SEPTEMBER 2024

Innovation Mission China
Green Chemistry and Circular Plastics

ChemistryNL

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Delegation leader
Jacqueline Vaessen (ChemistryNL)

Co-organized by
NIN China
ChemistryNL
RVO
EZ
Ministry KGG
Ministry I&W

29 Participants
Companies: 10,
Research institutes: 8
Government related: 7
Other: 3

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Innovation Mission China: Green Chemistry and Circular Plastics

A broad representation (29 participants from companies, knowledge institutes and governments) of the Dutch chemical ecosystem joined the mission for an 8-day program in China, led by Chair of the Top Team of ChemistryNL Jacqueline Vaessen. The focus themes for this mission were Circular Plastics, Biobased Materials and CCU. While each delegate had their own objectives to join, the overarching goals of the mission were for the delegation to get first-hand knowledge on the developments and opportunities regarding China, and to expand the network in China.

The mission was part of a larger initiative by the organizers to shape the bilateral science, technology and innovation (STI) agenda with China. This is a.o. identifying areas for long term collaboration to address global challenges and to strengthen the Dutch earning and innovation capacity.

Not only producers of bioplastics and biofuels joined the delegation, but also a company focusing on analysis equipment for plastics, Circular Plastics NL (CPNL), a National Growth Fund foundation that provides subsidies for innovative plastic recycling projects and a port. (Assistant) professors and international coordinators of research institutes focused on recycling and bioplastics were also part of the delegation. The Top Sector Chemistry, representatives of the Ministry of Economic Affairs, Ministry of Climate Policy and Green Growth, Ministry of Infrastructure & Water Management and RVO also joined this mission.

The delegation followed a program with diverse activities, which took place in **Shanghai, Zhejiang, Guangdong, and Beijing**. A seminar was co-organized with the National Innovation Center par Excellence (NICE) as one of the program elements of Pujiang Innovation Forum (PIF) in Shanghai, which showcased developments and policies of each theme in this mission: Circular Plastics, Biobased Materials and CCU.

There was also the opportunity to highlight the Dutch perspective on the feedstock and applications transition at sub-forums of PIF. Karlo van Dam, Director Sustainable Industry at the Netherlands Ministry of Climate and Green Growth, delivered a keynote speech at the Science and Technology Finance Sub-forum. Jacqueline Vaessen, Chair at Top Team ChemistryNL, was panelist at the International Synthetic Biology Sub-forum. The delegation visited industry parks like Shanghai Chemical Industry Park (SCIP), small **companies** like DataBeyond and PhaBuilder, but also big companies like Kingfa Science & Technology and BASF China. The delegation presented themselves at **network receptions** to counterparts and stakeholders in the ecosystems of each Chinese city, but in Beijing it was focused on **government** related discussions since a seminar was co-organized with the Ministry of Science and Technology (MOST) in Beijing. It focused on connecting Dutch and Chinese organizations for potential collaborations like public-private partnerships. A diverse group of Chinese knowledge institutes and companies were present to interact with the Dutch delegation.

Introduction: Chances for the Netherlands

The scale and speed with which the transition in China is being shaped is unprecedented. The country is known for the opportunities to scale up technologies to commercial size. In terms of knowledge and technology development, the Netherlands and China also have a lot to offer each other. China spends the most in the world when it comes to research and innovation in chemistry. In 2022, this was almost twice as much as in both the EU-27 and the US. Quality of research is increasing as well, enabling China to make remarkable leaps and be a leader in some chemical domains. As a result, China offers **extensive opportunities for research and business collaboration, valorization and market development for Dutch research institutes, the business community and for start-ups and scale-ups**. **On the other side, innovative Chinese research institutes and companies can strengthen the Dutch ecosystem**. Despite the opportunities, various challenges like protection of intellectual property rights need to be considered thoroughly.

China has become **the world's biggest producer and consumer of chemical products and plastics** and faces the same challenges as the Netherlands for sustainable chemistry and circular plastics. The scale of operation and research in the development of sustainable production of chemical products and plastics shows the determination for China to reach its sustainability goals, but it has its challenges with biobased feedstock, the usage of coal and the integration and collaboration with companies who are complementary to each other. The **competitive nature of Chinese companies and regions speed up development and research on these topics and the company visits showed inspiring examples for the fast pace of scaling up.**

Circular Plastics

China has gradually established a market-based plastic recycling system and the largest global plastics recycling capacity. China implemented a series of national plastic pollution control policies to tackle the enormous environmental concerns brought by plastics production and consumption. This applies to the entire chain with a focus on technological innovation to tackle challenges. Although plastics are mainly recycled mechanically in China, there is a remarkably growing focus on chemical recycling of plastics. Both at government, research and business levels. These efforts, on the other hand, are accompanied by an emphasis on both consumer and government responsibilities in returning and recycling plastics.

The plastic recycling industry faces several main challenges. At decision-making levels, obstacles for the plastics recycling industry include the absence of a comprehensive strategy, insufficient incentives, and outdated regulations that hamper its development. The standardization of different sectors of this industry is far left behind. In addition, local governments frequently resist supporting the recycling industry.

In consequence, now we see both quantity and quality gaps between the goals for and realities of plastics recycling. A substantial portion of plastic is lost. Plastic bottles are collected at a high collection rate, and in China 94% of PET plastic bottles are recycled according to the International Pollutants Elimination Network (IPEN), mostly to textile. But more often, plastics are sorted by an informal collection system with many hands collection and sorting, leading to low-quality materials and secondary pollution. And more importantly, most post-consumer non-bottle plastics are currently incinerated rather than recycled, which is counterproductive to circular economy goals.

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中国 - 荷兰绿色化学与可循环塑料研讨会
China-Netherlands Seminar on Green Chemistry and Circular Plastics
2024年9月13日，中国北京
13th September 2024, Beijing China
NL Netherlands

Technically, advancements in refining collection system and tracking plastic types and separation methods are urgently needed to attract attention from government and investment. On the quality front, there is demand for high quality recycled plastics, yet most recycled materials are often regarded low quality coming from plastics downcycling. Prices for recycled plastics are currently perceived as high in comparison to virgin plastics, hampering use of recycled plastics. China leads globally in converting bottles to fiber, accounting for over 80% of such recycling, while recycled PET (rPET) for food-contact applications remains prohibited. From this perspective, the idea of 'from A to A' circular product chain is proposed in China, like making new shoes from recycled shoes.

Another challenge comes from the market: the China Plastics Reuse and Recycling Association and the Institute of Environment for Sustainable Development at Tongji University, stressed the importance of innovative business models and consumption patterns. The positive response from the market would drive the development of new plastic recycling techniques, making this industrial chain more sustainable.

The Netherlands and China face the same challenges, but two countries have different plastic sorting and collecting systems, as well as different proportion of different types of plastic waste (waste plastics resource is purer in Europe). This would be a scenario for two countries to learn from each other. But we should also be aware of these differences and focus on the most relevant points. The development of plastic recycling methods remains the focus of technological innovation, especially chemical recycling approaches where we can use plastic waste as carbon source. Additional attention can also be paid to how additives affect the whole recycling process, aiming to find ways to improve the grade of recycled plastics.

- **Research collaborations can be made on these topics: innovations and scale-up of mechanical and chemical recycling of plastics**
- **Waste plastics characterizing, washing and sorting, open for international collaboration**
- **rPET reuse in bottles: now not functionally innovative, not profitable yet**
- **Effective policies and regulations to stimulate the scale up of circular plastics**

Biobased Materials

China has implemented since 2023 a series of initiatives aimed at promoting the development of its bioeconomy, effective policies and regulations to stimulate the scale up of circular plastics, focusing on renewable materials and bioprocesses. China also focuses on biodegradability due to bans on several types of non-degradable single-use plastics. Incentives for adding biobased materials are in place since 2023.

According to a bioeconomy policy paper, during the current five-year-plan period (2021-2025), the proportion of bioeconomy in China's GDP will continue to increase steadily from 2020 level of 4%; the number of domestic companies engaged in the sector is likely to witness an increase. Given its great potential, China will invest more on strengthening technological innovation and industrial development in the bioeconomy sector, aiming to gain a competitive edge in bioeconomy globally. The bioeconomy is expected to be a new driver for the country's economic growth and its transition toward green, low-carbon, and high-quality development.

Many national research projects also explore competitive strategies for the petrochemical industry within the dual-carbon framework, highlighting biomanufacturing sector for its potential to reduce carbon emissions and its disruptive force in enhancing China's industrial competitiveness by overcoming technological barriers.

China is strong in manufacturing a few biofuels and biochemicals such as bioethanol, polylactic acid (PLA) and polyhydroxyalkanoates (PHAs), from agricultural crops, mainly corn starch. Research into biochemical production with wood, agricultural residue and municipal organic waste as raw material are also accelerating in China. Biobased materials have a broad range of **applications**, from high-tech industries to pharmaceuticals and coatings, and the focus of this mission is on **polymers with the potential to replace fossil-based plastics** with high consumption. Among the most recognized candidates are **PLA** and **PHA**, both of which have been industrialized in China.

China has the potential to scale rapidly and **become the world's largest producer of PLA**. However, the market is not fully ready to adopt these new materials due to their **higher costs compared to fossil-based plastics**. There is a lack of norms and regulations that create the market for biobased polymers (and no plans for such regulation soon). PLA's lower biodegradability and small market share also make collection and recycling challenging. As for PHA, though it is biodegradable, it faces limitations in production scalability due to the constraints of fermentation processes. New was that some companies in China have developed automated bacterial screening systems to speed up the process from strain modification to bacterial cultivation.

Machine learning is implemented to analyze the results from high throughput experiments to further assist in finding the bacteria with the highest PHA producibility. From the other aspect, PHA is a big family of polymers with different structures whose chemical structure and physical properties still need to be further explored. This means that it could be a field for knowledge exchange and fostering collaboration between academia and industry. Spin off companies from universities are common in China, such as those selecting bacterial strains for PHA production (like PhaBuilder). The lab in the university works on modifying and selecting bacterial strains, and their spin-off company plays a key role in scaling up production.


Bio-Manufacturing · Core Platform
Shanghai Synthetic Biology Innovation Center
Bulk Bio-Chemicals
Bio-Pharmacy
High-Value Molecules
Functional Molecules
Bulk Chemicals
Bio Materials

Currently, food-grade feedstocks are predominantly used in manufacturing, which poses a challenge as they compete with food resources. While some companies are exploring alternative feedstocks, such as agricultural and food waste, food-grade feedstock continues to dominate due to lower costs and better product quality. This highlights the importance of focusing on technologies and companies that can efficiently convert biomass feedstocks into chemicals for biobased polymer production. In China, corn, cassava, sugarcane, and straw is used as feedstock to produce PEF.

In the mission, **the discussion on biobased polymers was centered around biotechnology**. However, for larger-scale production, biobased materials derived from (bio)chemical processes could also be considered in the future, even though many of these techniques remain in the research phase. Efficient utilization of diverse biomass feedstocks, such as lignocellulose, and the development of various biobased polymers, such as polycarbonates and copolymers, will offer significant value for future applications.

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Carbon Capture, Utilization and Storage (CCUS)

China has set climate targets, aiming to reach peak CO_2 emissions by 2030 and achieve carbon neutrality by 2060. In 2020, the country emitted 14 billion tons (14,000 Mt) of CO_2. But due to the expanding use of renewable energy, economic growth in China is no longer directly tied to increases in CO_2 emissions, allowing for decoupling between growth and emissions.

Despite progress, China's massive economic system continues to produce substantial CO_2 emissions, making it **urgent to advance innovative technologies in the CO_2 capture, utilization and storage (CCUS)** sector to reduce emissions and mitigate climate change. With increasing and significant investments in this area, **China also views CCUS as a business opportunity**, recognizing its potential for both environmental impact and economic growth.

In the early stages of CCUS in China, the primary focus was on **CO_2-enhanced oil recovery (EOR)**, which allowed for both increased oil recovery and the storage of CO_2 underground. CO_2 is injected into oil fields, where it helps to push out trapped oil, thus boosting output. Geologically, **China has the second-largest CO_2 storage capacity** in the world after the U.S., with an estimated **capacity of 2,400 gigatons**, and is currently operating more than **40 carbon capture and storage (CCS) projects**, with a combined capacity of around 3 Mt. In Guangdong, it has been planned to form an alliance to pursue a CCS project, exploring offshore CCS schemes in Southern China. 250 Mtons CO_2 will be stored 250 km offshore away from Daya Bay, which is planned to start from 0.6 Mtons to 2 Mtons. Experience is learnt from an operating CCS project with 0.3 Mton in Enping (□□) in Guangdong Province. However, this early focus lacked tax incentives, subsidies, or a regulatory framework to promote broader applications of CCUS beyond EOR.

Carbon Capture and Utilization (CCU) focuses on using **CO_2 as a circular raw material to create sustainable products** like materials and even animal feed. Both Dutch and Chinese government see the CCS as more viable solution during this transition stage, despite its required significant investment to implement at scale and limited commercial profitability. Indeed, lowering the CO_2 level via CCU does not make significant impact as we are dealing with massive amounts of CO_2 emissions.

In recent years, China has made **notable advancements in CCU technologies**. These technologies, both biological and chemical, are generally at the **industrial pilot stage**, with some progressing to the demonstration phase or approaching commercial scale. Interesting examples in practice have been shown in the Mission. CO_2 is captured using alcoholamine as adsorbent at a pilot/demonstration scale, followed by **turning the captured CO_2 into dry ice for local agricultural use and turning captured CO_2 into electrolytes for local batteries manufacturing**. But from a more economically sustainable and practical point of view, CO_2 needs to be converted into higher value products.

The most readily applied CCU technology is converting CO_2 to CO (carbon monoxide) or methanol (MeOH), which can be used to produce fuels and other higher value products. Especially for MeOH production, it is recommended in China as a strategy for decarbonizing coal-fired power plants, the origin of one of the most CO_2 emissions. These techniques can be integrated into existing industrial plants, and it requires additional support for green hydrogen supply. In China, there are two large full-scale e-methanol plants based on technology from Carbon Recycling International, which process about 50 kton of renewable carbon per year. Air Liquide has been set up to build two hydrogen production units coupled with CCU technology for CO production at the Shanghai Chemical Industry Park (SCIP).

Considering the massive scale of CO_2 emissions, future policies and innovations in CCU technologies are focused on high-emission industries. Research and academic collaborations are aimed at scaling up emerging techniques, such as coupling electro- and thermal-catalytic processes, and exploring the CCU technologies in higher-value product chains.

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Some general observations and challenges

- China is officially still a **developing country** with a GDP per capita of $12,000 – at $19,000 it is no longer a developing country.
- In a geopolitical complex time, sustainable manufacturing and products is a shared challenge for China and Netherlands (Europe) and is a driver for exchange and collaboration.
- The **impact of cleantech innovation** is obvious. The silence in the streets and air quality because of the large EV presence in traffic in cities like Shanghai, Beijing and Guangzhou is impressive. This transition happened very fast. Metropolises are quiet and relatively clean. Shanghai in 2025: more than 50% are EVs.
- **43% of the chemical market is related to Electric Vehicles manufacturing (10% of all cars in China are already EV)**.
- **Climate is viewed from a business perspective**.
- Assets in China mostly no older than 1990 – modern and efficient. Shell recently acquired 1 Mton of PE.
- Yancheng contains 10% of all wind power capacity in the world.
- In 2015, China presented **Made in China 2025** – It caused heavy competition (making clean technology cheaper) and overproduction.
- China's economic growth no longer necessarily follows the increase in CO2 emissions due to the ramp-up of renewable energy. Compared to 2022, about 10 times more solar and wind energy is needed in China to achieve climate neutrality by 2060. Hydrogen pipelines are being built from the Gobi Desert to the industrial parks.
- By standardizing more quickly on a large scale, **green growth is happening at a rapid pace**
- China closes the market for electrolyzers and wind industry
- China is in strong competition with European cleantech.
- China's investment in Europe is divisive in Europe – by investing billions e.g. in EV production in Spain, there is no unity in Europe on import tariffs.
- Risk that as soon as China becomes a monopolist, prices will change.
- The Netherlands' ties with China also entail risks related to unwanted knowledge and technology transfer. Comprehensive knowledge on protection of intellectual property is pivotal.

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Government and regulatory

Regulation of the European market is an important driver for sustainability in China. Environmental rules become more and more strict in China. The government is setting sustainability targets and introduced regulations for industry to reach the targets – we saw examples on regional level where targets are connected to the government as launching customer to support green business cases.

Permits take 6 months – regions compete for short permitting processes to attract private investments. The registration and regulation process, specifically chemical management regulation, can be very different at national level and provincial level (Guangdong Province is very strict, and Jiangsu Province is radical, i.e., change fast).

China's "dual carbon" framework is a significant part of its climate and sustainability strategy, aiming to peak carbon emissions before 2030 and achieve carbon neutrality by 206012. This ambitious plan involves a comprehensive transformation of China's economy, moving from fossil fuel dependency to sustainable, low-carbon development.

Key elements of the "dual carbon" framework

- **Peak Carbon Emissions by 2030: China aims to reach its highest level of carbon emissions by 2030, after which emissions will start to decline.**
- **Carbon Neutrality by 2060: The goal is to balance carbon emissions with carbon removal, achieving net-zero carbon emissions by 206012.**
- **Policy and Planning: The framework is supported by national policies and five-year plans that outline specific measures and targets for reducing emissions and promoting green technologies.**
- **Economic Transition: This involves shifting from high-emission industries to green and low-carbon sectors, enhancing energy efficiency, and increasing the use of renewable energy sources.**

Champion program for companies: $400 million in 100 startups – 15 selected. National champions are companies which help further the government's strategic aims and in return, the government supports these companies by providing easier access to financing, giving preference in government contract bidding, and sometimes oligarchy or monopoly status in protected industries, giving these companies several advantages over their competitors. National champions are promoted for the purpose of job creation, technology and skill acquisition, and building competitive advantage. China's national champions program has significantly impacted the chemical industry, positioning it as a global leader.

Overall, the national champions program has transformed China's chemical industry into a powerhouse, driving innovation, market dominance, and sustainability.

Key effects of the Champion program

1. ***Increased Innovation***: **Chinese chemical companies are rapidly advancing in innovation, aiming to become global leaders within the next decade. This push is supported by substantial government investment in research and development.**
2. ***Market Dominance***: **The program has enabled Chinese chemical firms to dominate both domestic and international markets. By providing these companies with financial support and preferential policies, the government has helped them outcompete foreign rivals.**
3. ***Strategic Mergers and Acquisitions***: **To strengthen their global presence, Chinese chemical companies have engaged in strategic mergers and acquisitions. This consolidation has created larger, more competitive entities capable of influencing global market trends.**
4. ***Environmental Regulations***: **The government has also enforced stricter environmental regulations on these national champions, pushing them to adopt greener technologies and sustainable practices. This shift not only improves their global image but also aligns with international environmental standards.**

Knowledge

NL and China face the same challenges. Collaboration can accelerate solutions to achieve climate goals.

Collaboration is emphatically in the Dutch interest. It strengthens the Dutch long-term innovation and earning capacity. China remains an influential and important technological and economic player. The China ecosystem is competitive, and developments and innovation are driven by business cases. In general, Chinese are eager to collaborate. China makes an important contribution to science, technology and innovation (STI). In the field of research, China is among the world's top in a growing number of domains.

China has the most researchers (and is growing the fastest) and scientific publications in the world. Growth is faster than in the EU, the US and the Netherlands. Besides, China's total R&D funding is higher than that of the 27 countries in the European Union combined. China is rapidly rising on authoritative rankings such as the Global Innovation Index, where it is knocking on the door of the international top 10 with 11th place (2024). Companies in China collaborate with universities and scientific research institutions in industry-education-research partnerships. The amount of spinoff companies from universities in the chemical industry is increasing.

The Chinese market is important, not only as a manufacturer, but also as a technology provider. In China there is significant growth and growth potential especially for sustainability related products. There is a scattered landscape in R&D: the stakeholders are looking at how to collaborate. Innovation is key differentiator; many resources are spent on research. When looking into chemistry specifically, China spends the most in the world when it comes to research and innovation. In 2022, this was almost twice as much as in both the EU-27 and the US. Quality of research is increasing as well, enabling China to make remarkable leaps and leader in some chemical domains, for example in new materials and batteries.

Cleantech Innovation Institute in Shanghai is 51% government funded, 49% private funding.

Dutch universities work closely with Chinese universities – the level of knowledge is now very high – 15/20 years ago: most beautiful labs, no knowledge, is different now.

More Dutch students (master or PhD) might consider part of their research at a Chinese university or research institute.


Sustainable industry
policy in The Netherlands
Karlo van Dam

Current bilateral Science, Technology and Innovation (STI) collaborations

There has been STI collaboration with China for many years. In 2023, the STI MoU was signed between the Ministry of Economic Affairs and Climate Policy, the Ministry for Education, Culture and Science and the Ministry of Science and Technology of China (MOST). An example is the current bilateral knowledge agenda via NWO and its Chinese partners Chinese Academy of Sciences (CAS) and Natural Science Foundation of China (NSFC).

With regards to chemistry, various joint labs between universities have been established, and universities and companies in both countries collaborate to generate research findings and valorize them. Programming on China can be explored in various ways, for example through the MoU, NWO, KIC, Global Stars and public-private partnership initiatives. Bilateral partner MOST indicates that it wants to jointly program on themes related to green chemistry and circular plastics.

Follow-up

A follow-up mission with a Chinese delegation on green chemistry and circular plastics to the Netherlands will be organized by MOST in spring 2025. Also, an innovation mission on energy materials to China is scheduled for 2025.

60+ follow-ups are identified and underway to explore future collaborations on government, company and university level. Examples are a visit of the Chinese Ministry of Industry and Information Technology to the Netherlands, initiating projects between the delegation members with Chinese organizations and visits of several Chinese companies that showed interest in expanding their activities into the Netherlands. The mission resulted in several concrete ideas for bilateral public-private projects. Currently the possibilities for financing these projects are being explored

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Organizers and contact

The mission was organized by the Netherlands Innovation Network (at the Netherlands embassy and consulates in China), ChemistryNL and Netherlands Enterprise Agency (RVO). It is supported by the Netherlands Ministry of Climate Policy & Green Growth, Ministry of Economic Affairs and the Ministry of Infrastructure & Water Management.

For questions and interest in cooperation with China in chemistry, please contact:
- Netherlands Innovation Network China via China-IA@minbuza.nl
- Top Sector Chemistry via info@chemistrynl.com

Stay informed about WTI developments and activities in China by following the LinkedIn page of the Innovation Attaché Network in China: **https://www.linkedin.com/company/netherlands-innovation-network-china**

Stay informed about chemistry activities in the Netherlands by following the LinkedIn page of ChemistryNL: **https://www.linkedin.com/company/chemistrynl**

Delegation Members

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Dutch government representatives
- Ministry of Climate Policy and Green Growth (KGG)
- Ministry of Economic Affairs (EZ)
- Ministry of Infrastructure and Water Management (I&W)
- Netherlands Enterprise Agency (RVO)

Knowledge and innovation consortia
- National Growth Fund Programme Circular Plastics NL
- Advanced Research Center Chemical Building Blocks Consortium (ARC CBBC)

Knowledge institutes
- University of Groningen
- Van ‘t Hoff Institute for Molecular Sciences, University of Amsterdam
- Wageningen University and Research
- Utrecht University

Industrial parks and companies
- Groningen Seaports
- Avantium
- Nature’s Principles
- Plantics
- Solinatra
- Neste
- Xunfeng Wittenburg
- Malvern Panalytical

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Program

Saturday 7 September | Shanghai	
Official mission kick-off	
Panel discussion with working group chairs of European Chamber of Commerce in China	The European Chamber of Commerce in China has various working groups in which European companies active in China discuss relevant developments and policies concerning selected sectors. Two relevant working groups are the Chemical Working Group and Environmental Working Group.
Networking dinner with European companies in China	
Sunday 8 September | Shanghai	
Pujiang Innovation Forum (PJIF)	The Pujiang Innovation Forum (PJIF), organized by the Ministry of Science and Technology of China and the Shanghai Municipal Government, is an annual event in Shanghai that promotes international collaboration in science and technology. It gathers experts, policymakers, and entrepreneurs to discuss innovation trends and showcase cutting-edge technologies. It creates a momentum for relevant Chinese organizations to be at the same place at once. In 2023 the forum had 30.000 offline and 60 million online participants.
PJIF Science and Technology Policy Forum	Karlo van Dam: keynote
Seminar and Networking Session	Netherlands - China Green Chemistry and Circular Plastics Seminar and Networking Session with National Innovation Centre par Excellence and Pujiang Innovation Forum
PJIF Synthetics Biology Forum	Jacqueline Vaessen: panel
Monday 9 September | Shanghai	
Visit to Shanghai Chemical Industry Park (SCIP)	Shanghai Chemical Industry Park (SCIP) is one of the largest petrochemical industrial parks in Asia with a managed area of 29.4 km2. It houses around 55 companies, from the world's leading petrochemical companies like Sinopec and BASF, to innovative start-ups.
Visit to BASF Innovation Campus Shanghai	The BASF Innovation Campus Shanghai is BASF's largest R&D site in Asia. It completed one expansion in 2015 and another in 2019. The company has invested a total of 280 million euros in its Innovation Campus Shanghai since 2012.

Tuesday 10 September | Shanghai / Shaoxing	
Visit Shanghai Institute of Cleantech Innovation	Shanghai Institute of Cleantech Innovation focuses on R&D for companies on new materials, engineering processes and scaling up into pilot plants. Projects include pilot plants on carbon utilization production of green methanol, catalysts, and plastics recycling. They do contracted R&D on biomaterials in the food industry and collaborate with organizations like BASF and University of Amsterdam among others.
Track 1: Visit to Jiaren New Materials	Zhejiang Jiaren New Materials is a chemical recycler of polyester. Output is mainly polyester fibers that is sold to the nearby textile industry, thanks to major brands that would also like to have PCR incorporated into their clothing/shoes. The company's capacity is 15 kt, but a 60 kt factory is being built. They have ambitions to them scale up to 150 kt.
Flight to Guangzhou	
Track 2: Visit to Bluepha	Bluepha is a synthetic biotech company that specializes in molecular and material innovation. They produce 100% biodegradable materials (PHAs). In Shanghai they have a highly automated R&D lab ensuring fast itirations to develop new processes.
Flight to Guangzhou	
Wednesday 11 September | Guangzhou / Dongguan	
Netherlands Consulate General Guangzhou	An introduction to GBA
Visit to Kingfa	Kingfa leads in Asia regarding modified plastics and is a major player in China for production and recycling of plastics. They are a.o. an engineering-resin supplier to top auto OEMs. Kingfa is also one of the small group of producers making high-tech engineering resins, such as polyether ether ketone and polyamide 10T. They already have collaboration with organizations in the Netherlands, e.g. with DPI.
Track 1: Visit DataBeyond and waste sorting center	DataBeyond Technology, founded in 2018, is a company specializing in AI and optoelectronic integration-based intelligent sorting equipment. It is primarily used for MRF, MSW, C&I, and C&D. The company has around 200 employees of which 60 work in R&D.
Track 2: Visit South China University of Technology	South China University of Technology (SCUT) is a leading university in China in chemistry and materials. In 2023, SCUT signed a strategic partnership framework agreement with BASF, deepening cooperation and building an innovation ecosystem.
Networking reception with Chinese companies and research institutes	

Thursday 13 September | Huizhou / Zhuhai	
Track 1: Visit to Huizhou Daya Bay Petrochemical Complex	Huizhou is one of China's petrochemical hubs, with their petrochemical industrial park in the Huizhou Daya Bay Economic and Technological Development Zone. So far, more than 73 petrochemical projects have been underway there, including 13 Fortune Global 500 companies. Companies in the Complex focus on a.o. (biodegradable) plastics, coatings, and additives. Total investments amounted to 272.3 billion yuan ($37.67 billion). The zone topped China's 30 high-quality development petrochemical industrial parks for the fifth consecutive year in 2023. Shell, ExxonMobil, CNOOC and the Guangdong Provincial Development and Reform Commission signed an MoU to explore the feasibility of developing a CCUS hub in Daya Bay in Huizhou.
Track 2: Follow-up visit to Kingfa Biomaterials	
Flight to Beijing	
Friday 13 September | Beijing	
Netherlands - China Green Chemistry and Circular Plastics Seminar and Networking Session with the Ministry of Science and Technology of China (MOST)	The Ministry of Science and Technology of China (MOST) is a governmental agency responsible for formulating and implementing strategies, policies, and plans for the development of science and technology in China. MOST plays a crucial role in promoting technological innovation and coordinating scientific research. It also manages national science and technology programs, facilitates international cooperation in scientific research.
Saturday 14 September | Beijing	
Track 1: Visit to PhaBuilder	PhaBuilder is a company with leading synthetic biotechnology. It produces a variety of high-value-added products such as PHA - a biodegradable material, ectoine - a pharmaceutical intermediate, and cadaverine - a Nylon 56 precursor. PhaBuilder was founded in February 2021 by Professor Chen Guoqiang of Tsinghua University.
Track 2: Visit to BBMG CCUS pilot project	China is the largest producer of cement in the world; its cement sector accounted for 28 per cent of the country's total CO2 emissions. This 100,000 t/year CCUS project in Beijing shows China's efforts in reducing carbon emissions in the energy intensive 'hard-to-abate" cement sector. BBMG's CCUS project is scheduled to start operation in the summer of 2024, shortly before the mission travels to China.


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