KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

JMC
CREATING SWEETNESS AND PURE CHEMISTRY

Bridging the Gap Between Academia and Industry:

Scalable Hydrocarbon Ionomers for Next-Generation Flow Batteries

Dr Scott Watkins
Chief Sustainability Officer

www.kisco.co

scott@kyungin.co.kr

01 KISCO Group

JMC
CREATING SWEETNESS AND PURE CHEMISTRY

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Dyes

Fine Chemicals

Electronic Materials

Inks

Products
Dyes, inks, fine chemicals and functional materials

Global Sales
US$ 275M (2025)

Employees
870

Listed on KRX
Since 1995

Founded in 1970

Production Capacity
420 reactors,
100,000MT/year
(sizes 10L–40,000L)

01 Made in Korea. Delivered Globally.

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

KISCO Group operates and manufactures at 11 sites across Korea

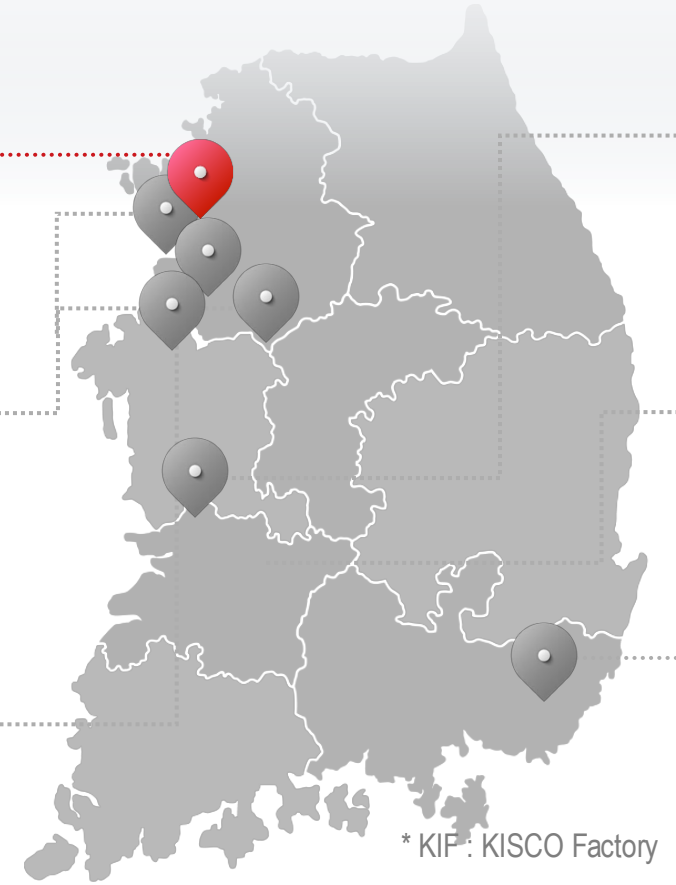
- Reactive and Acid Dyes
- Inks / Electronic Materials

- Electronic Materials

- Electronic Materials
- OBA

- Disperse Dyes / Mill Base
- Ink / Inkjet Inks

- Pigments for Color filters



* KIF : KISCO Factory

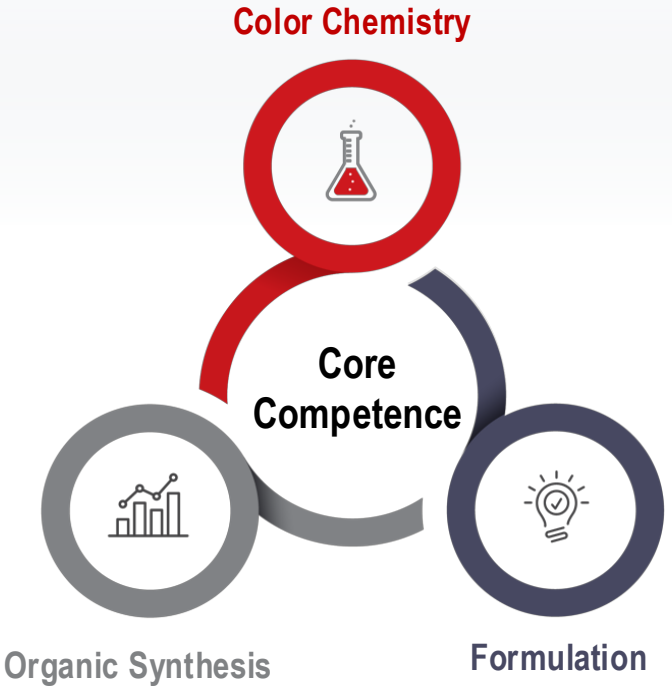
- Electronic Materials

- Electronic Materials

- Saccharin / BCMB
- Potassium Sulfate Fertilizer

01 Made in Korea. Delivered Globally.

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS



02 Sulfonated Ionomers

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Sulfonated and non-fluorinated ionomers have shown great academic promise but there are very few large-scale suppliers.

Issues:

- Regulatory pressures on fluorinated materials. Our company is also experiencing this in the textiles industry.
- Demand vs supply. We need to build a market.

- Take away: Sulfonated ionomers are available at scale.

02 Sulfonated Ionomers at scale

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Our entry into this area has been through international collaborations across Korea, Europe, North America and Australia.

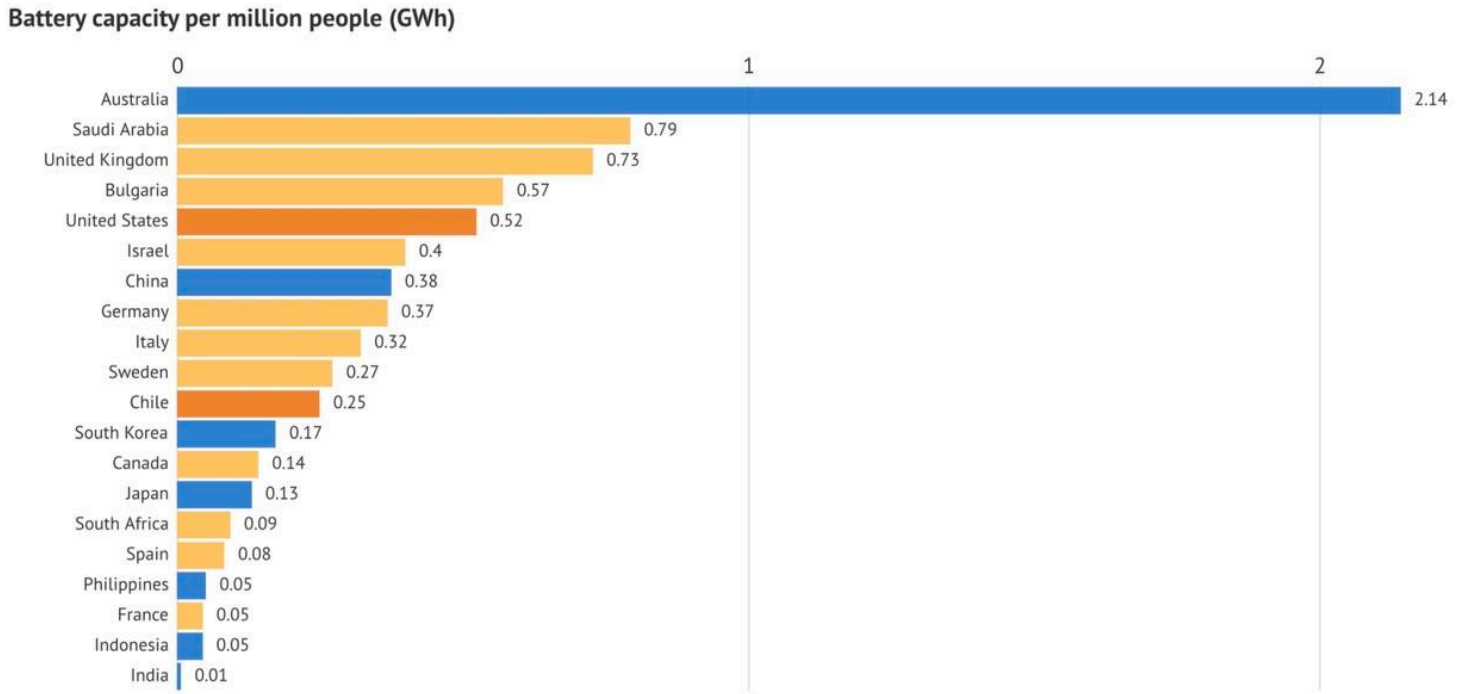
Application areas:

- Flow cell batteries, both vanadium and organic electrolytes
- Fuel cells
- Electrodialysis for ion extraction/purification

03 International Developments

Huge investment in batteries and lithium in both Australia and Korea.

- Tangible evidence of grid-scale battery deployments bringing electricity costs down, displacing gas and actually delivering to enhance renewables.
- Currently this is overwhelmingly lithium-based batteries but the market for long duration storage is growing.
- Enormous geopolitical interest in diversifying lithium and critical minerals supply is fuelling a growing interest in refining and purifying metals using electrochemical processes and all of these need membranes.
- For us as a manufacturer, the bigger the market there is for ionomers, the better placed we'll be to deliver products for Flow Cell batteries.



04 Research to Commercialisation

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Spin up or spin through?

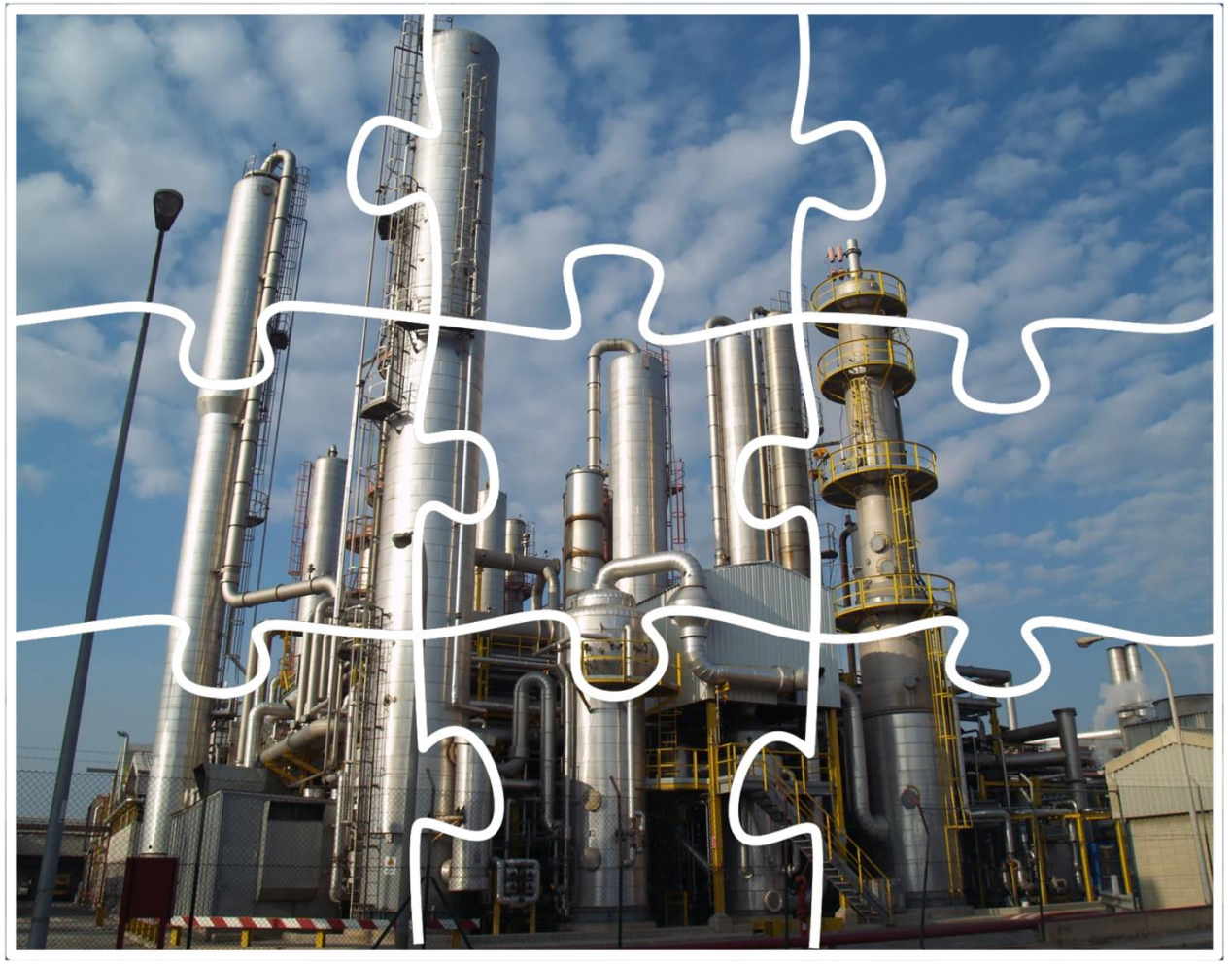
- Building and operating plants is hard.
- Waste is a huge challenge.
- Some of the products we've examined could generate as much as 60T of acid waste for every 1T of ionomer.

Capital

Demand → New Factory → Price

Demand → Existing Factory → Price

- Do these options result in the same price?



04 Research to Commercialisation

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Rapid iteration or bulk production?

- Some companies have expertise with smart chemistry processes like flow chemistry and combinatorial chemistry that are regularly used in the pharmaceutical industry to make small amounts of a variety of chemicals.
- Researchers often want “just 100g” of something when a company wants forecasts for how many tonnes you’re going to buy.

Is your research route actually commercially viable?

- What solvent are you using?
- Neat sulfuric acid can only be handled by specialist producers like us.
- What is the mass balance of the reaction?
- Extremely dilute conditions and long reaction times can be extremely low productivity when scaled.
- Typical production processes for us would use a $2m^3$ (2000L) reactor to produce 150kg of product.

05 Funding and Commercial Challenges

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

Another tension is how much researchers and companies can do for free.

- Some researchers don't want to pay for samples.
- Some companies don't want to pay for testing.
- Be flexible and consider the long-term potential. Try to make situations win-win.

Business plan

- Researchers also have to understand that companies will want forecasts and to develop clear business plans based on accurate costings.

Some of our customers will be very familiar with us asking repeatedly for forecasts.

- That's a very important and fundamental part of our business.
- Things can change but good news fast and bad news faster is a good strategy.

06 Cross-Cultural Training

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

"Global companies" can be naive or over-confident when dealing with Asian chemical companies and researchers.

Cross cultural considerations include:

- Hierarchies
- How meetings are run (discussion vs decision)
- Differences in the legal basis of contracts
- Don't assume that just because you have a Korean collaborator, subsidiary or K-pop album that you understand how Korean business works.

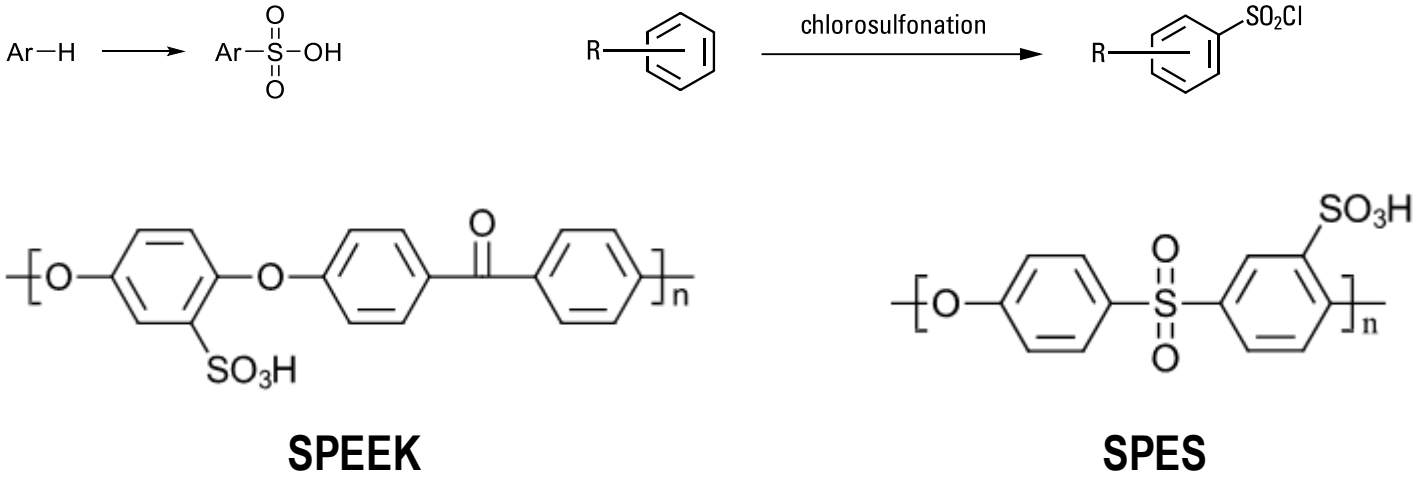
Explore what is offered by business councils or trade associations - or ask someone like me.

07 Sulfonated Ionomers

SPEEK is an example where JMC's large-scale sulfonation capability was the unique factor that enabled us to move into this area.

- We are now looking at other types of sulfonated ionomers but we're not yet and may not ever be, a catalogue chemical company.
- We work really well at scale, with defined forecasts.
- 300kg batch size now with clear roadmap to multi-tonne scale production

• Sulfonation



SPEEK

SPES

08 Key Points

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS

- The market for sulfonated ionomers needs to be built. That's a shared responsibility.
- Spin through can be very attractive.
- Don't forget waste.
- Consider all aspects of commercialization of research - practicalities, business model, pricing and forecasts; and cultural considerations.

Dr Scott Watkins
Chief Sustainability Officer

www.kisco.co

scott@kyungin.co.kr

THANK YOU

KISCO
CREATING COLORS AND CHEMICAL SOLUTIONS