
聲明

本檔案之內容僅供下載者自我學習或推廣化學教育之非營利目的使用。並請於使用時註明出處。例如「本頁取材自○○○教授演講內容」

Green Chemistry: Practitioner's Perspectives

Wei-Wang Chen, Ph.D.

March, 2021

Better Chemistry Better Life



Case Sharing -- Wastewater Ammonia Nitrogen Reduction

Better Chemistry Better Life

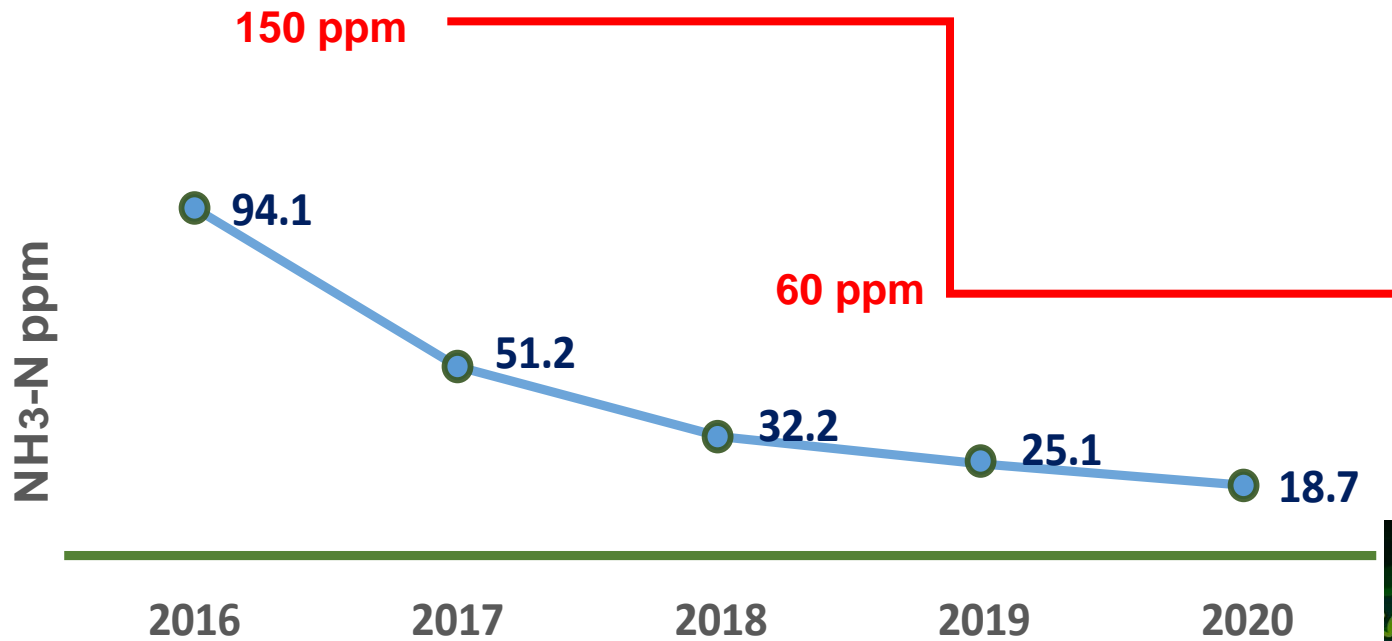


Why Controlling WW NH₃-N?

1. Water body eutrophication
2. Water pipeline and equipment clogging
3. Increase chlorine usage in industrial water preparation
4. Corrosive to copper

Why So Much WW NH₃-N?

1. Costs
2. Education



-----> 20 ppm

Inventory & Administration Controls

Metallization sequence rearrangement

Smart Copies

Reducing agent substitution

Chelating agent substitution

Continuous improvement

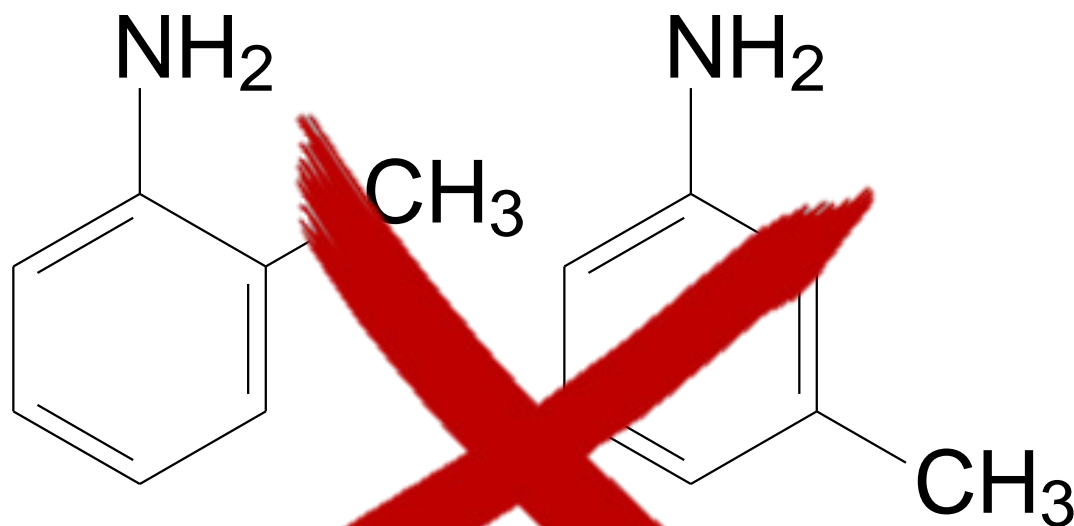


Case Sharing -- False Positives on Restricted Substances

Better Chemistry Better Life



o-Toluidine, cas no. 95-53-4



o-Toluidine

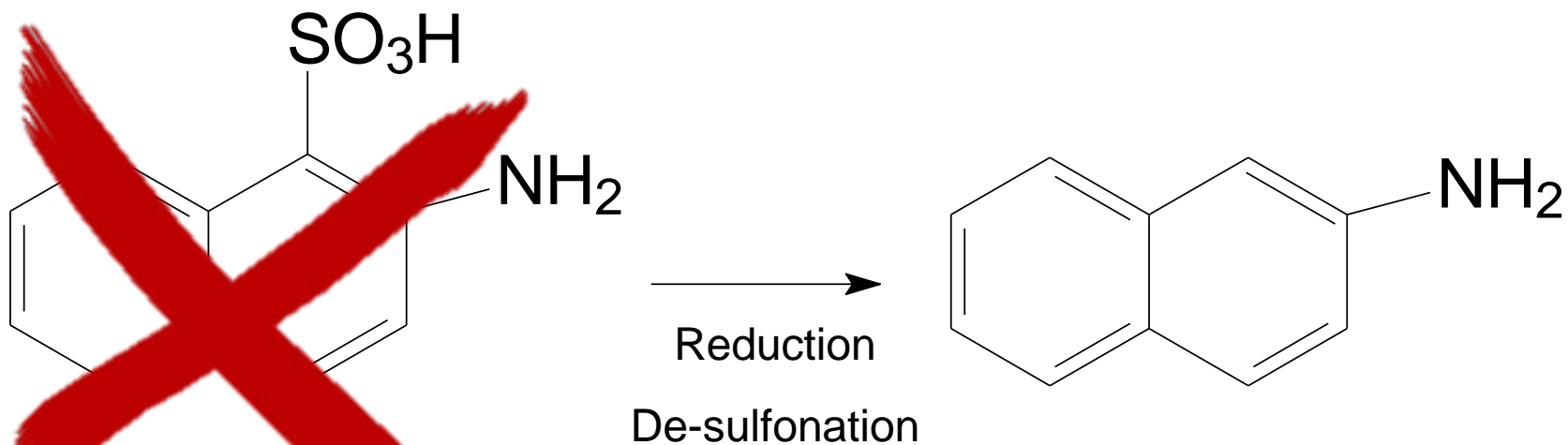
Restricted arylamine

m-Toluidine

Not restricted arylamine

Social Pressure > Technical Argument

2-Naphthylamine, cas no. 91-59-8



Tobias acid

Not restricted

2-naphthylamine

Restricted amine



**Social Pressure >
Technical Argument**

Regulations and Restrictions

Better Chemistry Better Life



Ecolabels for Textiles

1992



Oeko-Tex
Standard 100

The Organic Content
Standard (OCS)



2002

1999



EU environmental
symbol (EU flower)

GOTS



2006

2000



bluesign

ZDHC



2011

RSL by Supply Chain

Restricted substance List in finished products



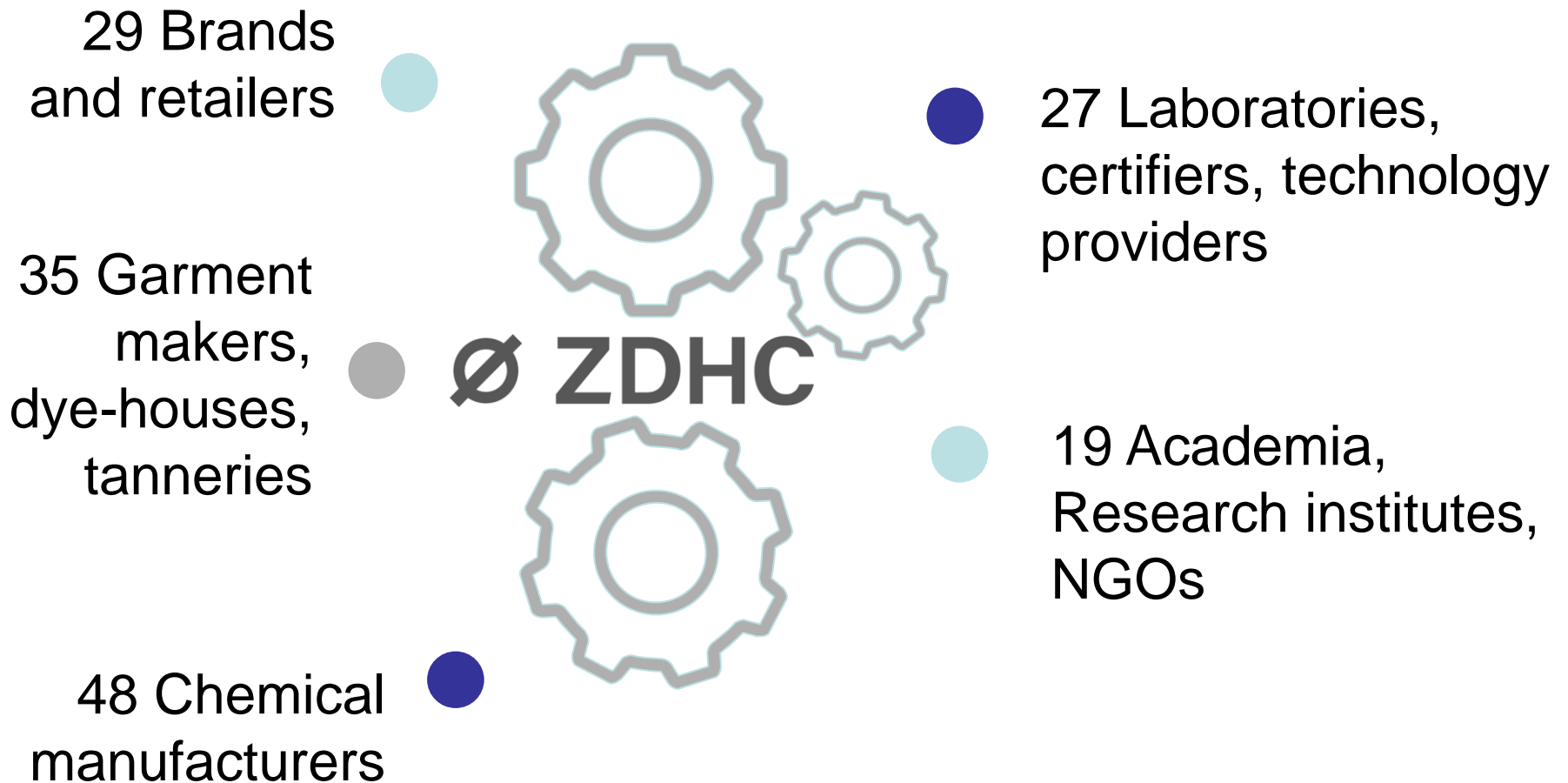


The ZDHC Foundation & Roadmap to Zero Programme

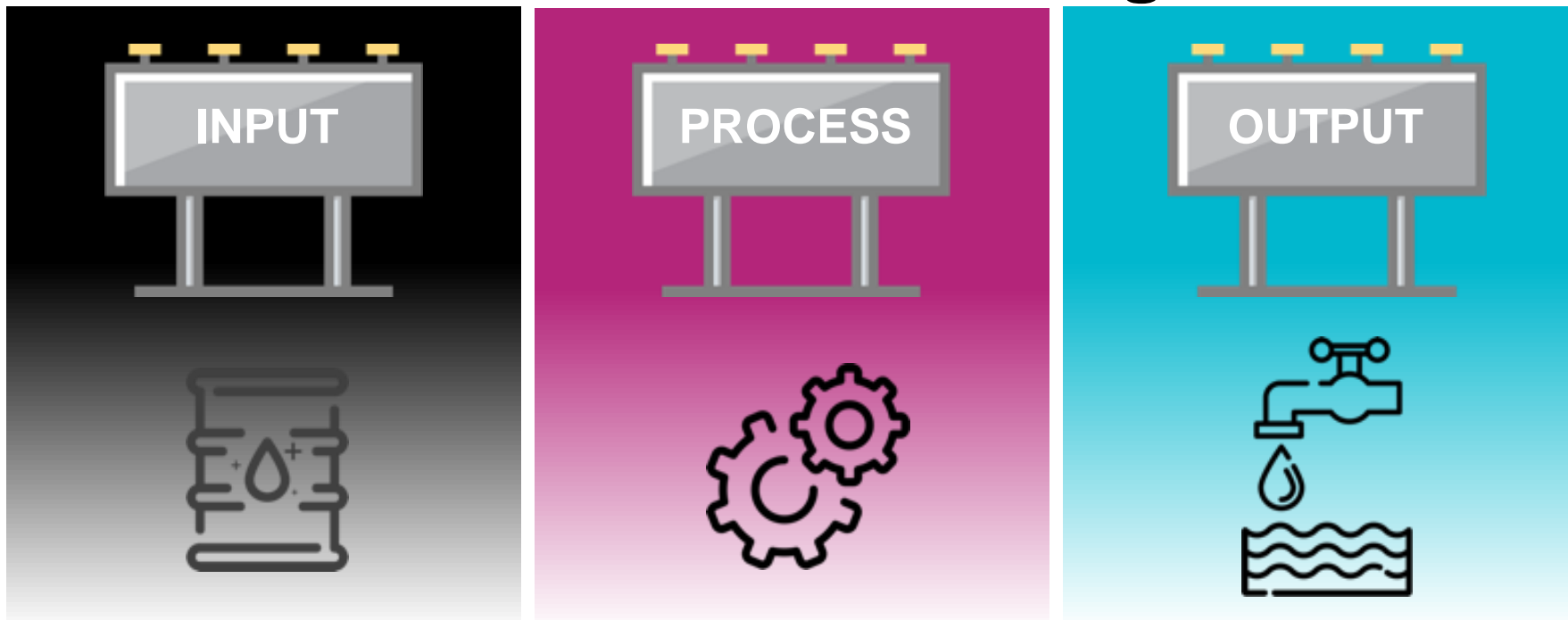
How collective action can transform an industry

Ø ZDHC

ZDHC Contributors (as of March 2021)



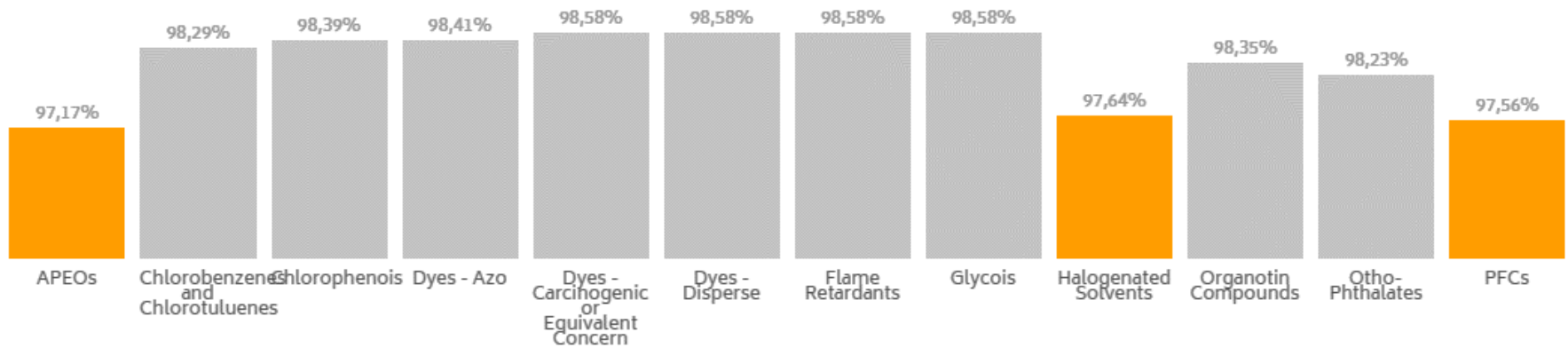
A holistic approach to Sustainable Chemical Management



ZDHC Impact Report

Nov 2019

% of facilities with non-detections per analyte group



Safer Chemistry Innovation in the Textile and Apparel

Safer Chemistry Innovation Areas and Sub-Areas

Source: Safer Made, 2018



Source: <https://www.safermade.net/textile-report>

Restriction of Hazardous Substance 《RoHS》

Restricted substances in electrical and electronic products in the EU market

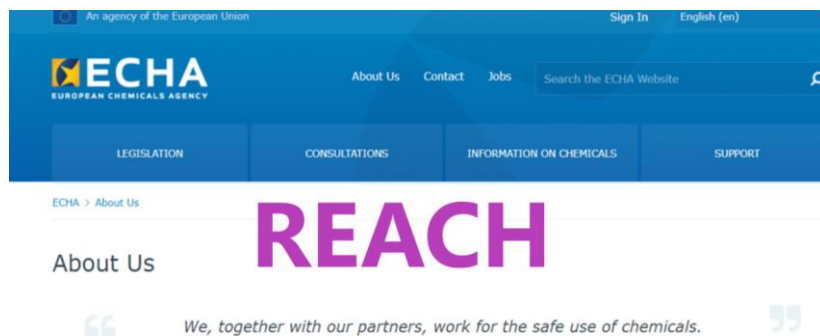
管制物質	濃度限值
鎘 (Cd)	0.01%
鉛 (Pb)	0.1%
汞 (Hg)	0.1%
六價鉻 (Cr6+)	0.1%
多溴聯苯 (PBB)	0.1%
多溴二苯醚 (PBDE)	0.1%
鄰苯二甲酸二(2-乙基己基)酯 (DEHP)	0.1%
鄰苯二甲酸丁酯苯甲酯 (BBP)	0.1%
鄰苯二甲酸二丁酯 (DBP)	0.1%
鄰苯二甲酸二異丁酯 (DIBP)	0.1%

CE
 實施：
2013年1月3日

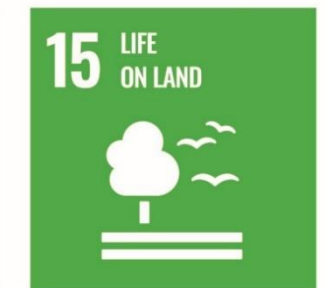
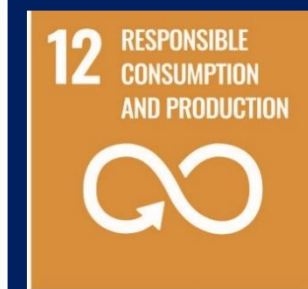
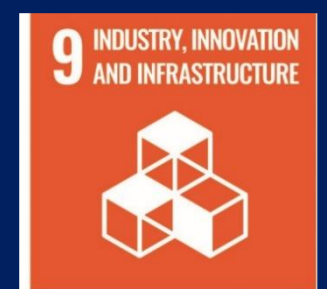
實施：
2019年7月22日
 PS：醫療設備和監控儀器**2021年7月22日**。

<https://www.etc.org.tw/>

Governmental Regulation



SUSTAINABLE DEVELOPMENT GOALS



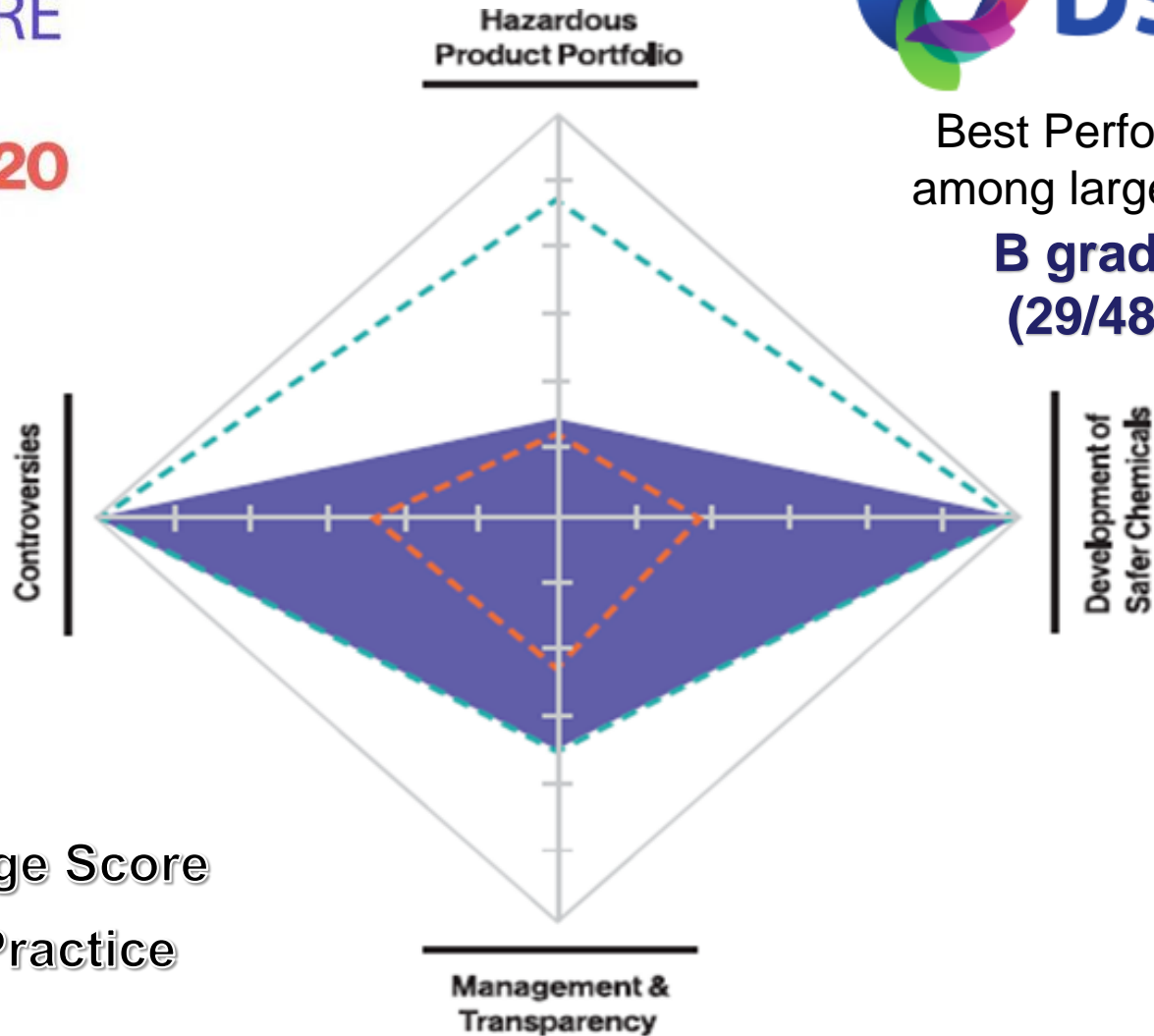
International Benchmarks-- DSM on ChemScore

Better Chemistry Better Life



Best Performer
among largest 35
B grade
(29/48)

- DSM
- Average Score
- Best Practice



2020 ChemScore – Highest Score



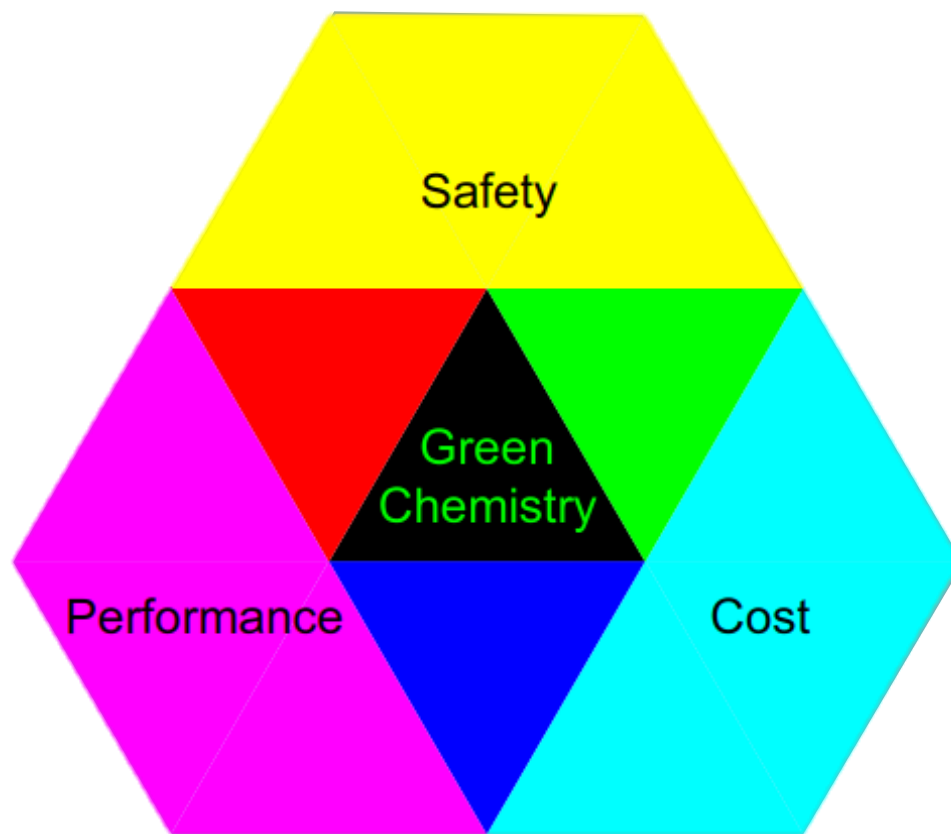
- Full marks in "Development of Safer Chemicals"
- GreenScreen® in the past five years
- No high-concern substances by 2025

Helps Needed

Better Chemistry Better Life



The Holy Grail of Green Chemistry



Source: <https://www.beyondbenign.org/webinar/green-chemistry-inventing-a-circular-economy/>

The Holy Grail of Green Chemistry

Commercial
Chemical Products
90%↑ Opportunities



Source: <https://www.beyondbenign.org/webinar/green-chemistry-inventing-a-circular-economy/>

Chemical Community Needs

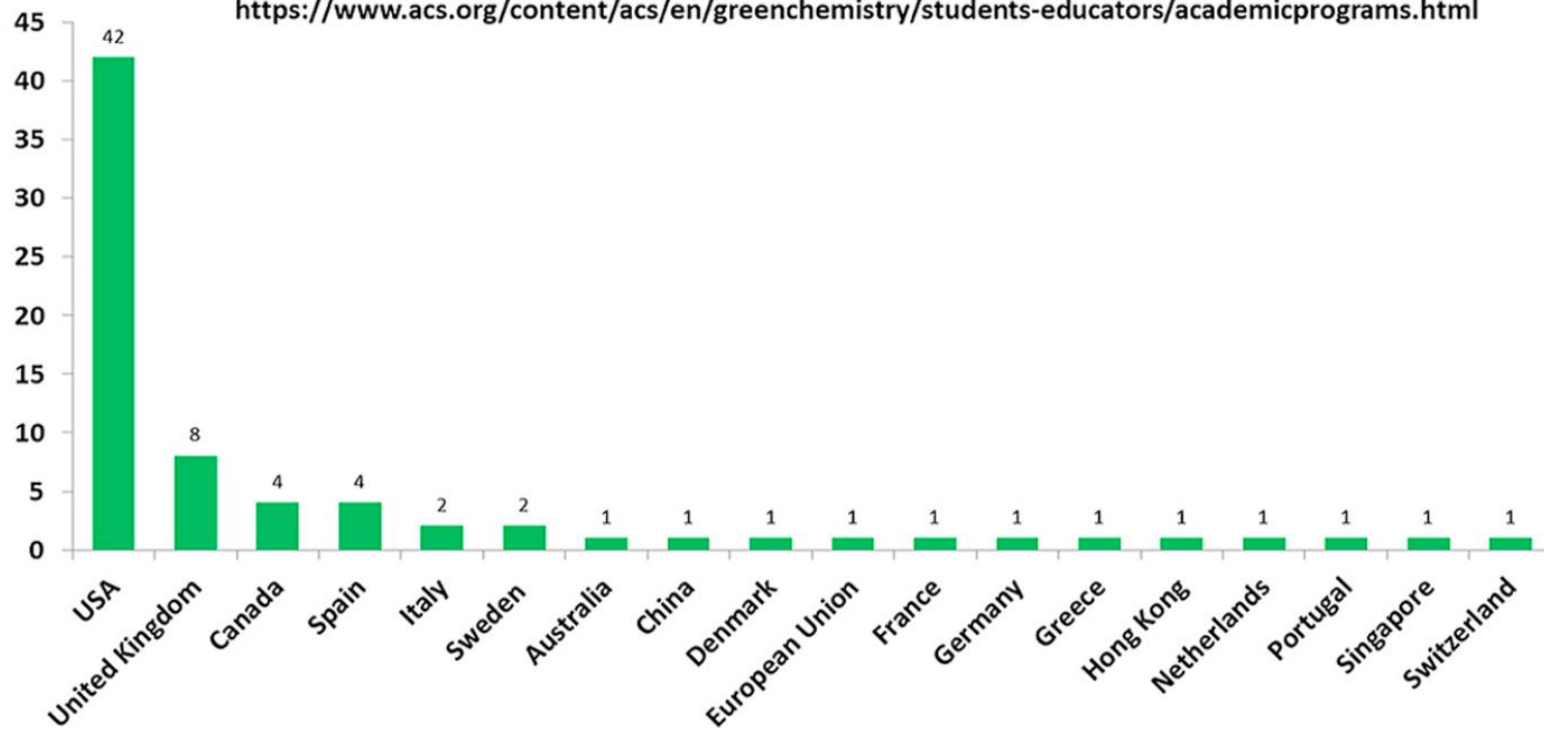
- Beyond “GC 12 Principles”
- Better theoretical frameworks and practical tools
- Breakthroughs in researches and industrial practices
- Chemistry education redesign
- Talent attraction
- Saving the world by reinventing chemistry

My Wish

A world-class Green Chemistry Center in Taiwan

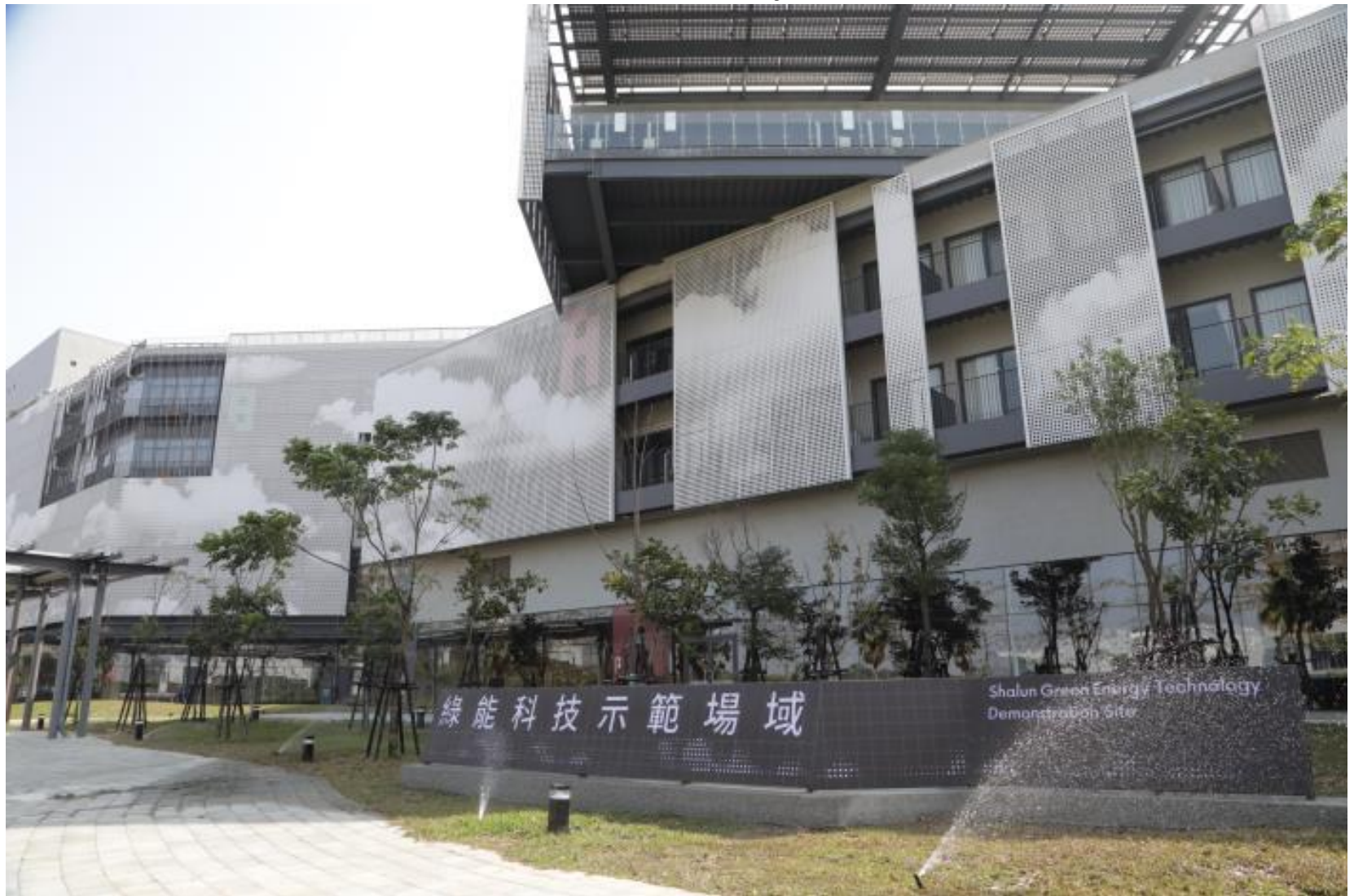
Forerunners fo Green Chemistry & Number of Global Institutions with Green Chemistry Academic Programs 2020

<https://www.acs.org/content/acs/en/greenchemistry/students-educators/academicprograms.html>



My Wish

A world-class Green Chemistry Center in Taiwan



Take-aways from this talk

- Building A world-class Green Chemistry Center in Taiwan
- Better theoretical framework and practical tools needed
 - Breakthroughs in researches and industrial practices
 - Chemistry education redesign
 - Talent attraction
 - Saving the world
- Supporting evidences
 - Industrial practices
 - Social expectations
 - Government regulations
 - International benchmarks