

Shaping our future



The strength to change



R&D for Chemicals and Vinyls

Francine Delplanque
Head of R&D and of HR
Peroxides



- R&D close to customer / market needs
- Longstanding experience by line of business enhances smart scientific choices in R&D:
 - ↳ Illustrations: HPPO, Epicerol[®] and SOLVAir[®] Select 300
- R&D geared to three areas:
 - ✓ Competitiveness
 - ↳ Illustration: Vinyls
 - ✓ Scientific breakthroughs
 - ↳ Illustration: Direct synthesis of H₂O₂
 - ✓ Product innovation
 - ↳ Illustration: Color filter pigments for flat displays

Today's major industrial development from previous R&D - HPPO



- Technological leadership
 - ⇒ Proprietary anthraquinone¹ **with higher productivity**
 - ⇒ **Largest capacities**
 - ⇒ **Lowest investment cost**
 - ⇒ **Optimized variable and fixed costs**
- Opens avenues for **new applications**
 - ⇒ Partnership with Dow Chemical and BASF to **supply H₂O₂ for production of Propylene Oxide: HPPO**
 - ⇒ **Start-up of 1st HPPO mega-plant (230 kt/y; Belgium) in 2009**
 - ⇒ **2nd HPPO mega-plant (330 kt/y; Thailand) expected in 2011**

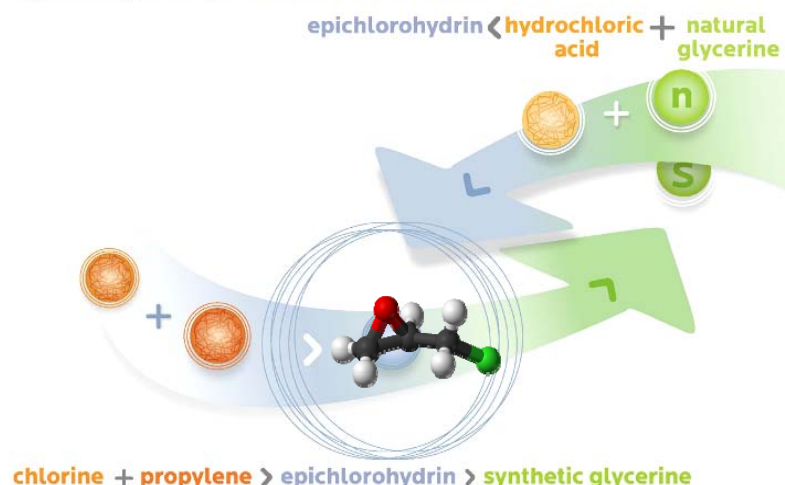
¹ One of the key ingredients of the working solution

Today's major industrial development from previous R&D - Epicerol®



EPICEROL®, a Glycerine-based technology

Epicerol®, from product to raw material



- 2003: first idea about EPICEROL®
- 38 patent applications
- 2007: industrial unit of 20 kt/year in France
- Construction of a production unit of 100kt/year in Thailand (start-up: 2012)

Sustainable process

- ✓ 35% less energy usage
- ✓ 10 x less water used
- ✓ 8 x less chlorinated by-products

Today's major industrial development from previous R&D - SOLVAir[®] Select 300



- **Innovative (patented) low-cost production process of sodium bicarbonate**
 - ↳ Based on previously unutilized carbonate-rich waste stream
- Designed for **treatment of air pollution**, a.o. from power plants
 - ↳ Up to 90 % removal of sulfur dioxide (SO₂)
- **Production unit of 125 kt/y** at Green River (US) started successfully in 1H10
 - ↳ 70% solid waste reduction
 - ↳ Valorization of up to 35 kt CO₂ on site

R&D for Chemicals and Vinyls

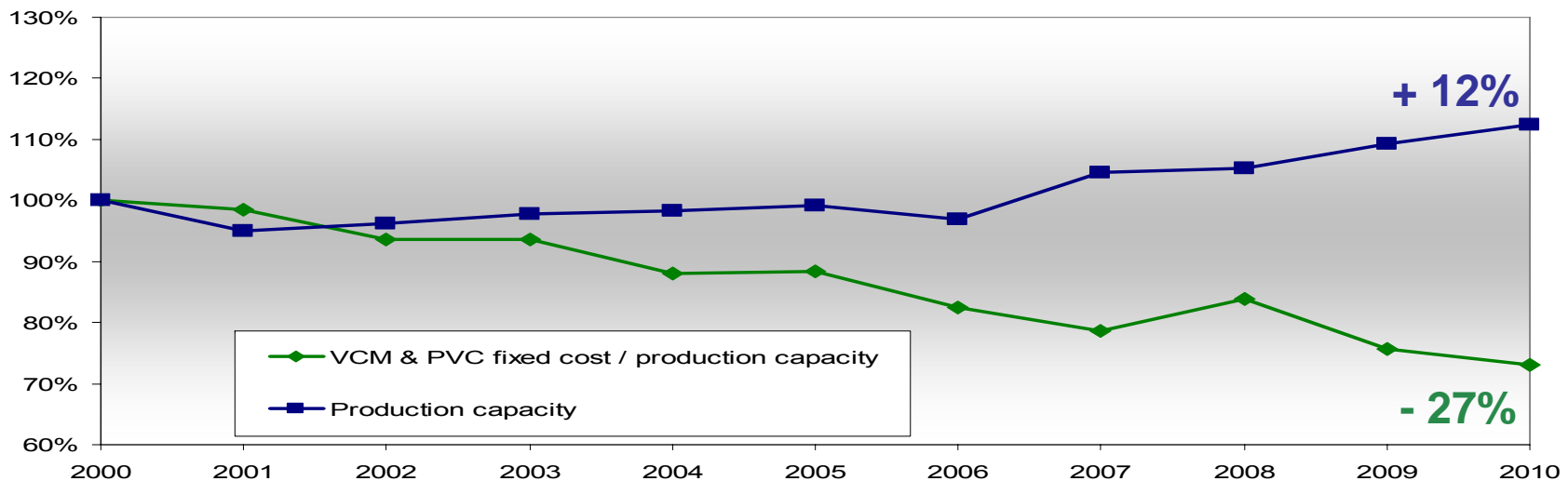
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Technological leadership in VCM and PVC thanks to R&D

SOLVAY GROUP

- Centralized R&D at SolVin and R&D license agreements with Solvay Indupa and with Vinythai
- Rich global exchange of best practices between 8 plants
- Technology license agreements (Singpu Chemical Industries)

Solvay Vinyls sharply decreased its fixed costs over 10 last years



R&D geared to competitiveness VCM / PVC – Capacity increase



- **Challenge**

- ➔ Reduction of polymerization batch time

- **Target**

- ➔ More efficient use of reactor cooling capacity all along the batch

- **A new process has been implemented with:**

- ➔ Proprietary initiator

- ➔ Strong inhibitor

- **Result**

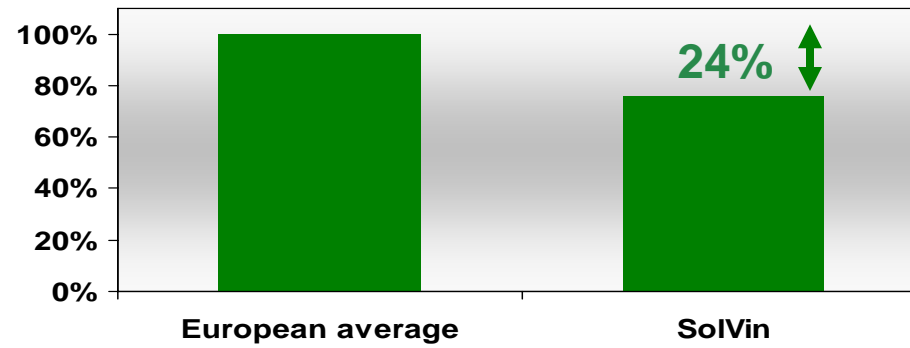
- ➔ **10 % higher productivity**

R&D geared to competitiveness VCM / PVC – Sustainability improvement



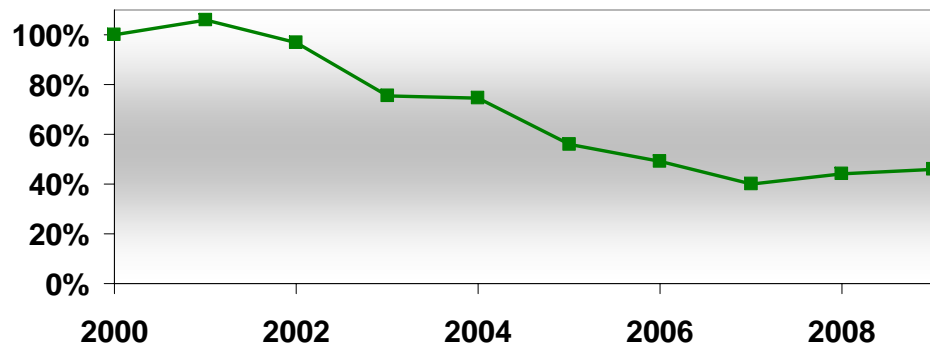
VCM / S-PVC steam consumption

SolVin is less energy intensive than its European peers



Source: ETS Benchmark done by IFEU in Europe (GJ/t VCM + GJ/t PVC)

VCM emissions from VCM / S-PVC production (SolVin plants) (g/t PVC)



SolVin sharply decreased its VCM emissions

R&D geared to competitiveness VCM / PVC – Sustainability improvement



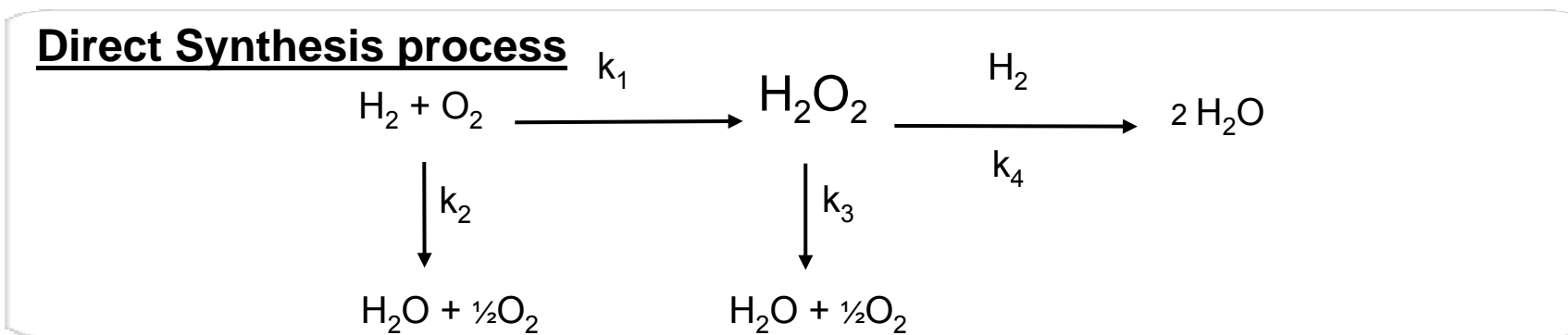
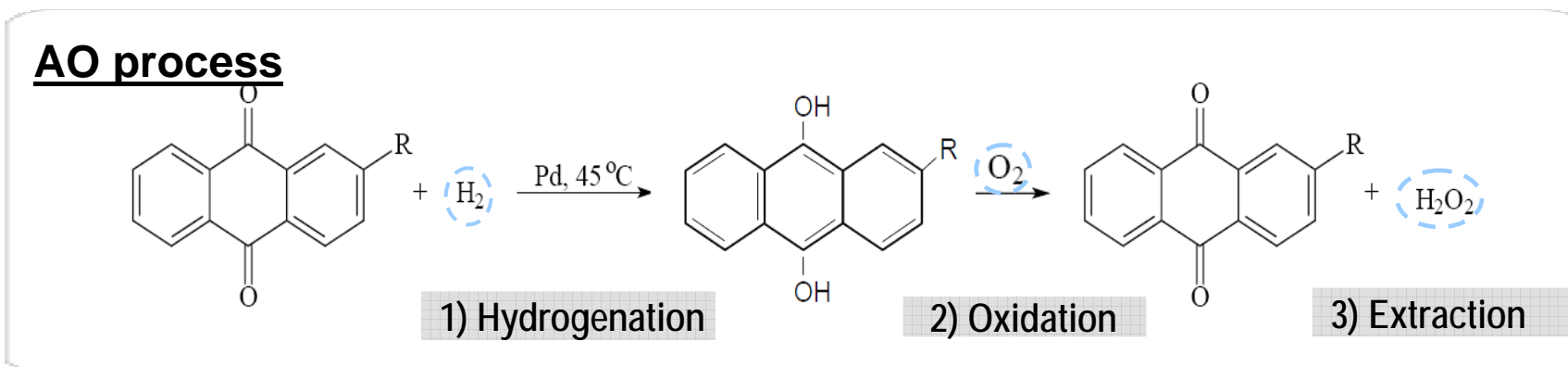
- **Increase sustainability advantage of VCM / PVC**
 - ➔ Reduction of emissions and energy consumption
- **Reduce dependence on petrochemical ethylene**
 - ➔ Production of ethylene from bio-ethanol under study (Brazil)
 - ➔ Other options under evaluation
- **Solve questions around additives and plasticizers in PVC compounding**
 - ➔ Selection of new bio-based plasticizers in collaboration with partners (customers and suppliers)
 - ➔ Substitution of lead-based additives in Solvay's compounds

R&D geared to scientific breakthroughs

H₂O₂ from direct synthesis



As the market & technological leader in H₂O₂, **Solvay continuously focuses on alternative technologies, direct synthesis being recognized as the best option**



R&D geared to scientific breakthroughs H_2O_2 from direct synthesis



- **Direct synthesis, a challenging process since almost one century**

- ✓ In principle, the simplest method
- ✓ Main potential advantage: cleaner process and lower CAPEX
- ✓ Still perennial problems in terms of :
 - Reactions: H_2O versus H_2O_2
 - Quality: to cover the full range of applications



- **Strong R&D partnerships, especially on catalyst developments**

- ✓ Open innovation approach with worldwide Best In Class academic teams

Award in November 2009 in catalyst for Direct synthesis

Collaboration with Cardiff University recognized by the Institute of Chemical Engineers Innovation and Excellence in Sustainable Technology

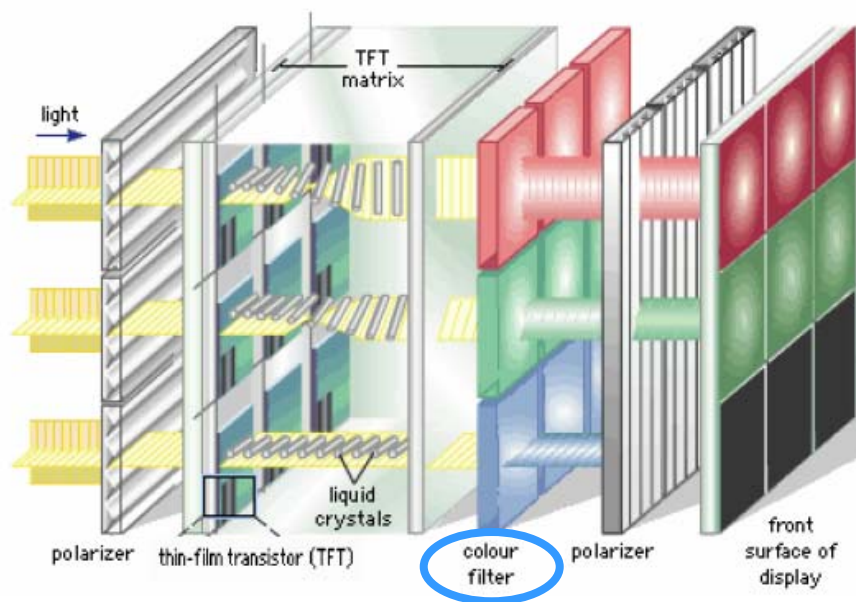
R&D geared to product innovation

Color filter pigments for flat displays



- Context

The Korean display industry (40% of global market) required an alternative source of color filter pigment pastes, which was supplied exclusively by Japanese companies



R&D geared to product innovation

Color filter pigments for flat displays



- **Main challenge for the display industry (LED equipped LCD)**
 - ✓ High contrast and high brightness
- **Existing related knowledge and competencies of Solvay**
 - ✓ Know-how in organic pigments/ dyes/ additives and in nanotechnology
- **Solvay's objectives**
 - ✓ Develop stable color filter pigment pastes (ink) of nanoparticles with round shaped crystals, very well dispersed in organic solvent
 - ✓ Focus first on blue color (copper phthalocyanine)
- **How ? R&D partnerships**
 - ✓ Open innovation through a network of universities
 - ✓ Since 2006, joint development with the Korean NEPES
 - Expertise in dispersion technology for nanoparticles
 - Direct access to key customers
 - ↳ **close collaboration with a key display manufacturer**

R&D geared to product innovation

Color filter pigments for flat displays



● Today's results

- ✓ IRIDOS, a 50/50 JV with NEPES (from R&D to Sales)
- ✓ After only 3 years of research, **blue pigment pastes approved**
- ✓ Production started end 2009 a brand-new plant in Onsan
- ✓ Ongoing approval processes with other potential customers
- ✓ Opens avenues for new applications, new color filter pigment pastes

● Our 2015 ambition

- ✓ To become a **key player on the color filter pigment pastes for the display market**
 - ↳ Global market \approx 200 million EUR in 2010

Financial impact of R&D

Chemicals + Vinyls; averages of last 3 years



- **Value of competitiveness improvements** **EUR 380m**
- **New sales from new products, applications and new technologies** **EUR 480m**
- **Value new business pipeline** **EUR 600m**
- **Average R&D contribution to Chemicals + Vinyls**
 - Competitiveness improvements** **8% of REBIT**
 - Current new sales** **10% of sales**
 - Future new sales** **12% of sales**

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