

KISCO

CREATING COLORS AND CHEMICAL SOLUTIONS



ABOUT KISCO GROUP

Kyung-In Synthetic Corporation (KISCO) is a large-scale developer and manufacturer of dyes, inks, fine chemicals and other functional materials that has been operating for over 40 years.

KISCO has 3 subsidiaries, JMC, DKC and Wisechem that together make up the KISCO group. The combined KISCO group has a market capitalization of around \$US250M and had sales of over \$US 300M in 2017. The group employs over 850 staff at 8 manufacturing plants in South Korea as well as one each in China and Turkey. We have over 80 R & D staff and are supported by representatives and agents in over 60 different countries.

KISCO core values include safety, the environment, respect for people and delivering on our commitments to our customers.

KISCO has a track record of successful, long-term partnerships and extensive experience with establishing and managing joint ventures. Through these partnerships KISCO is constantly expanding our range of activities and working with our partners to open up new markets and new applications for our technologies. We are based in Korea but our business is global.

Our name <Kyung-In>

Kyung-In refers to the region between Seoul and Incheon, Korea's major international airport. The Kyung-In region is home to thousands of companies providing ready access to a large range of suppliers and customers .



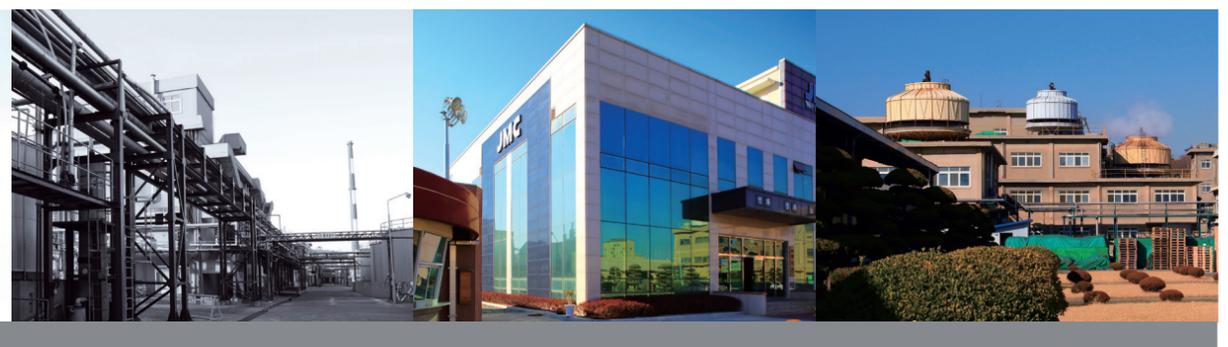
Our Subsidiaries and Joint Venture Companies

JMC Corporation

JMC (originally the Jeil Moolsan Company) was established in 1953 and is a world leader in the field of **saccharin and sulfur-based fine chemicals**. JMC was acquired by the KISCO group in 2004. JMC's research and development leverages the capabilities across the KISCO group and JMC provides raw materials for many other products manufactured by KISCO. JMC produces materials for **fluorescent pigments, resins, medicinal intermediates, electronics, plastics and agriculture**. JMC is also a large-scale manufacturer of saccharin, a safe, artificial sweetener that enables a drastic reduction in sugar content. We supply saccharin to some of the world's largest quality-oriented, multinational food and medicine producers.

Daito-KISCO Corporation (DKC)

DKC was established as a joint venture with Daito Chemix Corporation of Japan. DKC produces **photosensitive materials** that enable the **fine patterning with lithography of LCD, OLED and semiconductors** such as circuits for displays, laptops, tablets and mobiles. DKC brings together the experience of Daito Chemix with photosensitive materials and the experience of KISCO with colorants to produce materials that are fed directly into the supply chains of the major Korean electronics manufacturers.



Wisechem

Wisechem is a joint venture between KISCO and Korea Alcohol Industrial Co., Ltd. that produces **high quality mill base and dyestuff** materials for the **color filters in Liquid Crystal Displays (LCDs)**. Wisechem established the first manufacturing capability in this field in Korea and now supplies materials into Korea's growing supply chain of electronic materials and devices. This has increased the competitiveness of other companies involved in the LCD market in Korea, a field where Samsung and LG have a **60% market share of global LCD panel manufacturing**. Wisechem has invested strongly in research and development and is continuing to introduce new colorants for high resolution, high performance LCDs.

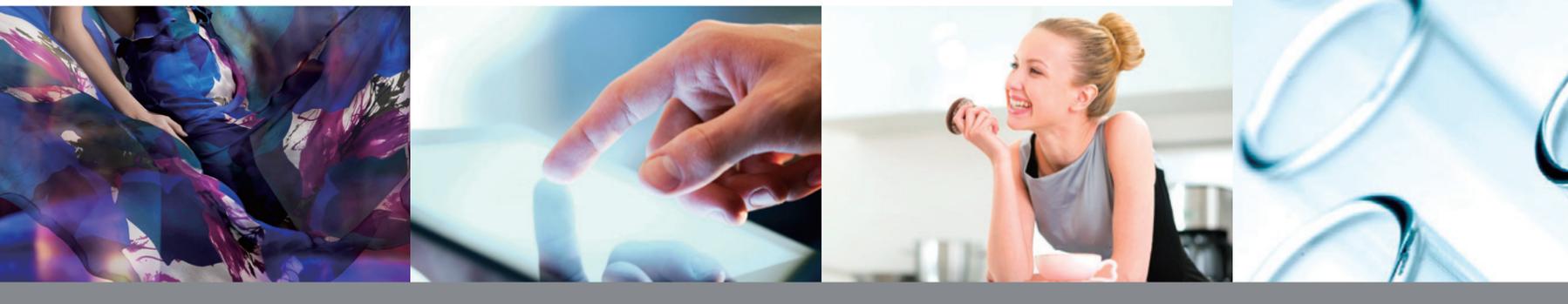
OUR PRODUCTS

Textile Dyes - Reactive, disperse and acid dyes as well as optical brightening agents that are used to color clothes all around the world

Papijet Inks - Water based inks for digital textile printing. These new inks are changing the way textiles are colored and enabling 'fast fashion' and on-demand manufacturing of clothes

Electronic Materials - Colorants for LCD color filters, photoinitiators for high precision electronics lithography and chemicals for displays and semiconductors that are all based on our deep knowledge of dyes and pigments

Fine Chemicals - Chemicals and intermediates for food, beverages, medicines, pharmaceuticals and agriculture



CAPABILITIES AND FACILITIES

KISCO creates colors and chemical solutions

We can help to expand our partners' business into Korea and apply our extensive research and manufacturing capabilities to help develop new solutions and products.

Production and Business Practices

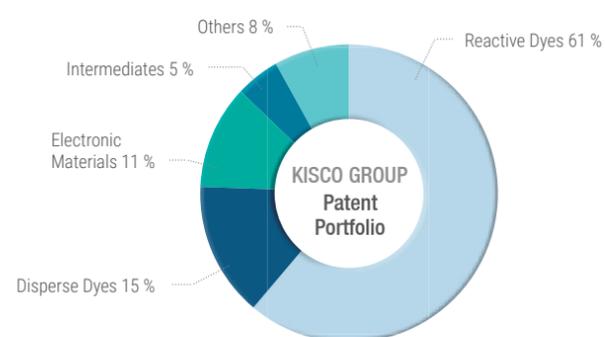
KISCO has the scale and flexibility to deliver high quality, globally competitively priced products. We have reactors that range in size from 20 to 80,000 liters and deliver products to our customers by the tonne or by the kilogram depending on their application. Our factories have storage and shipping facilities to accommodate large inventories and flexibility in domestic and overseas supply. KISCO also has in-house business development, legal and accounting staff to deal with both suppliers and customers. We supply agents, equipment manufacturers and other chemical companies.

KISCO has communication and management processes and uses a commercial Enterprise Resource Planning System (ERP) that ensure all parts of the business are aware of their obligations under contracts that we sign.

KISCO undertakes multi-step syntheses to prepare final products. KISCO has established long-term supply agreements and has a proud history of high reliability at stable costs. We began supplying many of our customers over 20 years ago and we regularly handle fluctuations in raw material prices and supplier demand.

RESEARCH AND DEVELOPMENT (CRO/CMO)

Developing new materials and solving problems for our partners



KISCO founded the first center dedicated to dye research in Korea in the 1980s. The Central Research Center has grown to occupy 5 levels of the original KISCO building in Seoul and now employs over 80 research staff. Of these, 3 have PhDs and 50 have Masters degrees.

Research staff directly assist in the transfer of new processes from the Research Center to pilot and large-scale production facilities. KISCO is experienced at managing Intellectual Property (IP). Within the KISCO group we manufacture some materials under license and have protocols in place to manage our IP and that of our partners.



Production Capacity

- Lab and pilot-scale flow reactors
- 40,000 tonne p.a. of textile dyestuffs
- 3,000 tonne p.a. of digital textile inks
- 2,500+ tonne p.a. of saccharin
- 3,500 tonne p.a. of other fine chemicals
- 420 reactors

Chemical Reactions

1. Chlorosulfonation / sulfonation: $ArH \rightarrow ArSO_2Cl, ArSO_3H$
2. Halogenation: $R-OH \rightarrow R-Cl$ (X=halogen), $Ar-H \rightarrow Ar-X$ (X=halogen)
3. Cyanation: $Ar-X \rightarrow Ar-CN, RCOX \rightarrow RCOCN$
4. Esterification: $R-OH + R'COX \rightarrow ROCOR'$
5. Nitration and reduction: $Ar \rightarrow Ar-NO_2 \rightarrow ArNH_2$
6. Oxime formation: $RCOCH_2R' \rightarrow RCOCR'-N-OH$
7. Benzoin condensation: $2ArCHO \rightarrow Ar-CH(OH)-CO-Ar$
8. Friedel Craft acylation: $ArH + Ar'COX \rightarrow ArCOAr'$
9. Friedel Craft alkylation: $ArH + RX \rightarrow ArR$
10. Oxidation
11. Phthalocyanine ring formation
12. Metal complexation
13. Pyrazine ring formation
14. Suzuki coupling: $ArB(OH)_2 + Ar'X \rightarrow Ar-Ar'$
15. Grignard coupling: $Ar-MgBr + R-X$ (or CO) $\rightarrow Ar-R$ (or $Ar-CH(OH)R$)
16. Buchwald-Hartwig reaction: $Ar-NH_2 + Ar'-X \rightarrow Ar-NH-Ar'$
17. Kumada reaction: $Ar-X + Ar'-MgBr \rightarrow Ar-Ar'$
18. Chloromethylation: $ArH \rightarrow ArCH_2Cl$
19. Radical polymerization
20. Polyester binder polymerization
21. Acrylic monomer synthesis
22. Boronylations
23. High temperature reactions, upto 260°C
24. Electronic materials with <10ppb impurities, analysed on site

KISCO Analytical Labs

The KISCO analytical labs provide on-site Quality Control (QC) and Quality Assurance (QA) on all products. The KISCO analytical labs are accredited to international standards through the Korea Laboratory Accreditation Scheme (KOLAS). KISCO is accredited to conduct chemical tests for color fastness to light, water, laundering and use; detection of allergenous and carcinogenic dyes; detection of APEOs, NPEOs, phthalate, aromatic amines, chlorinated aromatics, azo colorants, phenols, chromium, formaldehyde and heavy metals in textiles and leathers.



CHEMICAL CASE STUDIES

KISCO makes chemicals for our clothes, foods and electronic devices

CHEMICAL CASE STUDY SACCHARIN

Saccharin is an artificial sweetener that has been used for over one hundred years as a sugar substitute. Saccharin tastes over **300 times sweeter than sugar** which means that it can be used in small amounts to reduce sugar consumption. Saccharin is commonly found in candies, cookies, some formulations of soft drinks as well as in **mouth washes** and as part of the tablet coating in **medicines**. We also produce the saccharin that is used to make **table top sweeteners**.

Saccharin has been extensively studied and both the US FDA and EPA have conclusively declared it **safe for consumption**. Current global health standards only regulate saccharin for impurities based on the Remsen-Fahlberg synthesis route, first developed over 100 years ago. However, many other manufacturers use an alternative synthesis route that can give rise to other impurities and by-products. Saccharin made by the alternative route can therefore comply with the standards but still contain significant impurities. We manufacture saccharin via the Remsen-Fahlberg route using mainly water-based processes and we manufacture all starting materials ourselves. We have on-site analysis facilities that **test for all possible contaminants**.

Saccharin from our plants is consistently of a **higher quality and higher purity** than from competing manufacturers. This is in line with the approach across the KISCO group; we produce high quality materials that are **safe for our workers and our customers**. We have been proudly manufacturing saccharin at our plant since 1954 and are now applying this experience to an increasing range of **sulfur-based chemicals** for use in applications such as **fluorescent pigments, resins, medicinal intermediates, electronics, plastics and agricultural materials**.

CHEMICAL CASE STUDY COLORS FOR COLOR FILTERS

LCDs for televisions, laptops and phones use liquid crystals to control emission from a white back-light. The color of each pixel is controlled by a **color filter** – a colored, transparent film that turns the white light into blue, red or green. LCD color filters have typically been made from **pigments**. Tiny particles of these pigments are dispersed in a film and the nature of the pigment determines which colors are absorbed and which are transmitted. KISCO has a long history of developing new pigments but recently we have worked with some of Korea's leading display manufacturers to develop a whole **new type of color filter** based instead on **dyes**.

Beginning in 2008, KISCO has worked with **Samsung** to develop new materials for color filters based on **dye materials in a \$ US 3.4M project** co-funded by the Korean government. While the particles in pigment based color filters scatter some of the light, **dye based color filters** are highly transparent which results in **brighter, thinner displays with higher contrast**. KISCO's deep experience in developing highly stable, brightly colored dye materials has now resulted in a **new generation of LCDs** that are already **in the market**.



OUR PEOPLE AND THE ENVIRONMENT

Values our people and our planet

Environment, Health and Safety

KISCO is committed to manufacturing using **sustainable processes** that do not harm our **employees** or our **environment**. Every KISCO site is audited for waste and betters all legislated standards on air emissions and wastewater discharges. KISCO is certified under the **Global Organic Textile Standard (GOTS)** and is a **bluesign system** partner. KISCO is a member of the **Sustainable Apparel Coalition (SAC)** and publishes and an MRSL under ZDHC. KISCO has certifications for ISO9001, ISO14001 and OHSAS18001. Our food products, from JMC, are accredited under the **Food Safety Certification System** and are certified as **Kosher**.



Employee Welfare

KISCO **values our employees** and actively supports the **health, well-being and development** of our staff.

KISCO applies **fair work conditions** across the entire group of companies and actively enforces policies to **prevent social or gender-based discrimination**.

KISCO has been repeatedly recognized for **labor management excellence** through a number of awards from the Korean Government.

DOING BUSINESS IN KOREA

Korea has a modern, growing economy and is a country that

offers many advantages to businesses and has a government that actively supports trade and innovation.

KISCO has been designated as a **“World Class 300 Company”** by the Korean Government.



KISCO has a population of **50 million** and is one of the **world's top-10** economies in terms of foreign reserves, exports and total trade.



Korea is home to more than **15,500** foreign-invested companies and is at the center of Asia, a gateway to the region's more than **1.5 billion** consumers.



Korea is ranked 5th in the World Bank's **Ease of Doing Business Index** and is the **highest-ranked G20** country, ahead of the USA, UK, Germany and Japan.

Korea is **the most innovative country** in the world, according to the Bloomberg Global Innovation Index published in January of 2014. Korea scored exceptionally high in this ranking of 215 countries for **patent activity, manufacturing capability, high-tech density, tertiary efficiency and R & D intensity**.

For Korea, business is global, Korea is the only Asian economy to have **Free Trade Agreements (FTAs)** with **all three of the world's largest markets** – the United States, European Union, and China. Korea recently concluded agreements with China, Canada, New Zealand and Vietnam, expanding Korea's **global FTA network to 52 countries** that together account for more than 73% of the global GDP.

Korea is a **global manufacturing leader** in areas including **semiconductors, electronics and chemicals**. This success stems from Korea's partnerships with countless companies worldwide to create **global value chains**.

Korea has a **robust system of intellectual property enforcement** and patent examination times that are significantly shorter than in the US and Japan.





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Certified
ISO 9001
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OHSAS 18001



Sustainable
Apparel Coalition

