developed a synthesis process for large-scale production of FCDA and THFDM and succeed in producing degradable PEOX of pilot scale (5L-150L).



**TABLE 4:** Product plan of Zhongke Guosheng (Taixing)

| Category     | Item   | Product state | Capacity, t/a | Note   |
|--------------|--|---------------|---------------|--|
| Main product | 5-Hydroxymethylfurfural (HMF)                | Liquid        | 1,500         | For the production of THFDM or for sale                              |
|              |  | Solid         |               |  |
|              | 2,5-Furandicarboxylic acid (FDCA)            | Solid         | 1,000         | An oxidized derivative of HMF; for the production of PEF or for sale |
|              | 2,5-Bishydroxymethyl tetrahydrofuran (THFDM) | Liquid        | 200           | An hydrogenated derivative of HMF                                    |
|              | Poly(2-ethyl-2-oxazoline) (PEOX)             | Solid         | 30,000        | An aliphatic polyester made from oxalic acid and ethylene glycol     |
|              | Polyethylene 2,5-furandicarboxylate (PEF)    | Solid         | 1,000         | A functional polyester made by polymerisation of FDCA                |
| By product   | Methanol                                     | Liquid        | 16,000        | /  |

Source: Zhongke Guosheng (Taixing) New Material Technology Co., Ltd.

Founded in July 2021, GS Biotech concentrates on R&D of such bio-based furan-containing materials as HMF and the derivatives and has realised hundred-tonne level of scale production of HMF. To open up the HMF industry chain, GS Biotech has explored and exploited the continuous production technologies for chain production from biomass through HMF to downstream products, which enable it to manufacture HMF, FDCA, THFDM and other core monomers at a lower cost but larger scale. It has also developed a wide range of high value-added products thanks to the technical achievements made. At present, the company has pulled off varied applications of HMF and the derivatives and launched bio-based furan-derived polyesters, fibres, aramid fibre and surfactants to test the end-markets, in a bid to propel its development progress of bio-based furan-containing materials.

**Scale application developing course of GS Biotech:**

- In March 2022, GS Biotech reached an over-one-tonne FDCA supply agreement and completed delivery of its first one-tonne batch of FDCA in May of the same year.
- In July 2022, Zhongke Guosheng (Taixing)'s bio-based degradable materials R&D and production base project kicked start construction in Economic Development Zone of Taixing City, which was scheduled to start operation in 2023.
- In April 2023, GS Biotech sent out 10 tonnes of FDCA by order on an one-off basis; as of April 2023, the company has sold more than 100 tonnes of FDCA in aggregation.
- In May 2023, GS Biotech signed a strategic cooperation agreement with Zhejiang Kai Pu Qi New Materials Technology Co., Ltd., a wholly-owned subsidiary of Wankai New Material Co., Ltd. (Stock code: 301216.SZ), for industrial technology development of bio-based furan polyester materials, and materials ecology development and materials marketing. This partnership also boasts the world's first PEF synthesis industrialisation project of 1,000-tonnes scale.



## Taixing Lianxin's 25,000 t/a carbon-based biodegradable plastics project approved

Summary: In May, the environmental impact assessment report of Taixing Lianxin's 25,000 t/a carbon dioxide-based biodegradable plastics project was approved.

On 16 May, Lianxin Environmental Protection Technology (Taixing) Co., Ltd. (Taixing Lianxin) has the 25,000 t/a carbon dioxide-based biodegradable plastics project approved.

### Project overview:

- Construction nature: Expansion
- Total investment: USD73.08 million (RMB518.60 million), USD1.48 million (RMB10.50 million) of which for environmental protection
- Location: China Fine Chemical Industry (Taixing) Park, Taixing City, Jiangsu Province
- Site area: 29,970 m<sup>2</sup>
- Main construction content: Plastics production area and supporting equipment
- Designed capacity:
  - Main product: Carbon dioxide-based biodegradable polypropylene copolymer (PPCP) plastic—25,000 t/a
  - By product: Propylene carbonate (PC)—1,600 t/a
- Source of production techniques: The production technology to be adopted is jointly developed by the research team led by Professor Meng Yuezhong of Sun Yat-sen University and the technical team of Taixing Lianxin. The stability and reliability of such technology have been proved in the mass production of PPCP of Nanyang Zhongju Tianguan Low Carbon Technology Co., Ltd.
- PPCP process: Continuous + intermittent production system—the synthesis process (steps from input to synthesis and to closing) is in intermittent mode and end processing process (washing, extraction, devolatilisation, granulation, centrifugation, vibration, drying and packing) is in continuous mode
- Working system: Additional 70 people in three 8-hour shifts for 8,000 hours a year
- End of construction (estimated): July 2024



**TABLE 5:** Quality indices for carbon dioxide-based biodegradable plastic product

| Item                             | Unit              | Range     |
|----------------------------------|-------------------|-----------|
| Density (25 degree celsius)      | g/cm <sup>3</sup> | 1.28±0.05 |
| Vicat softening point (A50)      | degree celsius    | ≥40%      |
| Melt mass-flow rate (MFR)        | g/10min           | M±10%     |
| Tensile strength                 | MPa               | ≥35       |
| Bending strength                 | MPa               | ≥55       |
| Water content                    | %                 | ≤0.1%     |
| Ash content (850 degree celsius) | %                 | ≤0.1%     |
| Volatile component               | %                 | ≤1%       |
| N-Hexane extract                 | %                 | ≤2        |
| Absolute biodegradation rate     | %                 | ≥60%      |

Source: Lianxin Environmental Protection Technology (Taixing) Co., Ltd.

China's carbon dioxide-based degradable plastics industry is taking shape, in which polypropylene carbonate (PPC) has been produced by rather mature production technology and is regarded as most valuable, industrialisable kind of carbon dioxide-based plastics. But PPC is intrinsically insufficient in glass transition temperature (T<sub>g</sub>) and mechanical properties. To tackle this deficiency, domestic enterprises and research institutes have tapped deep into the application and property of PPC and created the new type of degradable material PPCP.

PPCP is polymerised resin composited by carbon dioxide, propylene oxide (PO) and phthalic anhydride (PA) with the aid of catalysts. In terms of mechanical property, heat resistance and barrier properties, PPCP is superior to PPC. In the cases of growing market demand and tightening environmental monitoring, PPCA has rosy prospect.

Taixing Lianxin (formerly known as Taixing Saha-Union Zongda Chemical Co., Ltd.) was founded in Sept. 2007 with a registered capital of RMB236.99 million. It is a sino-foreign joint venture, owned by Shandong Lianxin Environmental Protection Technology Co., Ltd. (Shandong Lianxin, 68.05%), Saha-Union Public Company Limited (19.08%), Saha-Union Investment (China) Co., Ltd. (8%), Hbcoal Daxie Energy and Chemical Co., Ltd. (4.64%) and Jiangsu Shineng Chemical Equipment Co., Ltd. (0.23%). It operates production of PA products, fumaric acid, and carbon dioxide-based degradable plastics.

In Feb. 2023, Shandong Lianxin inked agreement with the government of Dongying City, Shandong Province, to develop an



environmentally friendly PPCP biodegradable plastics project in Hekou District, with investment budget of USD1.41 billion (RMB10 billion) in construction of PA production base, storage centre, carbon dioxide-based biodegradable plastics research centre, and enterprise–university research collaboration and result transformation centre. The project is estimated to occupy an area of 20 ha for phase I construction, including building a base with a capacity of one million t/a for carbon dioxide-based biodegradable plastics. Once the project enters operation, the annual sales income is projected to be USD2.54 billion (RMB18 billion) and profit and tax of USD140.91 million (RMB1 billion), carbon dioxide consumption of 195,000 t/a.

### Industrialisation progress of FDCA in China in Q2

Summary: In Q2, Leaf Biotech closed a RMB200 million series B financing round for developing 2,5-furandicarboxylic acid (FDCA) industrial production, Suzhou CellUranics' proposed bio-based polymer material development project was given a go-ahead, and Panjin Sanli's 300 t/a bio-based furans pilot-scale experiment project was disclosed.

In Q2, China's 2,5-furandicarboxylic acid (FDCA) industry saw key producers making a step forward: Hefei Leaf Biotech Co., Ltd. (Leaf Biotech) obtaining USD28.18 million (RMB200 million) financing for FDCA industrial production, Suzhou CellUranics New Material Technology Co., Ltd. (Suzhou CellUranics) with the bio-based polymer material development project, and Panjin Sanli Zhongke New Material Co., Ltd. (Panjin Sanli) with the 300 t/a bio-based furans pilot-scale experiment project.

#### Leaf Biotech

On 25 June, Leaf Biotech closed USD28.18 million (RMB200 million) series B financing round which was led by Guanzi Capital, followed by Zhonglan Venture Capital, Huagai Capital, Zehui Capital. The proceeds will be used for FDCA industrialisation and to build a 10,000-tonnes-level production line.

Leaf Biotech was set up in July 2014 and has committed to FCDA R&D and industrial production, and the downstream application development and promotion. Its main business include FCDA, 5-Hydroxymethylfurfural (HMF) and the derivatives, with supports of the production technologies developed by the Anhui Province Key laboratory of Biomass Clean Energy, a high-level research institute of University of Science and Technology of China (USTC) focusing on the development of bio-based materials and energy & chemicals. This institute started research on the synthesis route of FCDA monomer in 2010, is China's first scientific group in this area.

Leaf Biotech has set the core technical barriers in the FDCA field in terms of material selection, catalyst system, industrial system, and so on. In 2022, Leaf Biotech launched the world's first FDCA production line of over 1,000 t/a capacity and is now working on the polymerisation of polyethylene 2,5-furandicarboxylate (PEF) and the development and production of PEF bottle, fibre and film and other related products. For 2023, it plans to set up a 10,000-tonnes-level FDCA production line and put it on stream by 2025.

#### Suzhou CellUranics

On 8 June, Suzhou CellUranics' bio-based polymer material development project was publicised with the pre-construction environmental impact assessment statement. The targeted products can be used for the production of Li-ion battery separator and 3D printing materials.



**Project overview:**

- Construction nature: New construction
- Total investment: USD0.28 million (RMB2.00 million), 15% (=USD42,000/RMB300,000) of which for environmental protection
- Location: Suzhou Industrial Park, Suzhou City, Jiangsu Province
- Site area: 596 m<sup>2</sup>
- Targeted product and capacity:
  - Glucaric acid – 100 kg/a;
  - 2,5-Furandicarboxylic acid (FCDA) –1,000 kg/a;
  - Polyester – 100 kg/a;
  - Polyamide –100 kg/a
- Working system: 15 people in 8-hour shift working for 1,920 hours per year
- Construction duration: 1 month

Suzhou Celluranics was set up in March 2023 and is wholly-owned by Jiangsu Celluranics New Material Technology Co., Ltd.

(CellUranics). CellUranics currently has two R&D bases located in Taixin City, Jiangsu Province and Chicago, the US, respectively. In August 2022, CellUranics closes tens of millions RMB of angel financing for developing FDCA synthesis, planning to start up a 5,000 t/a FDCA production facility by 2025 and add 500,000 t/a capacity for commercialised FDCA by 2028.

**Panjin Sanli**

On 28 April, the environmental impact assessment of the 300 t/a bio-based furans pilot-scale experiment project of Panjin Sanli was publicised for the first time for public review.

**Project overview:**

- Location: Panjin Fine Chemical Industry Development Zone, Liaoning Province
- Site & floor area: 4,456 m<sup>2</sup> & 2,206 m<sup>2</sup>
- Main construction plan: reconstruct the existing production lines and supporting facilities and equipment for new capacities of 90 t/a FCDA, 90 t/a 2,5-diformylfuran (DFF), 120 t/a dimethyl furan-2,5-dicarboxylate (FDME)
- Project duration: 2 year, 100 working days per year

Panjin Sanli was founded in July 2018 with a registered capital of RMB450 million and is wholly-owned by Qingdao Benzo New Materials Co., Ltd. (Benzo New Materials) undertaking pilot-scale experiments on new products and production techniques and producing novel materials of refined chemicals for its parent company. Benzo New Materials mainly engages in the R&D, production and sale of special polymer materials, polymerised monomers, and series products made via hydroformylation and nano-gold catalysis.





## Price Update

TABLE 6: Average market prices of major raw materials of bio-based materials in China, April–June 2023

| No. | Product     | Price, USD/t |
|-----|-------------|--------------|
| 1   | Sugarcane   | 165.76       |
| 2   | Corn        | 391.15       |
| 3   | Wheat       | 399.08       |
| 4   | Bagasse     | 42.61        |
| 5   | Corn cob    | 51.29        |
| 6   | Wheat straw | 80.57        |
| 7   | Corn stover | 75.50        |

Source:CCM

TABLE 7: Average ex-works prices of major bio-based materials in China, April–June 2023

| No. | Product                                   | Price, USD/t | Remark                                 |
|-----|---|--------------|--|
| 1   | PHA (Polyhydroxyalkanoates)               | 8,765        | Films                                  |
| 2   | PBS (Polybutylene succinate)              | 4,816        | Extrusion grade and injection moulding |
| 3   | PPC (Propylene carbonate)                 | 3,920        | Injection moulding                     |
| 4   | PLA (Polylactic acid)                     | 3,271        | Injection moulding                     |
| 5   | PVA (Polyvinyl alcohol)                   | 2,092        | Flocculent                             |
| 6   | Starch-based material                     | 3,281        | Film moulding                          |
| 7   | PTT (Polytrimethylene terephthalate)      | 3,420        | Fibre                                  |
| 8   | PBAT (Polybutylene adipate terephthalate) | 2,188        | Film moulding                          |

Source:CCM





## News in Brief

### Bluepha and TotalEnergies Corbion enter cooperation in PLA and PHA development

On 29 May, Beijing Bluepha Microbiology Technology Co., Ltd. (Bluepha) and TotalEnergies Corbion entered strategic cooperative relationship to promote polylactic acid (PLA) and polyhydroxyalkanoates (PHA) application in China. PLA and PHA imply broad application prospects: being made of bio-renewable sources and having excellent degradability, which enable significant reduction of environmental pollution and resource consumption. A wide cooperation from R&D to production and marketing of PLA and PHA, is expected to build a stronger footing of bio-based new materials in China.

TotalEnergies Corbion is a global leader in PLA materials with complete know-how to produce PLA from lactic acid and lactide and to recycle polyesters. It is a joint venture of TotalEnergies and Corbion, each with 50% of holding stakes. It headquarters in the Netherlands and operates a 75,000 t/a PLA production facility in Thailand.

Bluepha is a Chinese pioneer in the PLA industry. It has a facility installed with 5,000 t/a capacity for PHA since Oct. 2022, with an ongoing master project to achieve a total capacity of 25,000 t/a. Compared to general PHA materials, Bluepha™ PHA is superior in crystallisation speed and transparency, which help improve production efficiency and expand the material application range considerably. In April 2023, Bluepha™ PHA series products BP330 and BP335 were certified with OK MARINE, OK SOIL, OK HOME, and OK INDUSTRIAL issued by TÜV Austria, an international testing company. They are the first PHA products awarded with full TÜV-series certifications for biodegradable materials in China.

### Suzhou Sipeng Technology planning biosynthesis and biomaterials application project

On 12 June, the environmental impact assessment of the biosynthesis and bio-based materials application research project of Sipeng Technology (Suzhou) Co., Ltd. (Suzhou Sipeng Technology) was accepted by the government authority.

#### Project overview:

- Construction nature: New construction
- Total investment: USD1.41 million (RMB10 million), 5% (=USD0.07 million/RMB0.5 million) of which for environmental protection
- Location: Science and Technology Park of Zhangjiagang Bonded Area, Zhangjiagang City
- Site area: 1,565 m<sup>2</sup>
- Testing capacity: 500 tests per year
- Working system: 40 workers in three shifts and two 12-hour running systems, for 300 days a year
- Construction duration: 2 months





**TABLE 8:** Facility focuses and capacity

| Item   | Designed testing capacity, batch/year | Main materials  | Annual operating hours |
|--|---------------------------------------|---|------------------------|
| Research on Biosynthesis And Special Devices                                       | 250                                   | Glucose, glycerol, sodium hydroxide, potassium hydroxide, calcium hydroxide, yeast extract powder, corn steep powder, lactic acid | 7,920h                 |
| Research on Biosynthesis and Biocatalysis of General Chemicals                     |                                       |   | 7,920h                 |
| Research on Synthesis and Application of Bio-Based Materials and Polymer Materials | 250                                   | PLA plastic pellet, PBAT plastic pellet, modified starch, natural plant fibres (ramie fibre and sisal fibre)                      | 7,920h                 |

Source: Sipeng Technology (Suzhou) Co., Ltd.

Suzhou Sipeng Technology was set up on 28 Jan., 2023, by Shanghai Sipeng Technology Co., Ltd, a business focusing on synthetic biology techniques for bio-based products. Its parent company has received over USD1.4 million (RMB10 million) financing investment exclusively from 3E Bioventures Capital in an angel round in Sept. 2022, and closed a strategic cooperation framework agreement with Angel Yeast Co., Ltd. for co-development and application of biosynthetic products, special strains culture and production of bio-based commodities, to build a carbon-negative, intelligent biological manufacturing platform at global scale.

### Liangyungang Juwei Yuanchuang to build succinic acid project

Juwei Yuanchuang (Liangyungang) Biotechnology Co., Ltd. (Liangyungang Juwei Yuanchuang) plans 50,000 t/a straw-derived biosynthesis industrialisation project, with the environmental impact assessment first publicised on 22 June.

#### Project overview:

- Construction nature: New construction
- Area: 70,000 m<sup>2</sup>
- Total investment: USD70.46 million (RMB500 million)
- Location: Economic Development Zone of Guannan County, Lianyungang City, Jiangsu Province
- Construction content: Systems for continuous water heating, hydrolytic saccharification, fermentation, purification and packing.
- Production plan: Use bio-fermentation and other techniques to produce 12,000 t/a straw-derive succinic acid (SA), 30,000 t/a humic acid (incl. lignin for hard carbon materials), 7,500 t/a xylose (incl. xylo-oligosaccharide)

Liangyungang Juwei Yuanchuang was set up in May 2023 with a registered capital of RMB100 million. Its parent company Suzhou Juwei Yuanchuang Biotechnology Co., Ltd. focuses on biotransformation and exploitation of non-grain biomass and has founded scale production capacity for SA (polymer-grade, purity≥99.5).

### Homelink proposes USD105.69 million funding for sugarcane bagasse-derived material project

On 9 June, Ningbo Homelink Eco-iTech Co., Ltd. (Homelink, Stock code: 301193.SZ) disclosed the prospectus making a public issuance



of corporate bonds valued up to USD105.69 million (RMB750 million) to non-specified targets. The proceedings will be used to develop the 100,000 t/a degradable sugarcane bagasse (SCB)-derived material project.

**Project overview:**

- Construction nature: New construction
- Total investment: USD141.54 million (RMB1.00 billion), including the USD105.69 million (RMB750 million) funding from bond issuance
- Executive entity: Guangxi Lvlian Biotechnology Co., Ltd., a wholly-owned subsidiary of Homelink
- Location: Henan Industrial Park of Laibin City, Guangxi Zhuang Autonomous Region
- Main construction content: Pulp moulding workshop, automatic stereo warehouse, material room, boiler room, office building and other public utility and supporting facility
- Designed capacity: 100,000 t/a environmental friendly, degradable plant fibre products, derived from SCB and bamboo pulp
- Construction duration: 36 months starting from Nov. 2022

Homelink was established in 2009 and went public on Shenzhen Stock Exchange (SSE) in 2021. Its business contains R&D, production and sale of plastic products, fully biodegradable products and plant fibre products for disposable plastic tableware and houseware.

In 2020–2022, the sales of the company's plastic products accounted for more than 80% of its total primary business revenue.

Nevertheless, such proportion has been on the decline as governments around the world are strengthening restrictions and bans on plastics. In contrast, fully biodegradable products and plant fibre products are catching on. In 2021, the year in which Homelink's plant fibre series debuted, the category raked in USD1.04 million (RMB7.40 million) in sales. In May 2022, Homelink acquired Zhejiang Jiadebao Technology Co., Ltd., a plant fibre product manufacturer which has become a growth engine for the business, driving Homelink's sales of plant fibre series up by USD12.64 million (RMB89.70 million) YoY in 2022; and this category made up 4.54% of the Homelink's total sales in the year.

### CTA and Sugar Energy join hands for bio-based PEF synthesis development

On 14 June, China Textile Academy (CTA) and Zhejiang Sugar Energy Technology Co., Ltd. (Sugar Energy) inked cooperation at the ceremony for the "Bio-based Polyethylene 2,5-Furandicarboxylate (PEF) Synthesis Technology Development Project". According to the signed agreement, the two parties are to co-develop PEF polymerisation technology using 2,5-furandicarboxylic acid (FDCA) as base material, and to commercialise and market PEF products.

Registered in Dec. 2017 and headquartering in Ningbo, Sugar Energy specialises in design and development, production and commercialisation of bio-based furan new materials. At present, the company has founded capacities of 100 t/a FDCA and 200 t/a 5-Hydroxymethylfurfural (HMF), and it is building a 1,000-tonnes-level HMF project of pilot scale with an aim to ramp up its total HMF capacity to 3,000 t/a.

Established in 1956 and wholly-owned by China General Technology Group, CTA is a comprehensive research institute of great influence in China's textile industry. The company strives to develop polyester functionality and integrate new fibre materials, new techniques and





automation in technological development for all-dimensional solutions.

PEF polyester is still a nascent field across the globe. This tie-up of CTA and Sugar Energy aiming to materialise over 10,000 t/a PEF production can push application of furan-containing bio-based materials further in the development of the polyester industry.

### **Xinxiang Chemical to commence Juncao-derived fibre pilot-scale experiment**

On 30 May, the local government publicised the approved environmental impact statement of Xinxiang Chemical Fiber Co., Ltd. (Xinxiang Chemical, stock code: 000949.SZ)'s 5,000 t/a Juncao biomass fibre pilot-scale experiment project. Juncao is a kind of grass typically used to grow edible and medicinal mushrooms and as forage for livestock.

#### **Project overview:**

- Construction nature: New construction
- Total investment: USD14.09 million (RMB100 million)
- Location: Xinxiang Industrial Cluster, Xinxiang City, Henan Province
- Site area: 82,800 m<sup>2</sup>
- Designed product and capacity:
  - Juncao cellulose fibre – 5,000 t/a;
  - Lignin mixture (lignin, polysaccharides, salts, etc.) – 3,530 t/a
- Working system: 100 new employees rotating in three 8-hour shifts per day for 330 days in a year
- Construction duration: 10 months
- Pilot-scale executive plan: This project is to conduct process validation with 12-13 batches for a year to ensure process stability.

Previously in March–Aug. 2022, the company had experimented with a lab-scale production of Juncao-derived fibre and made breakthroughs from raw material processing to product production and wastewater treatment in terms of environmental protection and production technique. In this project, it explored the new material application for cellulose fibres replacing wood with grass in fibre production which could lift China's heavy reliance on imported wood pulp, and it has developed anti-bacteria filament yarn and other new functional cellulose products. Xinxiang Chemical also made methylene diphenyl diisocyanate (MDI) from the by-product Juncao lignin, which is applicable to produce polyurethane fibre, a development conducive to reduce petrochemical-powered polyurethane fibre production.

### **Cathay Biotech's study on lignocellulose-derived D-lactide**

In June, Cathay Biotech Inc. (Cathay Biotech), East China University of Science and Technology and Lund University jointly launched breakthrough scientific results, which was published on *Bioresource Technology*, a journal, titled *Simultaneous and Rate-Coordinated Conversion of Lignocellulose Derived Glucose, Xylose, Arabinose, Mannose, and Galactose into D-Lactic Acid Production Facilitates D-Lactide Synthesis*.

Their study showed a simultaneous and rate-coordinated conversion of lignocellulose-derived glucose, xylose, arabinose, mannose, and galactose into D-lactic acid by adaptively evolved *Pediococcus acidilactici* ZY271 by simultaneous saccharification and co-fermentation





(SSCF) of wheat straw. The produced D-lactic acid achieved minimum residual sugars, high chirality and high titer from a dry pretreatment. This study filled the gap in cellulosic D-lactide production from lignocellulose-derived D-lactic acid, a key hurdle to achieve lignocellulose-derived PLA industrial production, with a conclusion that cellulosic D-lactide and the commercialised starch-derived D-lactide are almost identical in nature.



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