

Bio-based Material Quarterly Newsletter

Q4 2023

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Headline

On 2 Nov., China issued a three-year action plan for promoting the use of bamboo as a substitute for plastics to reduce pollution.

In Q4, Henan Province issued the Non-Degradable Single-Use Plastics Prohibition and Restriction Regulation. Cities such as Puyang and Pingdingshan have acted fast signing a variety of project contracts related to biodegradable materials.

As of Q4, there are updates regarding to BBKA Group's three bio-based material projects, which are 100,000 t/a polylactic acid (PLA) project—completed, the 15,000 t/a lactic acid (LA) and 5,000 t/a acid mixture (incl. 3,000 t/a succinic acid) project—publicised prior to approval, and the 100,000 bio-based polyol project—reapplication approved.

Both Kingfa and Hisun Biomaterials reported growth in total revenue, largely driven by their biodegradable materials sales, but with a drop in net profit in Q1–Q3 2023.

There were some Chinese lactide and PLA related projects announcing progresses made in Q4, including: Langjing New Material's 1,000 t/a PLA project completing trial run, Zhuhai Kingfa's 30,000 t/a PLA project finishing construction, Jiangsu Jinghong's 5,000 t/a lactide line ending commissioning, Jinan Jufukai's PLA and PLA copolymers R&D lab relocation project pending for approval.

In Q4, there are updates on two bio-based nylon projects: Youxian Technology's 50,000 t/a bio-based nylon 66 / nylon 6 chip and fibre construction project pending for approval and Heilongjiang Eppen's nylon 6 continuous polymerisation workshop project publicised with environmental impact assessment details.

In early Oct., Yinguang Group announced its first successful manufacturing of bio-based PDI of 99.5%+ purity at an industrial scale of 1 tonne.

China's government bodies unveiled three bamboo fibre project's construction details, involving Shanying Huazhong's 100,000 t/a, Guangxi Desen's 100,000 t/a (the 1st phase of 300,000 t/a project), and Jiangxi Huazhu's 100,000 t/a (the 1st phase of 300,000 t/a project).

On 17 Nov., Sichuan Siliya's green and high-end cellulose fibre material project (phase I) was accepted with the environmental impact report details disclosed.

On 18 Dec., POLY Materials announced it had raised almost USD28.13 million (RMB200 million) in series B financing round, which would be used in construction of new production lines for CO₂-based polyol.







Editor's Note

Welcome to the Bio-based Material Quarterly Newsletter Q4 2023

Policy

In Q4, China issues the *Three-year Action Plan for Promoting the Development of "Replacing Plastics with Bamboo"* and passed the *Non-Degradable Single-Use Plastics Prohibition and Restriction Regulation of Henan Province* to step up implementation of plastic ban. MIIT released the *Directory for Guiding the Exemplary Application of the First Batch of Key New Materials (2024)* including key performance indices for 6 bio-based materials. The Customs Tariff Commission of the State Council launched the *Tariff Adjustment Plan for 2024* suggesting tariff on PLA imports to resume to 6.5% of most-favoured-nation rate, effective as of 1 Jan., 2024.

Market dynamics & company performance

Kingfa, Hisun Biomaterials and eSun reported growths in both revenue and profit in Q1–Q3 as sales of biodegradable materials grew.

In the polylactic acid (PLA) manufacturing, BBKA Group's Futerro PLA's 100,000 t/a PLA project and Zhuhai Kingfa's 30,000 t/a PLA project completed construction, Langjing New Material's 1,000 t/a PLA product pilot line project passed trial run, Jiangsu Jinghong's 5,000 t/a lactide line completed commissioning, and Jinan Jufukai's PLA and PLA copolymer R&D lab relocation project was pending for approval.

In addition, two bio-based nylon projects of Youxian Technology and Heilongjiang Eppen, and three bamboo fibre projects of Shanying Huazhong, Guangxi Desen and Jiangxi Huazhu were posted with latest progresses. BBKA Group had one 3,000 t/a succinic acid plant and a re-applied 100,000 t/a bio-based polyol project publicised. Sichuan Siliya's high-end cellulose fibre material project (phase I) was accepted. Lishui Guosheng's expansion project for 600 t/a HMF, 400 t/a FDCA and 5 t/a PEF was disclosed with environmental impact assessment information.

Yingguang Group worked out its first one-tonne-scale manufacturing of bio-based PDI of 99.5%+ purity. POLY Materials raised RMB200 million to build new production lines for carbon dioxide polyol. Shanghai Sipeng Technology and Angel Yeast announced to form JV to step up cooperation. Jingshan City Government signed up to build 300,000 t/a bio-based degradable materials project.

Price

In Q4, PLA prices fell slightly, while PHA prices have stood stable.

The USD/CNY exchange rate in this newsletter is USD1.00=CNY7.1104 on 1 Dec., 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

China's three-year plan for promoting alternative use of bamboo to plastics

Summary: On 2 Nov., China issued a three-year action plan for promoting the use of bamboo as a substitute for plastics to reduce pollution.

On 2 Nov., the National Development and Reform Commission, the Ministry of Industry and Information Technology, the Ministry of Finance, the State Forestry and Grass Administration and other departments jointly issued the *Three-year Action Plan for Promoting the Development of "Replacing Plastics with Bamboo"*, setting general targets by 2025 to develop a systematic foundation for the "replacing plastics with bamboo" industry, raise the levels of product quality, diversity, production and comprehensive economic benefits, and boost the market share of key products. The Plan also lists out specific targets to improve the comprehensive added-value of key products by 20%+ and the comprehensive utilisation of bamboo by 20 percentage points from 2022 to 2025.

Seven major areas are highlighted to act on, in a bid to address the current industrial pain spots such as small-scale production, high costs, relatively backward production techniques and equipment.

1. Technological innovation

- Start technological research for breakthroughs in the development of "replacing plastics with bamboo", guide and cultivate national key labs to achieve breakthroughs in generic technologies and major equipment
- Reinforce selection and targeted breeding of good germplasm, and cultivate a wide range of varieties that are adoptable for industrial production of diverse "plastic substitute" products
- Further R&D of bamboo products as plastic substitute, and seek ways to fix natural materials' shortfalls in performance
- Accelerate R&D of advanced manufacturing equipment, optimise production process, and improve the mechanisation level of bamboo harvesting, transportation and processing
- Support enterprises to increase investment in core technology development, transformation of scientific and technological achievements

2. Industrial ecosystem

- Support cultivation of family forest farms, cooperatives and other large-scale business entities in the main bamboo growing areas, and setup of professional teams in bamboo growing, management and harvesting
- Encourage development of whole industrial chain from raw materials to processing, product production, and marketing, and cultivation of industrial leaders in main bamboo growing areas, to raise the standardisation and concentration levels of the "replacing plastics with bamboo" industry
- Promote the development of circular bamboo economy through higher level of recycling of bamboo processing waste and promotion and application of bamboo material utilisation technologies and equipment

3. Production-distribution link

- Host relevant forums and dialogues to increase the interaction of governments and enterprises and the cooperation of universities and industries, in fighting against plastic pollution in commerce circulation industries
- Carry out bamboo product promotional events that link up production and distribution in major bamboo growing areas, to guide supply-demand collaboration and stimulate bamboo products consumption on the trend of green production and lifestyle.

4. Key application scenes



- Launch a catalogue of major "replacing plastics with bamboo" products for targeted application scenes that is based on the industrial development state and meets market demand, along with promotional action to lift up the proportion of bamboo substitution to plastics
- Encourage the use of bamboo-based shopping bags, stationery, tableware, furniture, etc. in the daily necessities and cultural and tourist industries; use of bamboo winding composite materials, bamboo-grid packing, bamboo-based car interior decoration products, bamboo-based packaging materials in industrial manufacturing; use of bamboo winding composite materials pipelines and pipes, bamboo grills, bamboo board, etc. in the fields of construction and building materials

5. Pilot application areas

- Select bamboo-abounded regions with good bamboo industrial infrastructure, and construct 5 to 10 pilot bases to carry out technological research and development, as well as works like product standard drafting and branding pivoting on "replacing plastics with bamboo", to fortify the local strength in "replacing plastics with bamboo"
- Explore opportunities of "replacing plastics with bamboo" in local public institutions, public transport system, trade circulation, food catering and accommodation, and postal express delivery; study successful typical cases and adopt advanced models that are replicable and scalable

6. Public-facing promotion and guideline

- Amp up publicity and public education of "replacing plastics with bamboo" and call for green production and consumption through multiple measures including traditional and new media
- Encourage local organisations to hold activities to disseminate the idea of "replacing plastic with bamboo" to communities, business districts and public institutions, including the upsides of bamboo substitution to plastics, the environmental risks caused by non-conforming use of plastic products; and lead the public into a lifestyle with reduced consumption of disposable plastic products and increased use of bamboo products

7. International exchanges and cooperation

- Encourage, under the guideline of the Belt and Road Initiative, domestic enterprises to "go out" and work with International Bamboo and Rattan Organization (INBAR), support them to operate in countries with relatively abundant bamboo resources to develop the local bamboo industry to phase out plastics, and create international brands and develop Sino-foreign production projects
- Support international talent trainings and exchanges and strengthen the publicity and implementation of relevant standards and certification systems to facilitate international trade.

Henan issues non-degradable single-use plastics prohibition and restriction regulation

Summary: In Q4, Henan Province issued the *Non-Degradable Single-Use Plastics Prohibition and Restriction Regulation*. Cities such as Puyang and Pingdingshan have acted fast signing a variety of project contracts related to biodegradable materials.

Henan is one of the provinces in China actively promoting biodegradable material industry over the recent period. To spread the "plastic ban", Henan issued the *Non-Degradable Single-Use Plastics Prohibition and Restriction Regulation* (the Regulation). Cities such as Puyang and Pingdingshan have acted fast in this effort, signing a variety of project contracts related to biodegradable materials.

New rules of Henan's "plastic ban"

Passed on 30 Nov., the Regulation is taking place in 1 Jan., 2024. It comprises of prohibitions and restrictions on the production, sale, and use of non-degradable single-use plastics (including non-degradable disposable plastic products, cutlery, parcel package) and directory



managing system for prohibitive and restrictive plastic products. These aim not only to fortify ban on plastics across the province, also to boost local demand for degradable plastics to the extent that the degradable will replace the disposable plastics and manufacturers could ramp up their degradable plastic production progressively.

Four bio-based material projects recently signed in Nanle County, Puyang City

On 27 Oct., the 3rd China (Puyang·Nanle) Biodegradable Material Industry Development Conference opened. Four bio-based material projects were signed on site by the local Government of Nanle County, accounting for a total investment of USD762.26 million (RMB5.42 billion):

- A polylactic acid (PLA) project, in cooperation with East China Engineering Science and Technology Co., Ltd. (stock code: 002140.SZ)
- A 50,000 t/a PLA fibre project, in cooperation with Ma'anshan Tong-Jie-Liang Biomaterials Co., Ltd.
- An agri-waste comprehensive utilisation project, in cooperation with ECO Zhuoxin Energy-saving Technology (Shanghai) Co., Ltd.
- A biomass saccharification and high-value-added fermentation project, in cooperation with Henan Chemical Electric Science and Technology Corporation

As a biodegradable material industrial cluster in Puyang, Nanle boasts 2.13-km² area for high-standard bio-manufacturing and 2.5-km² area of biomass industrial parks. The county has also established China's one and only complete biodegradable material industrial chain, now contributing a total of 800,000 t/a capacity for a wide range of bio-based products with globally competitive breakthrough "lactide-PLA" production technology that cuts cost by a large margin.

The signing of four projects shows Puyang's commitment to leverage its advantageous establishment of biodegradable material industrial chain, to double down on the areas of weakness such as lactide, polyhydroxyalkanoates (PHA) and polytetrahydrofuran and to expand to modern medical materials, fibre products, etc. With the objective to scale up end-use product production, the city targets to raise garbage and shopping bags capacity to 60,000 t/a and degradable meal box capacity to 13,000 t/a by 2025, in response to the provincial "plastic ban".

Cooperative bio-based new material industrial base in Pingdingshan City

On 22 Dec., the local Government of Pingdingshan City signed a four-party strategic cooperation agreement with Zhongyuan Yuzi Investment Holding Group (Yuzi Investment Group), State Power Investment New Life Town Technology Co., Ltd. (SPINLTown), China BBKA Group Corporation (BBKA Group). Their cooperation is to start a project building a bio-based new material industrial base that connects the whole industrial chain from straw-derived sugar, to lactic acid, polylactic acid (PLA) and the modified products in Pingdingshan, Henan. BBKA Group's technology to produce PLA with mixed sugar and by-product fulvic acid that are derived from straw, reed, tree twigs and other agricultural and forestry wastes through enzymatic hydrolysis will be adopted in the project.

Fulvic acid can be use in efficient organic fertiliser for improving farmland condition. Mixed sugar is an ingredient of lactic acid for lactide and further production of PLA, modified PLA, and degradable plastic products, and can be processed into biomass ethanol for bio-jet fuel,





partly substituted for oil energy.

Yuzi Investment Group is a state-owned financing company focused on major technology and innovation, and strategic emerging industries in Henan. SPINLTown is a joint venture of China Power International Development Limited and New Life Town Group, committed to county-wide agricultural resource integration and exploration, low-carbon technology application, new energy, and integration of primary, secondary and tertiary industries for rural revitalisation purpose. Such cooperation is of great importance to boost the local non-grain bio-based new material PLA industry and high-value-added utilisation of agricultural and forestry wastes, and resolve difficulties like low level of straw reclamation during the premiumisation and green development of provincial bio-based industries.



Market Analysis

BBCA Group's bio-based material project progresses in Q4

Summary: As of Q4, there are updates regarding to BBCA Group's three bio-based material projects, which are 100,000 t/a polylactic acid (PLA) project—completed, the 15,000 t/a lactic acid (LA) and 5,000 t/a acid mixture (incl. 3,000 t/a succinic acid) project—publicised prior to approval, and the 100,000 bio-based polyol project—reapplication approved.

China BBCA Group Corporation (BBCA Group)'s three bio-based material projects attained progresses for construction in Q4, undertaken by three subsidiaries respectively.

1. The 100,000 t/a polylactic acid (PLA) project

On 21 Nov., Anhui BBCA Biochemical & Futerro PLA Co., Ltd. (Futerro PLA)'s 100,000 t/a PLA project was completed with publicised details as follows:

- Construction nature: New construction
- Location: Economic Development Zone of Guzhen County, Bengbu City, Anhui Province
- Total investment: USD49.22 million (RMB350.00 million), 2.66% (=USD1.31 million/RMB9.31 million) of which for environmental protection
- Site area: 33,133 m²
- Construction content: PLA workshop and the public and auxiliary utilities
- Designed capacity: 100,000 t/a PLA
- Main material consumption: 121,423 t/a Self-produced lactic acid
- Production route: "Two-step" approach (microwave heating and conventional heating in the ring-opening polymerisation (ROP) of lactide)
- Construction period: broke ground in Nov. 2019 and entered trial production in Oct. 2022
- This project was originally designed for 70,000 t/a PLA and 30,000 t/a PLA fibre. However, under the comprehensive consideration of market and economic changes, the designed process for 30,000 t/a PLA fibre is cut down to 30,000 t/a PLA, making this project's total capacity to 100,000 t/a PLA.

Futerro PLA was set up in April 2018 with a registered capital of RMB189 million, and it primarily operates in R&D, production and sale of PLA and the related materials and products.

2. The 15,000 t/a lactic acid (LA) and 5,000 t/a acid mixture project

On 10 Nov., the Ecology and Environment Bureau of Guzhen County disclosed Anhui Xingguang Biotechnology Co., Ltd. (Xingguang Biotech)'s pre-construction environment assessment statement of the 15,000 t/a LA and 5,000 t/a acid mixture project prior to approval granting, and details are as follows:

- Construction nature: Reconstruction
- Location: Economic Development Zone of Guzhen County, Bengbu City, Anhui Province
- Total investment: USD7.74 million (RMB55.00 million), 0.54% (=USD42,192/RMB300,000) of which for environmental protection
- Site area: 6.6 ha, no extra land to be taken
- Construction content: Reconstruct the installed ferric phosphate (FePO₄) production line (a part of Xingguang Biotech's project of anode materials for lithium iron phosphate-based battery), and purchase a series of production equipment





- Designed capacity:
 - Main product: 15,000 t/a LA and 5,000 t/a acid mixture
 - By-product: 3,000 t/a succinic acid and 3,000 t/a calcium malate

Xingguang Biotech was founded in Aug. 2016 with a registered capital of RMB105 million, and it primarily operates in R&D, production and sale of bio-based materials, food and feed additives.

3. The 100,000 t/a bio-based polyol project (reapplied project)

On 2 Nov., Anhui Huaihai Biotechnology Co., Ltd. (Huaihai Biotech)'s reapplication of the environmental impact statement of the 100,000 t/a bio-based polyol project was approved by the Ecology and Environment Bureau of Bengbu City, Anhui Province, and details are as follows:

- Construction nature: New construction
- Location: Economic Development Zone of Guzhen County, Bengbu City, Anhui Province
- Total investment: USD53.16 million (RMB378.00 million), 2.12% (=USD1.13 million/RMB8.00 million) of which for environmental protection
- Site area: 18,333.33 m²
- Construction content: Purchase and install production and supporting equipment in the rental factory buildings, and build storage house and public and auxiliary utilities
- Designed capacity: 100,000 t/a bio-based polyols—90,000 t/a lactide polyol and 10,000 t/a polycarbonate polyol

Huaihai Biotech was founded in Sept. 2021 with a registered capital of RMB50 million, and it mainly operates in R&D, production and sale of LA, PLA series products, amino acid series products, and other bio-based materials.

Q1–Q3 2023 Financial reports of Kingfa and Hisun Biomaterials

Summary: Both Kingfa and Hisun Biomaterials reported growth in total revenue, largely driven by their biodegradable materials sales, but with a drop in net profit in Q1–Q3 2023.

In late Oct., Kingfa Sci. & Tech. Co., Ltd. (Kingfa, stock code: 600143.SH) and Zhejiang Hisun Biomaterials Co., Ltd. (Hisun Biomaterials, stock code: 688203.SH) launched their three-quarter reports for 2023. Both cited that the increased sales of biodegradable materials were the main driver for their revenue growths, though it came with a drop in net profit.

Kingfa's key data in Q1–Q3 2023

Q1–Q3:

- Revenue: USD4.82 billion (RMB34.29 billion), up 16.97% YoY
- Net profit attributable to the parent company: USD68.12 million (RMB484.34 million), down 59.75% YoY
- Net profit after excl. extraordinary gains/losses: USD48.47 million (RMB344.66 million), down 63.10% YoY

Q3:

- Revenue: USD1.96 billion (RMB13.94 billion), up 41.56% YoY
- Net profit attributable to the parent company: USD2.15 million (RMB15.27 million), down 96.19% YoY
- Net loss after excl. extraordinary gains/losses: -USD1.27 million (-RMB9.02 million), a 103.89% change from the positive number of





the same period last year

- The over 40% revenue growth in Q3 was contributed by the increased sales of green petrochemicals after its new production unit for acrylonitrile butadiene styrene (ABS) plastics started up in H2 2022, whilst the net profit fall occurred as a consequence that both its green petrochemicals and medical & health sectors saw contracted net profits, and inventory and asset were written down by the end of Q3.

Core business performance: Sales of modified plastics and new materials, however, hit record in the three quarters. In Q1–Q3, Kingfa's modified plastics sales rose by 16.37% YoY to 1.48 million tonnes, and finished new materials products sales grew by 42.32% YoY to 124,100 tonnes—fully biodegradable plastics sales have exceeded the last-year total of 98,500 tonnes to 100,600 tonnes, up by 45.59% YoY.

At present, Kingfa has a totally 180,000 t/a capacity for PBAT/PBS and 30,000 t/a for polylactic acid (PLA) resin. It is promoting R&D on bio-based monomers and materials and is constructing a 10,000 t/a bio-based 1,4-butanediol (BDO) project expected to turn operational by the end of 2023.

Hisun Biomaterials' key data in Q1–Q3 2023

Q1–Q3:

- Revenue: USD77.36 million (RMB550.05 million), up 14.88% YoY
- Net profit attributable to the parent company: USD5.24 million (RMB37.28 million), down 11.3% YoY
- Net profit after excl. extraordinary gains/losses: USD4.65 million (RMB33.05 million), up 19.64% YoY

Q3:

- Revenue: USD30.45 million (RMB216.49 million), up 22.89% YoY
- Net profit attributable to the parent company: USD2.47 million (RMB17.53 million), down 15.17% YoY
- Net profit after excl. extraordinary gains/losses: USD2.17 million (RMB15.42 million), up 60.85% YoY
- The over 20% revenue growth resulted from the increased sales of PLA and modified PLA products; while deducted government subsidy and gain from disposal of intangible assets in Q3 led to a reduced net profit attributable to the parent company, but an improved net profit after excl. extraordinary gains/losses.

PLA project progresses: Hisun Biomaterials has built a 65,000 t/a designed capacity for PLA according to latest data. Its subsidiary Zhejiang Honor Biomaterials Co., Ltd. has completed the commissioning in the 2nd phase of the 20,000 t/a PLA production line project, which enables it to produce PLA continuously. Its another subsidiary Zhejiang Haichuangda Biomaterials Co., Ltd. has completed most of the structure construction of the 150,000 t/a PLA project which is scheduled to enter operation by H2 2024.

Chinese lactide and PLA related project progress update

Summary: There were some Chinese lactide and PLA related projects announcing progresses made in Q4, including: Langjing New Material's 1,000 t/a PLA project completing trial run, Zhuhai Kingfa's 30,000 t/a PLA project finishing construction, Jiangsu Jinghong's 5,000 t/a lactide line ending commissioning, Jinan Jufukai's PLA and PLA copolymers R&D lab relocation project pending for approval.





In Q4 2023, a crop of Chinese lactide and polylactic acid (PLA) related companies updated their project progresses, including Shandong Langjing New Material Technology Co., Ltd. (Langjing New Material), Zhuhai Kingfa Biomaterial Co., Ltd. (Zhuhai Kingfa), Jiangsu Jinghong New Materials Technology Co., Ltd. (Jiangsu Jinghong), and Jinan Jufukai Biotechnology Co., Ltd. (Jinan Jufukai).

Langjing New Material: 1,200 t/a lactide and 1,000 t/a PLA product pilot line project

In late Sept., the company completed trial run of the newly built PLA-related capacities. This has made it the first manufacturer in Shandong to put PLA production on an industrial scale.

Project details:

- Construction nature: New construction
- Total investment: USD14.06 million (RMB100 million), USD843,800 (RMB6 million) of which for environmental protection
- Location: Zibo Science and Technology Industry Park, Fangzhen Town, Zhangdian District, Zibo City, Shandong Province
- Main construction plan: one production line for 1,200 t/a lactide and 1,000 t/a PLA new material, using L-lactic acid as feedstock to produce lactide which is for sale and for the subsequent PLA production.

Langjing New Material was founded in Nov. 2020 with a registered capital of RMB100 million. Prior to this project, the company had kicked start the operation of a 100 t/a "lactic acid—lactide—PLA" pilot production line at the start of 2021. In Nov. 2021, it received investment from Singapore-based SP Chemicals Pte Ltd. to scale up its manufacturing production. In this April, the abovementioned production line was installed and entered commissioning.

Zhuhai Kingfa: 30,000 t/a PLA polymerisation and modification project

On 24 Dec., Zhuhai Kingfa obtained environmental clearance for its completed construction of the 30,000 t/a PLA polymerisation and modification project.

Project details:

- Construction nature: Expansion
- Total investment: USD41.83 million (RMB297.43 million), 0.54% (=USD2.11 million/RMB15 million) of which for environmental protection
- Location: Jinwan District, Zhuhai City, Guangdong Province
- Site area: 5,819 m²
- Acceptance of content: 30,000 t/a PLA unit using lactide as feedstock—the annual output of 12,000 tonnes is for sale and 18,000 t/a for subsequent processing of PLA modified materials
- Working system: 150 new employees in 3 three shifts for 300 days per year
- Construction period: Nov. 2022–Aug. 2023
- On-site monitoring: 31 Aug.–30 Aug., 2023; 4 Dec.–5 Dec., 2023

Zhuhai Kingfa is owned by Kingfa Sci. & Tech. Co., Ltd. (Kingfa, stock code: 600143.SH).

Jiangsu Jinghong: 5,000 t/a lactide line engineering

On 18 Dec., Jiangsu Jinghong notified that its first phase engineering of the 55,000 t/a PLA and equipment manufacturing project—the 5,000 t/a lactide line, had completed commissioning, and the 5,000 t/a PLA line is under construction scheduled for commissioning in early 2024.



**Whole project details:**

- Construction nature: New construction
- Total investment: USD84.38 million (RMB600 million), 5.06% (=USD4.27 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 content (over two stages): one 5,000 t/a PLA production line in phase I and one 500,000 t/a PLA production line in phase II
- Working system: 55 employees—20 in phase I and 35 in phase II in three eight-hour shifts
- Operation hours: 300 days or 7,200 hours per year
- Designed start of operation: Phase I in H1 2024 and Phase II in 2025

Jiangsu Jinghong was established in Aug. 2001 with a registered capital of RMB50 million. It is specialised producer of PET chips, polyethylene terephthalate glycol (PETG) shrinkable films for food & beverage, labelling materials, Li-ion battery separators.

Jinan Jufukai: PLA and PLA copolymers R&D lab relocation project

On 13 Dec., Jinan Municipal Ecology and Environment Bureau publicised the environmental impact statement of Jinan Jufukai's PLA and PLA copolymers R&D lab relocation project before granting approval.

Project details:

- Construction nature: New construction (relocation construction)
- Total investment: USD703,200 (RMB5 million)
- Location: High-Tech Zone of Jinan City, Shandong Province
- Site area: 827 m²
- Number of annual lab experiments: 780 experiments—260 of lactide preparation, 260 of polymerisation of PLA and PLA copolymers, and 260 of testing
- Working system: 12 employees in one 8-hour shift for 2,080 hours or 260 days per year
- Construction duration: 4 months

Jinan Jufukai was incorporated in May 2010 with a registered capital of RMB300,000.



Company Dynamics

Update on Chinese bio-based nylon projects

Summary: In Q4, there are updates on two bio-based nylon projects: Youxian Technology's 50,000 t/a bio-based nylon 56 / nylon 66 chip and fibre construction project pending for approval and Heilongjiang Eppen's nylon 56 continuous polymerisation workshop project publicised with environmental impact assessment details.

In Q4, there are updates on two bio-based nylon projects as below.

Youxian Technology (Dandong) Co. Ltd. (Youxian Technology)

On 27 Oct., the Ecology and Environment Bureau of High-Tech Zone Branch of Dandong City publicised Youxian Technology's 50,000 t/a bio-based nylon 56 / nylon 66 chip and fibre construction project before granting approval.

Project details:

- Construction nature: Expansion
- Total investment: USD38.08 million (RMB270.75 million)
- Location: Hi-Tech Industrial Development Zone of Dandong City, Liaoning Province
- Area: 15,069 m² (the existing site area) & 30,070 m² (new floor area)
- Construction content and capacity: Add one 50,000 t/a production line for bio-based nylon 56 / nylon 66 chips and fibres, PA56/PA66 filament production unit, production workshop, storage house, boiler room and other supporting facilities
- Main material consumption: Nylon 56 salt and nylon 66 salt (all out-sourced)
- Working system: 95 New workers in three 8-hour shifts for 333 days per year
- Construction period: 24 months starting from Oct. 2025

Youxian Technology was founded in 2013 with a registered capital of RMB100 million. Currently, the company has 20,000 t/a capacity for bio-based nylon 56 fibres (nylon 56 and nylon 56 short fibre).

TABLE 1: Youxian Technology's product scheme

Product	Type	Capacity, t/a
Bio-based nylon 56 / nylon 66	Chip	8,000
	Fibre	12,000
PA56/PA66 Filament		30,000

Note: Nylon 56 chip and fibre will make up 50%–60% and nylon 66 chip and fibre, 40%–50%.

Source: Environmental impact report of 50,000 t/a bio-based nylon 56 / nylon 66 chip and fibre construction project

Heilongjiang Eppen New Material Co., Ltd. (Heilongjiang Eppen)

On 27 Nov., details of the pre-construction environmental impact assessment on Heilongjiang Eppen's nylon 56 continuous polymerisation workshop project were posted.

**Project details:**

- Construction nature: Expansion
- Investment: USD12.94 million (RMB92 million), USD154,703 (RMB1.1 million) of which for environmental protection
- Location: Dorbod Mongol Autonomous County, Daqing City, Heilongjiang Province
- Area: 1,710 m² (the existing site area)
- Construction content: Add one nylon 56 chip workshop and nitrogen-making facility, and supporting facilities
- Designed capacity: 10,000 t/a nylon 56 chip—3,000 t/a engineering plastics, 7,000 t/a spinning grade
- Main material consumption: Nylon 56 salt solution (self-produced)
- Core technology: The production technology route is corn—lysine—PDA—nylon 56 salt—nylon 56 chip series products, developed by Institute of Microbiology, Chinese Academy of Sciences
- Working system: 40 new workers in four 8-hour shifts for 330 days per year
- Construction period: May 2024—Aug. 2024

Heilongjiang Eppen was founded in April 2019 and is wholly owned by Ningxia EPPEN Biotech Co., Ltd. This nylon 56 continuous polymerisation workshop is a part of the company's bio-based pentamethylene diamine (PDA) and nylon 56 project that has put in place capacities for 1,5-PDA (10,000 t/a), nylon 56 salt solution (10,000 t/a), and potassium sulphate (3,300 t/a).

Yinguang Group announces successful pilot PDI production

Summary: In early Oct., Yinguang Group announced its first successful manufacturing of bio-based PDI of 99.5%+ purity at an industrial scale of 1 tonne.

In early Oct., Gansu Yinguang Chemical Industry Group Co., Ltd. (Yinguang Group) announced that it had successfully manufactured the first batch of bio-based pentamethylene diisocyanate (PDI) of 99.5%+ purity at an industrial scale of 1 tonne. This pilot production of PDI adopted Yinguang Group's proprietary phosgene-process PDI synthesis technology. It means that China now acquires the industrial capacity for PDI product, a great driver for the domestic isocyanate industry development.

PDI is a new bio-based aliphatic isocyanate, mostly prepared through phosgenation of 1,5-pentanediamine (PDA) and made at high heating steam pressure into PDI biuret or tripolymer. It has good mechanical properties, chemical stability and light- and weather-resistance, applicable for a myriad of products such as premium coating, elastomers and adhesives. As the low-carbon recycling economy catches on a global scale, PDI suggests a prospective market to tap given its low-carbon and environmentally friendly features.

Global PDI industry

PDI research and development can date back to 2000, led by BASF SE, Germany-based Covestro AG and Japan-based Mitsui Chemicals Inc. In 2015, the first commercial batch of PDI products entered market. The world's first plant-derived isocyanate (STABIO™ PDI™) and the PDI-based polyisocyanate curing agent were developed by Mitsui Chemicals. Covestro's preparation of PDI includes bio-fermentation of non-grain starch sugar for lysine, and then decarboxylase catalyse of lysine for PDA. Covestro's PDI products meet the technical requirements for track vehicles, having superior gloss stability and abrasion resistance than 1,6-hexamethylene diisocyanate (HDI) and selling mainly to Europe.

China's PDI development



In China, the study of PDI started late, initially being led by Yinguang Group. The company is 100% owned by China North Industries Group Corporation (NORINCO) as one of NORINCO's production site for polyurethane (PU) materials and energetic materials.

Since 2019, Yinguang Group has worked with universities and downstream companies in bio-based PDI industrial chain development, playing out its well-established technical strength and scientific research achievements. A R&D team was set up and had conducted 12-month lab-scale experiments. In 2020, the team materialised kilo-level PDI production and developed a process for a larger production. In May 2023, Yinguang Group's subsidiary Gansu Yinguang Juyin Chemical Industry Co., Ltd. (Yinguang Juyin) founded a PDI research institute which kicked start the pilot production abovementioned in July. Currently, the research team is focusing on PDI distillation for the 2nd-batch production and collecting testing data for future scale-up. The next stage is to tackle down the bottleneck problems in continuous phosgenation reaction and improve product quality, to facilitate construction of 10,000-tonne-level PDI production unit and downstream application research and development.

Previously in 2022, Wanhua Chemical Group Co., Ltd. (Wanhua Chemical) launched the world's first thermoplastic polyurethane (TPU) product with a bio-content range up to 98% that is made from 100% biomass-sourced raw materials.

Being a late starter, China is catching up in bio-based PDI research and development which could be fuelled up by the rapidly growing bio-based material market with gradually ramp-up production of bio-based PDA materials at home.

Three bamboo fibre projects' planning unveiled in Q4

Summary: China's government bodies unveiled three bamboo fibre project's construction details, involving Shanying Huazhong's 100,000 t/a, Guangxi Desen's 100,000 t/a (the 1st phase of 300,000 t/a project), and Jiangxi Huazhu's 100,000 t/a (the 1st phase of 300,000 t/a project).

Recent period has seen Chinese manufacturers ramping up the bamboo fibre and related products production. In Q4, three bamboo fibre projects' planning was disclosed as listed below.

Shanying Huazhong Paper Industry Co., Ltd. (Shanying Huazhong)'s 100,000 t/a bamboo fibre project was approved by the Ecology and Environment Bureau of Jingzhou City on 8 Oct., and is under construction.

- Construction nature: Reconstruction
- Reconstruction purpose: Exploit the nearby bamboo resource as one of the fibre sources for pulping, to ease material shortage, cut cost, and improve the company's comprehensive competitiveness. The planned 100,000 t/a bamboo pulping line (using mechanical vapor recompression/MVR technology) is to replace part of the existing waste paper pulping capacity which will reduce to 370,000 t/a from 470,000 t/a.
- Total investment: USD18.90 million (RMB134.40 million), 3.68% (=USD0.70 million/RMB4.95 million) of which for environmental protection
- Location: Qingji Industrial Park, Economic Development Zone of Gong'an County
- Site area: 2,137,700 m² (the existing area, no extra land to be taken)
- Construction content: Reconstruct the existing warehouse into a bamboo fibre production line and MVR concentration station; add alkali liquor tank field, bamboo staging area, and other transport engineering; use of other environmental protection engineering and public utilities rely on the existing facilities





- Raw and auxiliary materials: Bamboo piece, reed, agri-wastes, sodium hydroxide
- Working system: 30 Currently-employed workers; production units will be running for 6,000 hours per year
- Construction period: Oct. 2023 to Aug. 2024

Founded in Jan. 2017 with a registered capital of RMB5.02 billion, Shanying Huazhong is wholly owned by Shanying International Holding Co., Ltd. (Shanying International, stock code: 600567). Shanying International is one of the leading Chinese paper-making companies having operations throughout the industrial chain from waste paper collection to production of package paper, paperboard and cardboard, and capable of producing 7 million tonnes of paper and 1 billion of board paper and cardboard per year.

Guangxi Desen Wood Industry Co., Ltd. (Guangxi Desen)'s 100,000 t/a capacity construction plan was approved to progress by the Administrative Examination and Approval Bureau of Luzhai County on 4 Dec. It is the 1st phase (detailed as follows) of the company's 300,000 t/a bamboo fibre project, while the 2nd phase is to build a 200,000 t/a line.

- Construction nature: New construction
- Total investment: USD8.44 million (RMB60.00 million), 2.08% (=USD0.18 million/RMB1.25 million) of which for environmental protection
- Location: Luzhai County, Liuzhou City, Guangxi Province
- Site area: 90,801.6 m²
- Construction content: One line for bamboo fibre production and deep-processing
- Designed capacity:
 - 100,000 t/a Bamboo fibre
 - 85,000 t/a Degradable agricultural film
 - 10,000 t/a Degradable food container
 - 45,000 t/a Lignin
- Raw and auxiliary materials: Fresh bamboo leaves, sodium hydroxide, hydrogen peroxide (H₂O₂), adhesives
- Working system: 50 Workers in two 8-hour shifts for 4,800 hours or 300 days per year
- Construction duration: 4 Months

Founded in April 2022 with a registered capital of RMB20 million, Guangxi Desen operates in the processing and sale of wood and bamboo materials and related products.

Jiangxi Huazhu New Material Technology Co., Ltd. (Jiangxi Huazhu)'s 100,000 t/a capacity construction plan was accepted on 7 Dec. It is the 1st phase (detailed as follows) of the company's 300,000 t/a bamboo fibre project.

- Construction nature: New construction
- Total investment: USD140.64 million (RMB1.00 billion), 2.15% (=USD3.02 million/RMB21.50 million) of which for environmental protection
- Location: Anyuan County, Ganzhou City, Jiangxi Province
- Site area: 19,582.53 m²
- Construction content: Main structures (preparation room, desugaring and degumming workshop, wiredrawing workshop), ancillary works, storage and transport engineering, environmental protection engineering and public utilities
- Designed capacity: 100,000 t/a Bamboo fibre, under the regulation for non-woven fabric stipulated in the national standard of Bamboo Fiber (GB/T41553-2022)
- Working system: 150 Workers in three 8-hour shifts per day for 340 days in a year



- Construction duration: 6 Months

Founded in Oct., 2022 with a registered capital of RMB37.50 million, Jiangxi Huazhu primarily operates in R&D, production and sale of bio-based materials.

Sichuan Siliya's high-end cellulose fibre material project (phase I) accepted

Summary: On 17 Nov., Sichuan Siliya's green and high-end cellulose fibre material project (phase I) was accepted with the environmental impact report details disclosed.

On 17 Nov., Sichuan Siliya Fiber Technology Co., Ltd. (Sichuan Siliya)'s green and high-end cellulose fibre material project (phase I) was accepted with the environmental impact report details disclosed. The whole project is designed to occupy an area of 49.13 ha (737 mu) and form capacities of 80,000 t/a viscose staple fibre and 250,000 t/a Lyocell staple fibre.

Phase I plan:

- *Construction nature: New construction*
- *Location: Fuxi Industrial Park, Gaoxian County Industrial Zone, Yibin City, Sichuan Province*
- *Investment: USD421.92 million (RMB3.0 billion)*
- *Main construction content (over two stages): one 80,000 t/a viscose staple fibre line in 1st stage and two 50,000 t/a Lyocell staple fibre line in 2nd stage*
- *Working system: 1,060 workers in 4 shifts and three 8-hour running system for 8,000 hour each year*
- *Construction schedule: 1st stage to start operation in Dec. 2023 and 2nd stage to start up by the end of 2024*
- *Product quality standard:*
 - *Viscose staple fibre, applicable to high clean non-woven fabrics, should be in compliance with the quality control standards for viscose staple fibre products determined by downstream enterprises in the absence of effective rules as the National Standard for Viscose Staple Fibre (GB/T 14463-2008) is invalid.*
 - *Lyocell staple fibre, cross-linked, should be in compliance with the requirements for premium-grade products stipulated in Industrial Standard for Lyocell Staple Fiber (FZ/T52019—2018).*

TABLE 2: Sichuan Siliya's product scheme

Category	Product	Specification	Capacity, t/a
Main products	Viscose staple fibre	1.33 dtex×38mm, 1.11 dtex×38mm, 1.67 dtex×38mm (produced to market demand)	80,000
	Lyocell staple fibre		100,000
By products	Concentrated sulfuric acid	98% concentration	516
	Sodium sulfate	/	48,000
	Sodium hydrosulfide	35% concentration	13,022

Source:EI report of the green and high-end cellulose fibre material project (phase I)

TABLE 3: Sichuan Siliya's viscose staple fibre quality indices

No.	Item	Range
1	Dry strength, cN/dtex	2.2±0.2
2	Wet strength, cN/dtex	-
3	Dry elongation, %	20±5
4	Wet elongation, %	-
5	Sulphur content (via lead acetate + hydrogen sulphide reaction), mg/100g fibre	≤5
6	Size deviation, %	≤6
7	Length variation, mm	≤2
8	Whiteness (ISO2470), %	≥85

Source:EI report of the green and high-end cellulose fibre material project (phase I)

TABLE 4: Sichuan Siliya's Lyocell staple fibre quality indices

No.	Item		Cross linked type		
			Premium grade	First grade	Qualified product
1	Dry strength, cN/dtex	≥	3.3	3	2.8
2	Wet strength, cN/dtex	≥	2.8	2.5	2.3
3	Wet modulus, (cN/dtex)/5%	≥	1	1	0.8
4	Dry elongation, %	/	M2±1.5	M2±2.5	M2±3.5
5	Variation coefficient of dry strength, %	≤	18	-	-
6	linear density deviation rate, %	±	4	7	11
7	Length deviation rate, %	±	4	7	11
8	Percentage of overlength fibre, %	≤	0.5	1	2
9	Multiple length fibre, mg/100g	≤	4	10	30
10	Defect, mg/100g	≤	5	15	30



11	Oiled yellowish fibre, mg/100g	≤	/	5	20
12	Whiteness, %	≥	M3±3	-	-
13	Wet abrasion number	≥	350	300	300

Note: M2 refers to the central value of the elongation of the cross-linked fibre, which shall not be less than 11.5%;

M3 refers to the central value of whiteness which shall not be less than 70%.

Source: Lyocell Staple Fibre (FZ/T52019—2018)

Sichuan Siliya was founded in Sept. 2022 with a registered capital of RMB1.6 billion and it is a wholly-owned company of Yibin Grace Group Co., Ltd. (Grace Group). Grace Group, established in 1984, is a state-owned specialised supplier of bio-based cellulose filament and stable fibres. In 2022, its revenue reached USD4.95 billion (RMB35.2 billion), up 15% YoY and its gross industrial output accounted to USD2.59 billion (RMB18.4 billion).

POLY Materials raises RMB200 million in series B financing

Summary: On 18 Dec., POLY Materials announced it had raised almost USD28.13 million (RMB200 million) in series B financing round, which would be used in construction of new production lines for CO₂-based polyol.

On 18 Dec., Hefei POLY Advanced Materials Technology Co., Ltd. (POLY Materials, previously known as Hangzhou POLY Material Technology Co., Ltd.) revealed that it had raised almost USD28.13 million (RMB200 million) in series B financing round led by Hefei Industry Investment Group with participations from Kunlun Trust Co., Ltd. (owned by China National Petroleum Corporation), Zhong'an Capital, Anshu Capital, and the current shareholder Zhuhai Bohuiyuan Liangyi Investment Center (Limited Partnership). The proceeds will be used to build new production lines for CO₂-based polyol.

POLY Materials was registered in Sept. 2017 with a capital of RMB7.86 million. It is a high-tech company focused on high-value-added utilisation of carbon dioxide and industrialisation of carbon-negative new materials. The company owns a proprietary polymerisation technology for CO₂-based new materials, with the core business being CO₂-based poly (ether carbonate) polyol (PCE polyol).

PCE Synthesis and features

Mao Hongbing, CEO of POLY Materials, introduced that at present the mainstream of industrial utilisation of CO₂ is to reduce CO₂ with hydrogen gas to methanol or methane, or to generate synthesis gas by mixing CO₂ with water. These require demanding conditions like high temperature and high pressure and face pain points such as low conversion rate and high costs.

Against the backdrop, POLY Materials adopts polymerisation of CO₂ with epoxides in its catalytic synthesis technology development which helped the company develop PCE products with over 30% of mass fraction of CO₂ that is on par with the international leading level. In addition, POLY Materials' PCE polyol has varied performance indicators close to that of polycarbonatediol (PCD) and can be used to various kinds of polyurethane (PU), such as waterborne PU, adhesives, artificial leather, foaming materials.

Mao believes that the polymerisation of CO₂ with epoxides is one of the CO₂ chemical utilisation approaches with the highest added





value and it is the most economically valuable technical route of carbon utilisation boasting mild reaction, high CO₂ fixation, low comprehensive cost, and good product performance.

Compared with the competitive products, PCE has three main advantages:

- Carbon reduction and energy saving: Each tonne of PCE fixes 0.3 tonne of CO₂ while using 30% less petroleum-based feedstock, reducing the high carbon footprint from the feedstock reduction. Compared to the conventional process, the innovative synthesis process can reduce energy consumption by 25% during the process, and the overall product carbon footprint can be cut down by more than 50%.
- Lower cost: Overall cost reduces resulting from the 30% replacement of raw materials with CO₂.
- High performance: The new CO₂-based synthesis route forms products of new molecular structure that measure up to the high-end imported polyol products, and reflects great improvement in product cost performance.

POLY Materials' Course of industrialisation

In 2020, POLY Materials completed the pilot-scale experiment and has owned over 10 authorised invention patents of core technologies.

In Nov. 2021, the company signed a contract with the Coal Chemical Industrial Park of Huainan City to build 300,000 t/a CO₂-based polyol project. In March 2023, this project broke ground, expected to materialise the biggest CO₂-based polyol production base in China.

Project construction is planned over two phase:

- Phase I: Build 50,000 t/a capacity for CO₂-based polycarbonate polyol and propylene carbonate, with a budget of USD84.38 million (RMB600 million), scheduled for startup in Q1 2024 with estimated annual sales income of USD210.96 million (RMB1.5 billion) after full operation
- Phase 2: Build 250,000 t/a CO₂-based polycarbonate polyol and propylene carbonate, with a budget of USD196.89 million (RMB1.4 billion), scheduled for construction start in 2024 with estimated annual sales income of USD843.83 million (RMB6.0 billion) after full operation



Price Update

Correction for Price Update, *Bio-based Material Quarterly Newsletter Q3 2023*

A data error has been found in the table Average market prices of major raw materials of bio-based materials in China, July–Sept. 2023.

Original mistake: Corn cob price, **USD36.09/t**

Correction: Corn cob price should be **USD49.72/t** in July–Sept. 2023.

TABLE 5: Average market prices of major raw materials of bio-based materials in China, Oct.–Dec. 2023

No.	Product	Price, USD/t
1	Sugarcane	167.16
2	Corn	362.38
3	Wheat	418.40
4	Bagasse	40.07
5	Corn cob	49.80
6	Wheat straw	91.60
7	Corn stover	76.17

Source:CCM

TABLE 6: Average ex-works prices of major bio-based materials in China, Oct.–Dec. 2023

No.	Product	Price, USD/t	Remark
1	PHA (Polyhydroxyalkanoates)	8,525	Films
2	PBS (Polybutylene succinate)	3,814	Extrusion grade and injection moulding
3	PPC (Propylene carbonate)	3,773	Injection moulding
4	PLA (Polylactic acid)	3,034	Injection moulding
5	PVA (Polyvinyl alcohol)	1,709	Flocculent
6	Starch-based material	3,075	Film moulding
7	PTT (Polytrimethylene terephthalate)	3,387	Fibre
8	PBAT (Polybutylene adipate terephthalate)	1,696	Film moulding

Source:CCM

News in Brief

China to resume 6.5% MFN tariff on PLA imports

On 21 Dec., the Tariff Policy Commission of China's State Council published the Tariff Adjustment Plan for 2024 with a provisional import tariff rate table excluding polylactic acid (PLA). That means the 3% provisional tariff rate on PLA that has implemented for over ten years in China will soon end and the 6.5% most-favoured-nation (MFN) tariff will resume.

The Adjustment will take place on 1 Jan., 2024. If no further adjustment made, China's PLA tariff for Thailand, and Hongkong and Taiwan regions will retain zero in line with ASEAN (Association of South East Asian Nations)'s free trade agreement and Regional Comprehensive Economic Partnership (RCEP). Other countries and regions may be affected at a minimal level accounting for only a fraction of PLA imports to China.

But the US is likely to be the biggest victim to become subject to the MFN tariff after the adjustment. Data from China Customs shows that in Jan.–Nov. 2023, 17,299 tonnes of PLA were imported to China from the US, accounting for 59.4% of the total; during the period the monthly average was 1,573 tonnes, more than double the monthly number of 758 tonnes in 2022. Meanwhile, US-imported PLA price averaged around USD2,621/t in Jan.–Nov. 2023, compared with the averaged USD3,198/t in 2022.

Lishui Guosheng proposes to ramp up HMF, FDCA and PEF production

Zhongke Guosheng (Lishui) New Material Technology Co., Ltd. (Lishui Guosheng) is planning a technological upgrading and expansion project for 600 t/a 5-Hydroxymethylfurfural (HMF), 400 t/a 2,5-furandicarboxylic acid (FDCA), and 5 t/a poly (ethylene 2,5-furandicarboxylate) (PEF), with the environmental impact assessment details publicised on 29 Nov. for public comments:

- Construction nature: Technological upgrading and expansion
- Location: Economic and Technological Development Zone of Lishui City, Zhejiang Province
- Area: 5,000 m² (rental space)
- Designed capacity: Capacity to increase to 600 t/a HMF, 400 t/a FDCA and 5 t/a PEF by adding new production equipment and adjusting the existing production processes

Lishui Guosheng was set up in Aug. 2021 by Zhongke Guosheng (Hangzhou) Technology Co., Ltd. (GS Biotech), pivoting on "HMF-FDCA-PEF" whole industrial chain pilot production.

Yuanli Chem signs investment agreement for bio-based new materials project development

On 27 Oct., Yuanli Chemical Group Co., Ltd. (Yuanli Chem, stock code: 603217) announced its signing of an investment agreement with the Management Committee of Economic and Technological Development Zone of Hinggan League, Inner Mongolia Autonomous Region to develop a bio-based new materials project over three phases.

Main content disclosed includes:

- Project investment budgets: Estimated USD168.77 million (RMB1.2 billion) for phase I and follow-up investment for phase II & III to be determined in later period
- Land use: 40 ha (600 mu) for phase I, and over 66.67 ha (1,000 mu) for each of phase II & III
- Production process: Produce bio-based new materials (starch, bio-based succinic acid, etc.) with corn, corn cobs and straw as raw materials



Shanghai Sipeng Technology and Angel Yeast reach joint venture agreement

On 16 Oct., Shanghai Sipeng Technology Co., Ltd. (Sipeng Technology), the world's leading synthetic biological technology platform, and Angel Yeast Co., Ltd. (stock code: 600298), the world's 2nd largest yeast producer, held a signing ceremony for the joint venture agreement in Yichang City, Hubei Province.

Since Shanghai Sipeng Technology and Angel Yeast's strategic cooperation signed in Nov. last year, a series of engineering and experimental projects for multiple, high-yielding strains have been carried out jointly with productive results, leveraging both Angel Yeast's edges in yeast production and commercial channels and Shanghai Sipeng Technology's well-founded background in synthetic biology and product pipeline. As per the latest agreement, the to-be-established JV will undertake the commercialisation of related products based on the biotechnological achievements made from their cooperation, with aims to seize a first-mover advantage in low-carbon manufacturing of commodity goods and build an international carbon-negative bio-manufacturing platform.

Shanghai Sipeng Technology was founded in 2022 and is the only firm around the world directly generating polylactic acid (PLA) using carbon dioxide inside cells, a one-step biosynthetic approach developed by the Research Team of Food and Environmental Microbiology of School of Life Sciences and Biotechnology, Shanghai Jiaotong University. This production process for the new-generation degradable PLA provides a solution for plastic pollution and a low-cost production pathway that captures carbon dioxide instead of using grains as raw materials during the PLA synthesis, in flavour of "carbon neutrality" and "carbon peak".

Jingshan City to build 300,000 t/a bio-based degradable materials project

On 30 Nov., the Government of Jingshan City, Hubei Province settled a contract with Wuhan Huali Environmental Protection Industry Co., Ltd. (Wuhan Huali) and Hubei Jingjing Technology Co., Ltd. (Hubei Jingjing) to co-develop a 300,000 t/a bio-based degradable materials project in the Calcium Industrial Park of Yanmenkou Town of Jingshan City. This project entails a total investment of USD14.06 million (RMB100 million) and targets to produce multi-series, multi-branded and multi-purpose bio-based degradable materials from raw materials of calcium carbonate powder and chaffs. The project construction is set to start in Dec. 2023 and end before Dec. 2024. It is estimated to generate USD42.19 million (RMB300 million) worth of products per year, after the first two years of operation.

Wuhan Huali is set up in Dec. 2020 and primarily operates in R&D, production and sale of bio-plastics and the related products. It is one of the leading starch-based bio-plastics producers in China. Hubei Jingjing is a new business founded in Nov. 2023, committed to calcium carbonate processing across the full supply chain. Their cooperation is expected to improve agri-waste recycling and extend the local calcium processing industrial chain in Jingshan City.

eSUN's three-quarter earnings boom

On 31 Oct., Shenzhen Esun Industrial Co., Ltd. (eSUN, stock code: 836514.NQ) released earnings report for Q1–Q3 2023:

- Revenue of USD46.27 million (RMB328.97 million) rose by 40.40% YoY due to significant sales growth in 3D printing products and eco-friendly biomaterials while sales of trade products dipped.
- Net profit attributable to equity shareholders of the listed company of USD7.81 million (RMB55.53 million) shot 404.97% YoY,



boosted by its optimisation of product portfolio, regional locations, distribution and supply chain.

- R&D expense also jumped during the period by 88.41% to USD1.65 million (RMB11.73 million), most of which were used for new product development and product iteration as eSUN was confident about its business growth and reinvigorated market recorded in the first half of the year.

MIIT Issues 2024 directory for key new materials

On 22 Dec., the Ministry of Industry and Information Technology of the People's Republic of China (MIIT) issued the Directory for Guiding the Exemplary Application of the First Batch of Key New Materials (2024), including related indices for 6 kinds of bio-based materials. This issuance also annulled the 2021 version.

TABLE 7: Indices for bio-based/biodegradable materials

No.	Materials	Performance requirement	
1	Bio-based plasticisers	100% alternative to phthalate plasticisers; ageing resistance $\geq$ 1,200h (ASTMG-154)*; environmental index certified by EU's REACH as green, safe and non-toxic	
2	Bio-based eucommia ulmoides rubbers	purity: 90–99%; Mooney viscosity: 50–130 (ML 1+4, 125°C); tensile strength: 20–30MPa	
3	Bio-based polyamide resins	total ethanol (or esters) solubility $\leq$ 170 mins; yield stress $\geq$ 40MPa; charpy impact strength $\geq$ 30 kJ/m ²	
4	Bio-based degradable polyester rubbers	molecular weight $\geq$ 70,000; biodegradation percentage $\geq$ 70%; gel content $\leq$ 10%	
5	Polyhydroxy fatty acid materials	P34HB resin	density: 1.20–1.35g/m ³ ; melting point: 40–170°C; glass-transition temperature $\leq$ -10°C; heat distortion temperature (HDT): 130–150°C; elongation at break: 180%–300%; impact strength: 20–43 KJ/m ² ; water vapour transmission rate $\leq$ 5g/m ² ·24h; oxygen transmission rate (OTR) $\leq$ 1mL/m ² ·d·Pa
		P34HB straw	HDT $\geq$ 100°C; melt index (180°C): 6–8g/10min; tensile strength: 30–45MPa; impact strength: 5–10KJ/m ²
		P34HB fibre	spinning speed: 2,500–3,000m/min; fibre tensile strength and fineness composite index: $\geq$ 2.0cN/dtex; tensile strain scope: 30%–50%; boiling water shrinkage $\leq$ 10%; inhibition rate $\geq$ 99.99%
		PHA	density:1.18–1.22g/mL; melting point: 120–150°C; glass transition temperature: -6,6°C; melt index (165°C2.16kg): 1–5g/10mins;



			HDT (0.45Mpa)≥80°C
6	Bio-based itaconate rubbers	Rubber	Mooney viscosity (ML 1+4, 100°C): 30–65; itaconate-composited mass fraction: 40%–80%
		Vulcanised rubber	tensile strength≥15MPa

Note:1. P34HB refers to Poly (3-hydroxybutyrate-co-4-hydroxybutyrate); PHA refers to Polyhydroxyalkanoates.

2. ASTMG-154 is the Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.

Source:Directory for Guiding the Exemplary Application of the First Batch of Key New Materials (2024)

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