

The Chemistry of Cosmetics
&
How Chemical Engineers Make it Happen

March 16, 2016

MY “CURRICULUM VITAE”

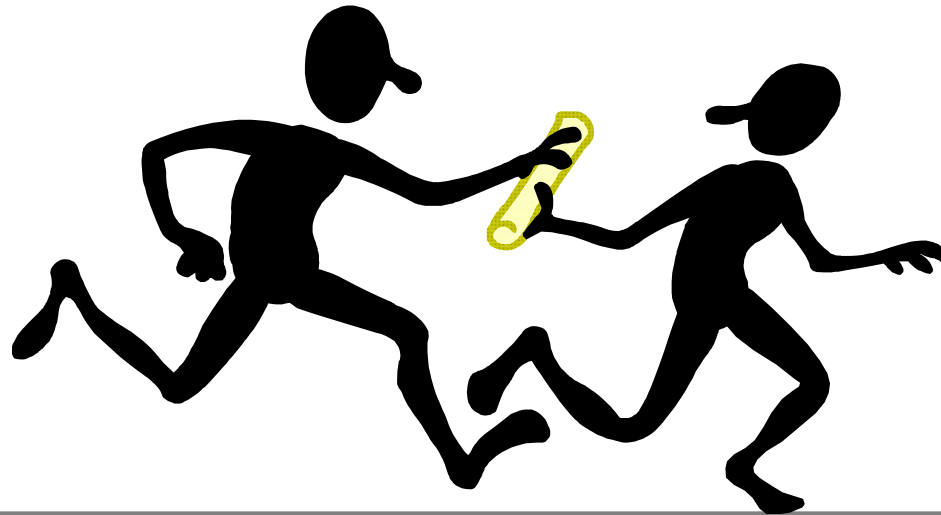


- Peter Sibilski, P.E., CEM, FAIChE
 - Plant Manager, Pharmetic Manufacturing Co., LLC
 - B.S. ChE 1981 from NJIT
 - MBA, Technology Management from University of Phoenix
 - Work experience includes:
 - Diamond Shamrock – specialty chemicals
 - Occidental Chemical – specialty chemicals
 - Henkel Chemical – specialty chemicals
 - Olin Hunt – microelectronics chemicals
 - BOC Gases – industrial gases
 - Schering-Plough - pharmaceuticals
 - ALZO International, Inc. – specialty chemicals
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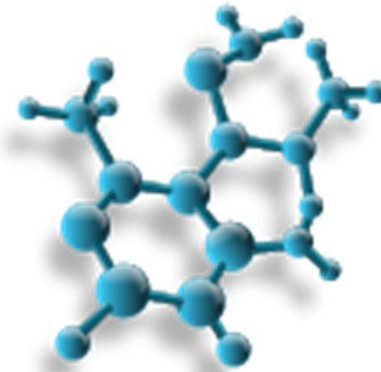
PROJECT HAND-OFF

- The R&D / Applications Lab has just come up with a new formulation that you now have to scale up and make in the plant on a production level.
- The easy part is done – the hard part (and the job of the Chemical Engineer), now begins.....



FORMULA / CHEMISTRY

- **What are we making? (ester, urethane, etc.)**
- **What are the reactants? (solid, liquid, gas)**
- **Raw material availability?**
 - » *Readily available? (source?)*
 - » *Packaging?*
 - » *Specialty item?*
 - » *Long delivery time?*
 - » *Minimum quantities?*
 - » *Regulatory issues?*
- **Hazards of raw materials?**
 - » *Health*
 - » *Fire*
 - » *Reactivity / compatibility*
 - » *Other weird stuff?*



Isophorone Diisocyanate information

2. Hazards Identification

Emergency Overview

DANGER! Color: Clear Form: liquid Odor: Pungent.

Toxic gases/fumes may be given off during burning or thermal decomposition. Closed container may forcibly rupture under extreme heat or when contents have been contaminated with water. Use cold water spray to cool fire-exposed containers to minimize the risk of rupture. Causes respiratory tract irritation. May cause allergic respiratory reaction. Harmful if inhaled. Respiratory sensitizer. Lung damage and respiratory sensitization may be permanent. Causes skin irritation. May cause allergic skin reaction. Skin sensitizer. Animal tests and other research indicate that skin contact with diisocyanates can play a role in causing isocyanate sensitization and respiratory reaction. Causes eye irritation. May cause lung damage.

Potential Health Effects

|| Primary Routes of Entry: Skin Contact, Inhalation, Eye Contact

|| Medical Conditions Aggravated by Exposure: Skin Allergies, Eczema, Asthma, Respiratory disorders

FORMULA / CHEMISTRY

Isophorone Diisocyanate information

14. Transportation information

Land transport (DOT)

Proper Shipping Name: Isophorone diisocyanate
Hazard Class or Division: 6.1
UN/NA Number: UN2290
Packaging Group: III
Hazard Label(s): Toxic

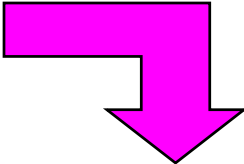
Sea transport (IMDG)


Proper Shipping Name: ISOPHORONE DIISOCYANATE
Hazard Class or Division: 6.1

Packaging Group:
Hazard Label(s):

Air transport (ICAO/IATA)

Proper Shipping Name:
Hazard Class or Division:
UN-No:
Packaging Group:
Hazard Label(s):



	Class 6 - Toxic materials and infectious substances
	Division 6.1 Toxic materials
	6.2 Infectious substances

Toxic

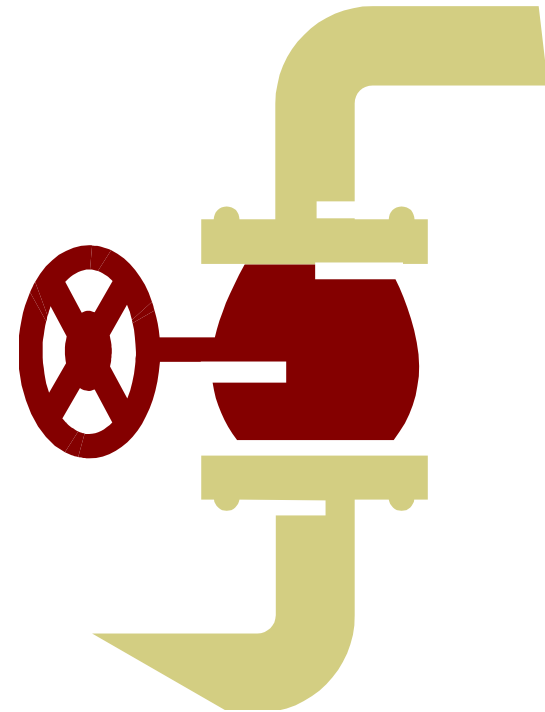
BY-PRODUCTS / EXCESS REACTANTS

- What are they?
- Quantities?
- Can they be re-used?
- Will customer take them back?
- Will they need to be disposed of?
 - » *Hazardous or non-hazardous waste?*



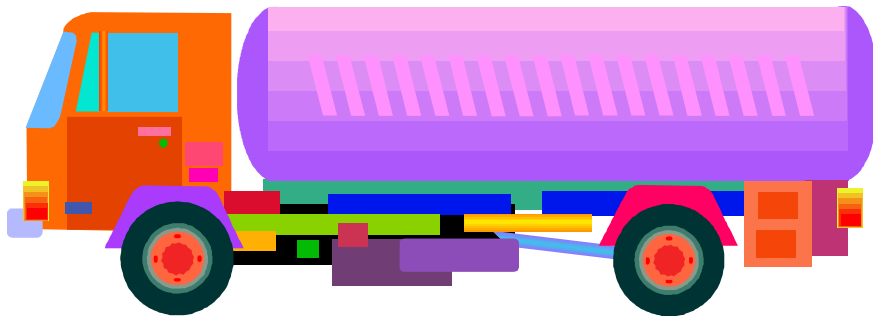


- **How do we make this stuff?**
 - » *Is existing equipment sufficient?*
 - » *Viscosities?*
 - » *Melting / boiling points?*
 - » *Phase changes?*
 - » *Exotherms / endotherms?*
 - » *Temperature / pressure / vacuum?*
 - » *Catalyst systems used?*
 - » *Packaging requirements?*
 - » *Equipment clean-up issues?*
 - » *Potential for cross-contamination?*
 - » *Minimum batch sizes?*



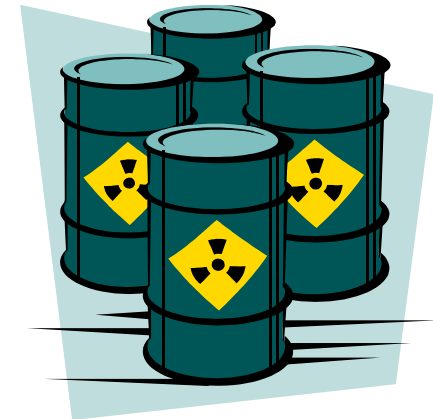
STORAGE / SHIPPING REQUIREMENTS

- **Special storage requirements?**
 - » *Heated / refrigerated storage req'd?*
- **Special shipping requirements?**
 - » *Heated / refrigerated shipment req'd?*
- **Shelf-life issues?**
 - » *Does it “go bad”?*
- **Can it be reworked if necessary?**



ENVIRONMENTAL / SAFETY ISSUES

- Will safety training be required?
- Will new MSDS's be required?
- Will new safety equipment be required?
- Are raw materials on the air permit list?
 - » *Permit modification required?*
- Are any new hazards being introduced into the plant?
 - » *Annual batch reporting issues?*
- Will equipment clean-up generate waste material?
 - » *Disposal issues?*
 - » *Wastewater system upset potential?*



ECONOMICS / PROFITABILITY

- **What is potential selling price?**
- **What are manufacturing costs?**
 - » *Raw materials*
 - » *Energy & utilities*
 - » *Labor & benefits*
 - » *Supervision / QC / Maintenance overhead*
 - » *Packaging costs*
 - » *Safety / environmental related costs*
 - » *Sales and marketing costs?*
 - » *R&D costs*
 - » *Miscellaneous costs*
- **Selling price > manufacturing cost? – WINNER!**
- **Selling price < manufacturing cost? – ????????????**



RELEVANCE?

COMMUNITIES EDUCATION

Beauty and the Engineer

No, a cosmetics engineer is not a department store makeup clerk with a fancified title.

A small New York school has launched a new cosmetics engineering option within its master's in chemical engineering. The focus helps prepare students for jobs working with cosmetics and personal care

**One student—a football
and lacrosse player—wants
to be “the nose” of the
perfume industry.**

products and comprises rigorous courses such as Emulsion Technology.

Manhattan College is the first institution to offer such a program, which launched with the 2011–12 school year. According to Ann Marie Flynn, chair of the chemical engineering department, the program was driven by student requests. Cosmetic companies such as L'Oreal and Avon were hiring chemical engineers from the college, and students began asking about such a degree.

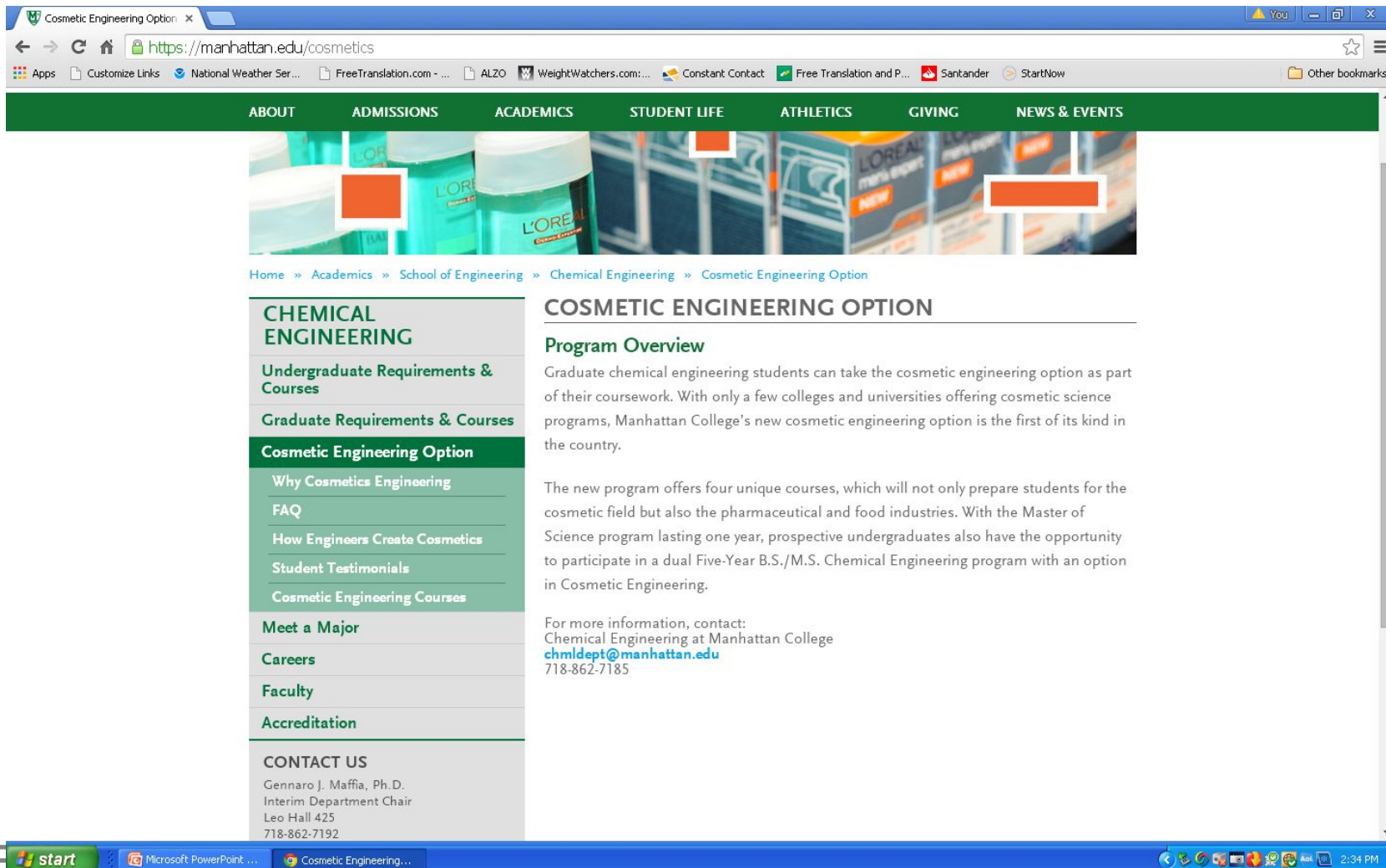
Flynn began searching for examples,

little of Manhattan College was the one to unearth this,” she says.

Flynn began talking to engineers at cosmetics companies about what was missing in the education of students they hired and trained. That wish list



YES, IT'S REAL!



The screenshot shows a web browser window displaying the Manhattan College website. The browser's address bar shows the URL <https://manhattan.edu/cosmetics>. The website has a green navigation bar with the following menu items: ABOUT, ADMISSIONS, ACADEMICS, STUDENT LIFE, ATHLETICS, GIVING, and NEWS & EVENTS. Below the navigation bar is a banner image of L'Oréal Paris products. The main content area features a breadcrumb trail: Home » Academics » School of Engineering » Chemical Engineering » Cosmetic Engineering Option. The page title is "COSMETIC ENGINEERING OPTION". A left sidebar contains a table of contents with the following items: CHEMICAL ENGINEERING, Undergraduate Requirements & Courses, Graduate Requirements & Courses, Cosmetic Engineering Option (highlighted), Why Cosmetics Engineering, FAQ, How Engineers Create Cosmetics, Student Testimonials, Cosmetic Engineering Courses, Meet a Major, Careers, Faculty, and Accreditation. The main content area includes a "Program Overview" section with the following text: "Graduate chemical engineering students can take the cosmetic engineering option as part of their coursework. With only a few colleges and universities offering cosmetic science programs, Manhattan College's new cosmetic engineering option is the first of its kind in the country." Below this is a paragraph: "The new program offers four unique courses, which will not only prepare students for the cosmetic field but also the pharmaceutical and food industries. With the Master of Science program lasting one year, prospective undergraduates also have the opportunity to participate in a dual Five-Year B.S./M.S. Chemical Engineering program with an option in Cosmetic Engineering." At the bottom of the main content area, contact information is provided: "For more information, contact: Chemical Engineering at Manhattan College, chmldept@manhattan.edu, 718-862-7185". The Windows taskbar at the bottom shows the Start button, open applications (Microsoft PowerPoint, Cosmetic Engineering), and the system tray with the time 2:34 PM.

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TO SUMMARIZE.....

- **It's never as easy as they say it will be**
 - **It never works the way it's supposed to work**
 - **When it doesn't work they will not know how to fix it any better than you will**
 - **You will always forget something**
 - **Something will happen that you never expected**
 - **You will need to remain flexible and adaptive**
 - **Listen to your operators**
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"There is no expedient to which a man will not resort to avoid the real labor of thinking."

Sir Joshua Reynolds



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