



**28th Annual
Anodizing Conference
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Organic Dyes and Pigments
colorant solutions for all industries

Global Anodizing Dye Perspective - Navigating the Dynamic Supply

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ALUMINUM ANODIZERS COUNCIL™

In today's presentation:

- What are Anodizing Dyes
- Key chemical features of Anodizing Dyes
- Manufacturing of Anodizing Dyes
- Dynamic dye supply situations and the effect on Anodizing Dyes
- Your Anodizing Dyes supplier



In today's presentation:



Anodizing Dyes – What are they?

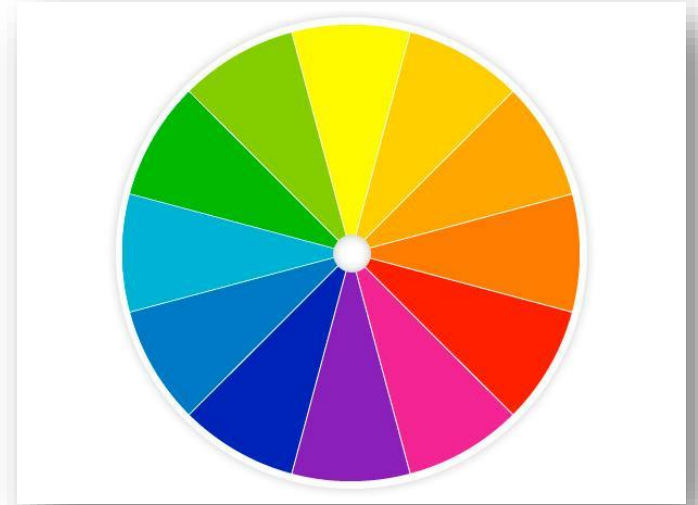
- Acid Dyes
 - Fixed at low pH
 - Used in a variety of industries – Textiles, HI&I, Agriculture, Detergents
 - Run almost the entire shade gamut

Anodizing Dyes – What are they?

- Mordants
 - Not really a “dye”, but a fixative agent combined with a dye
 - Feature earth tones
 - Utilize chromium complexes which are not environmentally friendly

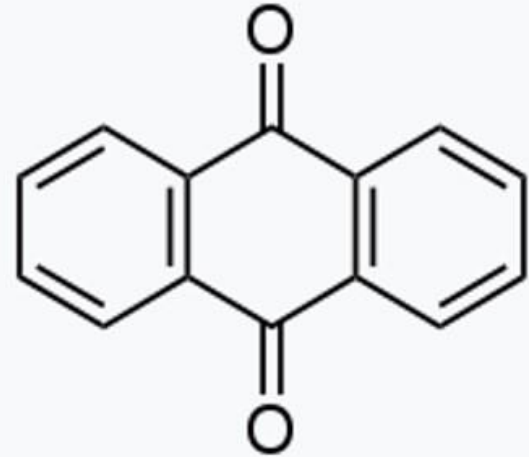
Anodizing Dyes – Chromophore Chemistry

- Anthraquinone
- Metalized Azo
- Metal Free Azo
- Sulphonated Coumarin



Anodizing Dyes – Chromophore Chemistry

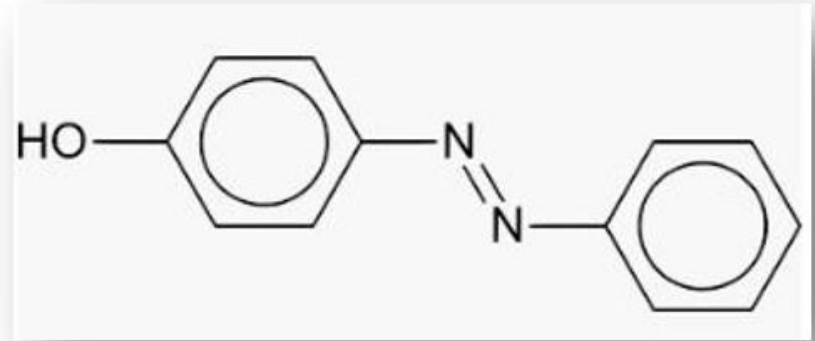
- Anthraquinone
 - Feature Blues and Greens, some reds
 - Water affinity can be manipulated
 - Molecule can be manipulated to have affinity for a variety of substrates
 - Good light fastness



(fig 1) Anthraquinone

Anodizing Dyes – Chromophore Chemistry

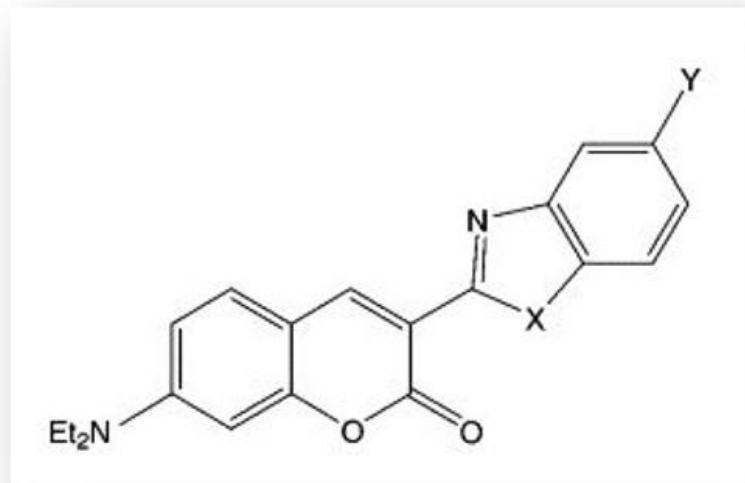
- Azo Dyes
 - Metalized and Metal Free
 - Metalized (copper, cobalt, nickel, chromium) have better fastness and increased performance
 - Oranges and many red shades



(fig 2) Azo Structure

Anodizing Dyes – Chromophore Chemistry

- Sulphonated Coumarin
 - Bright fluorescents, especially yellow
 - Absorb and emit in most regions of visible spectrum



(fig 3) Coumarin

Anodizing Dyes – Manufacture

- First synthetic dye synthesized in 1856
 - First synthesized by William Henry Perkins
 - Looking to create quinine
 - Mistake in lab working with coal tar
 - Eureka – Aniline Purple, became known as **Royal Purple**.

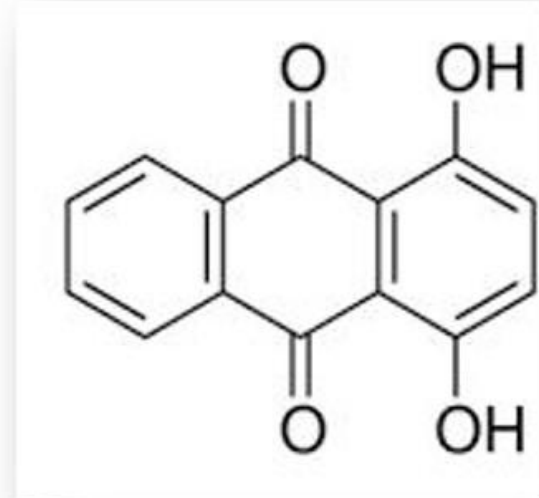


Anodizing Dyes – Manufacture

- Look around at the use of dyes and colorants EVERYWHERE, and on all kinds of SURFACES
- Dye manufacture is varied, complex, messy, and necessary and depends on numerous chemicals and chemical intermediates

Anodizing Dyes – Intermediate

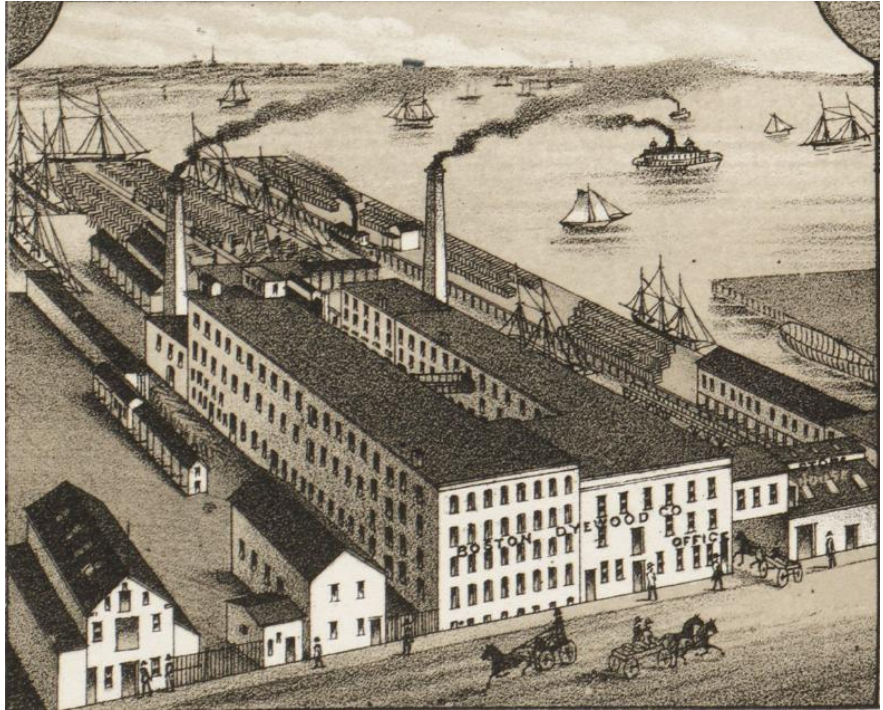
- Quinizarin - one (of many) important intermediates
- 1,4-Dihydroxyanthraquinone
- Needed for anthraquinone dyes



(fig 4) 1,4-Dihydroxyanthraquinone
(Quinizarin)

World Wide Dye Manufacturing - History

- Supportive chemical manufacturing grew with dye manufacturing growth
 - Logistics, technical expertise, infrastructure, labor
 - Production and consumption hand in hand



World Wide Dye Manufacturing - History

- At one time, prevalent throughout the entire developed world

Capacities of leading producer nations, in millions of pounds

280	Germany (1913)
94	United States (1923)
43	Britain (1920)
24	France (1923)
24	Switzerland (1920)
10	Italy (1922)
10	Japan (1919)

[“*The American Dye Industry.*” Journal of the Society of Dyers and Colorists, 40 (December 1924); 428-429]

World Wide Dye Manufacturing - History

- 1970s – The World Changes
 - Dye Production moves to China
 - Fewer environmental costs, plentiful low cost labor, increased expertise, government incentives
 - **Dye Consumption moves to China**
 - Same Reasons



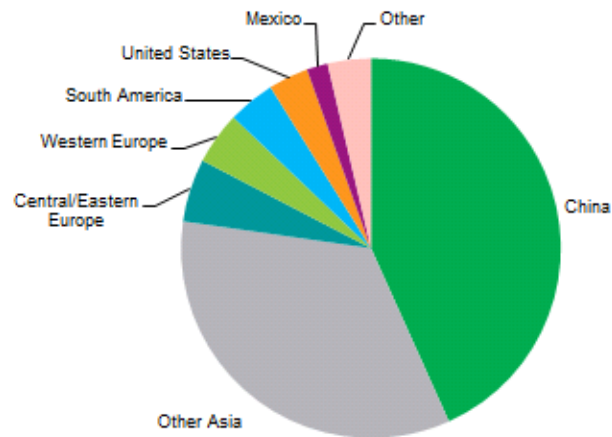
World Wide Dye Manufacturing - Shift

Global Dye Production (2018)



Source AATCC December 2018 Issue

World consumption of synthetic dyes—2017



Source: IHS Markit

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China Dye Manufacturing – Landscape 2010

- Dye manufacture and chemical support areas grouped together in “Provinces”
- Similar pathway of other manufacturing industries
- Largely unregulated or regulations ignored
 - Environmental, Safety, Worker Benefits
- Dye manufacture grew with dye consumption
- Became large exporter of dyes

China Dye Manufacturing – Rise of the Middle Class

- *“Over the past several decades, China’s economic development has lifted hundreds of millions of Chinese out of poverty and resulted in a burgeoning middle class. Middle class households typically have enough income to satisfy their primary needs – food, clothing, and shelter – with some disposable income left over for additional consumption and savings. **In 2002**, China’s middle class was only **four percent** of its population. A decade later (**2012**), this number had climbed to **31 percent**, constituting over **420 million people**. China’s growing middle class presents an array of new economic opportunities, but also poses significant political and demographic challenges.”*

www.chinapower.csis.org



China Dye Manufacturing – Middle Class

- Chinese middle class larger than entire US Population
- New demands on quality of living
- Higher standard of expectations from government



China Dye Manufacturing – 2013

- *“Revised Environmental Protection Law of the People’s Republic of China”*
 - New environmental regulations
 - Implemented **IMMEDIATELY**
 - No 5 or 10 year “Plan”
 - Included crackdown on corruption
 - Environmental Fines (Mfg. and Politicians)
 - Jail time

China Dye Manufacturing – 2016+

- Unannounced closing of major dye manufacturing facilities and chemical intermediate suppliers
 - Unable to meet timetable – close instead of fines or jail
 - Sudden shortages of specific dyes depending on Province closing down
 - Tight availability, fluctuating prices

China Dye Manufacturing – Safety & Health

- Rise of Middle Class also put pressure on worker and community safety.
- Previous accidents and incidences kept quiet
 - Worker safety and manufacturing process safety largely ignored, or not planned for
- With the new China, (and changes in mass communications), government forced to improve safety.
 - Too quick now to respond with closures over safety.

China Dye Manufacturing – Safety & Health



China Dye Manufacturing – Recent Accidents

Date	Industrial Zone	Key Supplier	Category	Impact
May 2018	Shandong Hongwei blast	Reactive Blue 19	Reactive Dye Acid Dyes	supply
July 2018	Sichuan province explosion, kills 19 and injures 12	Chongqin Kuayue	Disperse intermediates	supply
August 2018	Jihua Blue 56 plant explosion with 1 dead	Jihua	Disperse intermediates	supply
March 2019	Yanchen plant explosion with 78 dead	Tianjiayi	Disperse/Reactive intermediates Acid Dyes	supply

China Dye Manufacturing – **THIS JUST IN** Happy 70th Anniversary (Oct 1)



China Dye Manufacturing – **THIS JUST IN**
*With the arrival of National Day, all over the country
are carrying out environmental protection inspection!...
This year's 10.1 celebrations will be even more grand.
To ensure blue sky and white clouds during the
National Day, all production enterprises north of the
Yellow River will stop production and emission
reductions from September 1... is mad, more than
20,000 chemical companies in 28 cities will stop
production! ...*



(Wang Rui, JaBang Dyes; September 27, 2019)

China Dye Manufacturing – **THIS JUST IN**

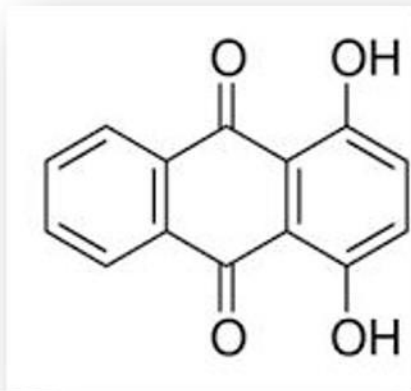
*“A number of cities issued emission control plans and launched a campaign to prevent and control pollution and protect the environment, **sweeping through 56 cities.** Shandong province, a major chemical industry province, **closed 42.5% of the province's chemical enterprises;...**”*



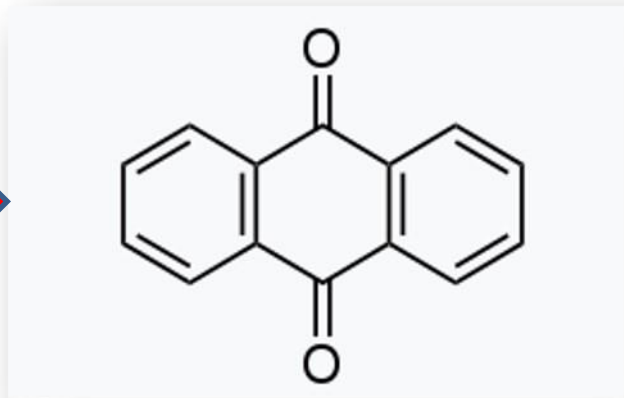
(Wang Rui, JaBang Dyes; September 27, 2019)

China Dye Manufacturing – Tianjiayi

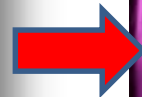
- World's largest (of a few) producer of **Quinizarin**



(fig 4) 1,4-Dihydroxyanthraquinone
(Quinizarin)



(fig 1) Anthraquinone



China Dye Manufacturing – Quinizarin

- World wide shortage of anthraquinone dyes
- Pricing fluctuating upward 30-80% over 4 months
- Product unavailability, except in held inventories
- Other dye producers (China, India) can not get Quinizarin, no relief.
- Forced users to find other dyes, or to discontinue product lines.
- What about India???

China Dye Manufacturing – Tariffs

- Previous to the most recent tariffs, there was a 6% duty on dyes coming in to the United States (which still remains)
- All dyes coming from China were subject to a 10% (9/24/2019) Tariff, increased to 25% in May 2019
- As of this writing (8/30/2019), there is no change, only talk of expanding tariffs on both sides.

What will the landscape be like a month from now, when this presentation is given?



India Dye Manufacturing – Then

- Robust producer of dyes for a significant time
- Smaller consumer of dyes
- Many manufacturers, but depend on many raw materials from China
- In general, lacking commerce sophistication
 - Responsiveness, logistics, consistent quality



India Dye Manufacturing – Now (since the Chinese push for environmental and safety improvements)

- "Indian dyestuff and intermediates enterprises are actively seeking technical cooperation with Chinese dyestuff and intermediates enterprises, and it is proposed to set up factories in India in the form of technical equity participation. (Aug, 2019, Jiansu YaBang Dyestuff Corporation)

India Dye Manufacturing – Now (since the Chinese push for environmental and safety improvements)

- "It is not just individual companies that are worried. "The international competitiveness of our dyestuff products is also gradually declining, and we are facing a strong impact from Indian products..." (Aug, 2019, Jiansu YaBang Dyestuff Corporation)

India Dye Manufacturing – Now (since the Chinese push for environmental and safety improvements)

- "First, India's labor costs are relatively low.
 - Second, India has 2.8% export tax rebate for dyestuff products. China has reduced the export tax rebate rate for dyestuff products from 13% to 0 since January 1, 2006. As for dye intermediates, China has an export tax rebate of 9 to 13 percent, while India has a 1.5 percent tax rebate.
 - Third, India's environmental policy is relatively loose.
 - Fourth, local water, coal, electricity, and land have many concessions.
 - Fifth, the country's climatic factors are conducive to dye production."
- (Aug, 2019, Sun Yang, director of Zhejiang Hisoar Pharmaceutical Co.)*



India Dye Manufacturing – Future

- What happens when India imposes more stringent environmental, safety and labor laws?
- Does dye manufacturing move to another geographical area?
 - Need logistics, sophisticated chemical manufacturing, educated management, engineering expertise

Anodizing Dyes – Weather the Storm?

- At this point, Anodizing Dyes have not been greatly effected by the dynamic supply and pricing conditions effecting the dye manufacturing industry
 - Small footprint
 - Existing stocks and inventories
 - Healthy margins
 - Better control of Chinese plants
 - Existing cooperation with India



Anodizing Dyes – The Future?

- Will always be subject to dye manufacturing industry ups and downs
- Likely to see some price increases, if to cover the tariffs alone.

How can the user of Anodizing Dyes be ready for the future?



Anodizing Dyes – Your Dye Supplier

- Able to navigate the dynamic dye manufacturing landscape
- Technical and quality expertise to utilize dyes from various sources
- Expertise in global supply chain management
- Qualify multiple sources both in China and India
- Work closely with Anodizers to forecast usage and trends so that adequate inventories are maintained.



End of Session



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