

# Overview of Superabsorbent Polymer Development & Major SAP Producers

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# **Ian Davenport**

**Founder and President of Davenport  
International Associates LLC**

**25 Years experience of global SAP industry**

**Exclusive Danson representative for US &  
Canada**

**1) History & Development of Superabsorbent Diapers**

**2) Global Supply / Demand of SAP**

**3) SWOT (strengths, weakness, opportunities, threat)  
Analysis Major SAP Producers**

# Development of SAP Diapers

**Early 1980's – 1<sup>st</sup> SAP diaper launched in Japan by Unicharm, others follow quickly**

**1985/86 – P&G Pampers US includes SAP**

# Development of SAP Diapers

**Diaper thickness dramatically reduced as 1g SAP replaces 4+ g. of fluff pulp. Early SAP diapers contain around 5g. of SAP and 40g. of fluff pulp**

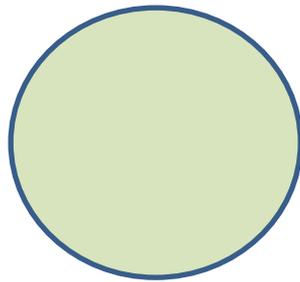
**1<sup>st</sup> generation SAP has good absorbency BUT there was trade off between Capacity (CRC) and Absorbency under Load (AUL)**

**Improved CRC meant reduced AUL**

**Improved AUL meant reduced CRC**

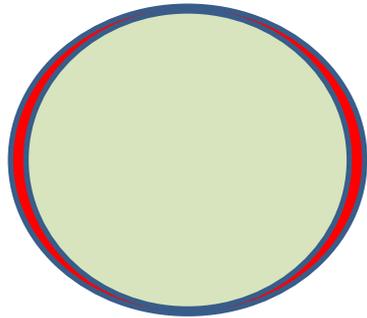
# Development of SAP Diapers

**1<sup>st</sup> generation SAP has a uniform cross link density**



# Development of SAP Diapers

**1988-1990, second generation SAP increased cross linking at the surface – usually by Surface Crosslinking (SXL)**

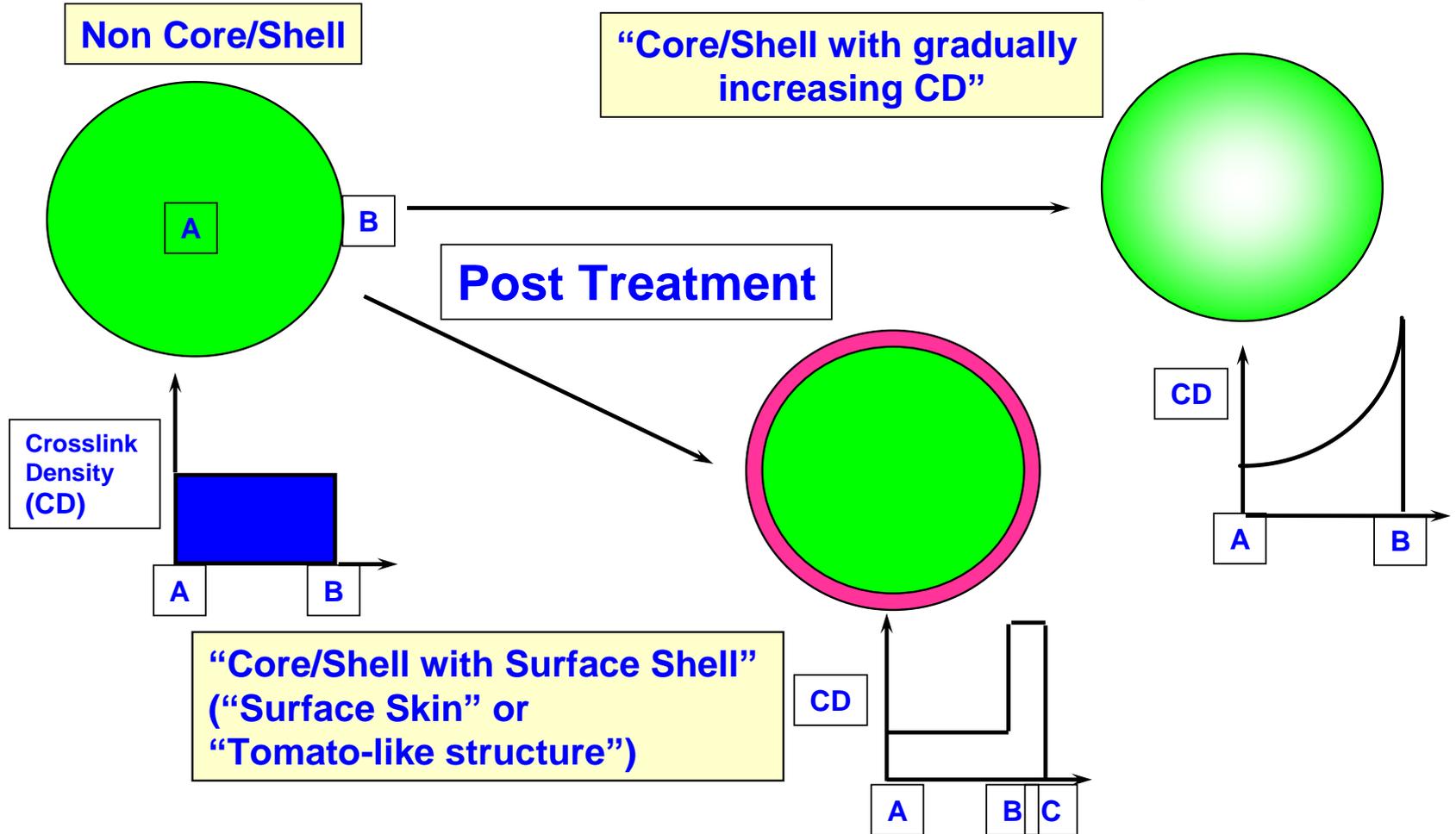


**This allows much higher AUL while retaining capacity.**

**Think of this as like a tomato – the surface is flexible but the tomato is held inside**

# Core/Shell Structured SAP Particles

CD = Cross Link Density



# Development of SAP Diapers

**SAP per diaper has gradually increased to >50% of core weight, with ultra thin diapers moving to a core of 25-30g. total weight, containing 10-14g. SAP**

**The diaper machine puts the SAP under huge pressure; sometimes the 'shell' breaks so that the SAP in the diaper performs badly – we call this 'ATTRITION'**

# Development of SAP Diapers

**New properties and tests have been developed over time:**

**Permeability**

**Gel Conductivity**

**Special particle size distribution (PSD)**

**Labels such as 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> generation have been given but all are improvements on 2<sup>nd</sup> gen. process  
SAP now has to do more than absorb and retain fluid, it must also transport fluid after swelling**

# Development of SAP Diapers

## **Permeability/ Conductivity**

- **The transport of liquid through a layer of swollen Superabsorbent. This is a combination of porosity, particle size and the packing of the particles**

**Different companies have proprietary test methods**

# **Development of SAP Diapers**

**Latest diapers have ZERO fluff**

**P&G China first followed rapidly by high tier P&G diapers in US and Europe**

**SAP now 12-14 g per diaper in high tier diapers with hot melt adhesive and curly fiber; SAP has slightly higher CRC to compensate for loss of fluff pulp & in some cases SAP has a more specific particle size distribution**

# Development of SAP Diapers

**Competitors of P&G will find ways to follow BUT patent landscape is designed to make it hard to follow**

**Patents tend to cover diaper design and specific raw material combinations**

# Development of SAP Diapers

**Major diaper producers try to patent SAP properties as used in a diaper to block competition:**

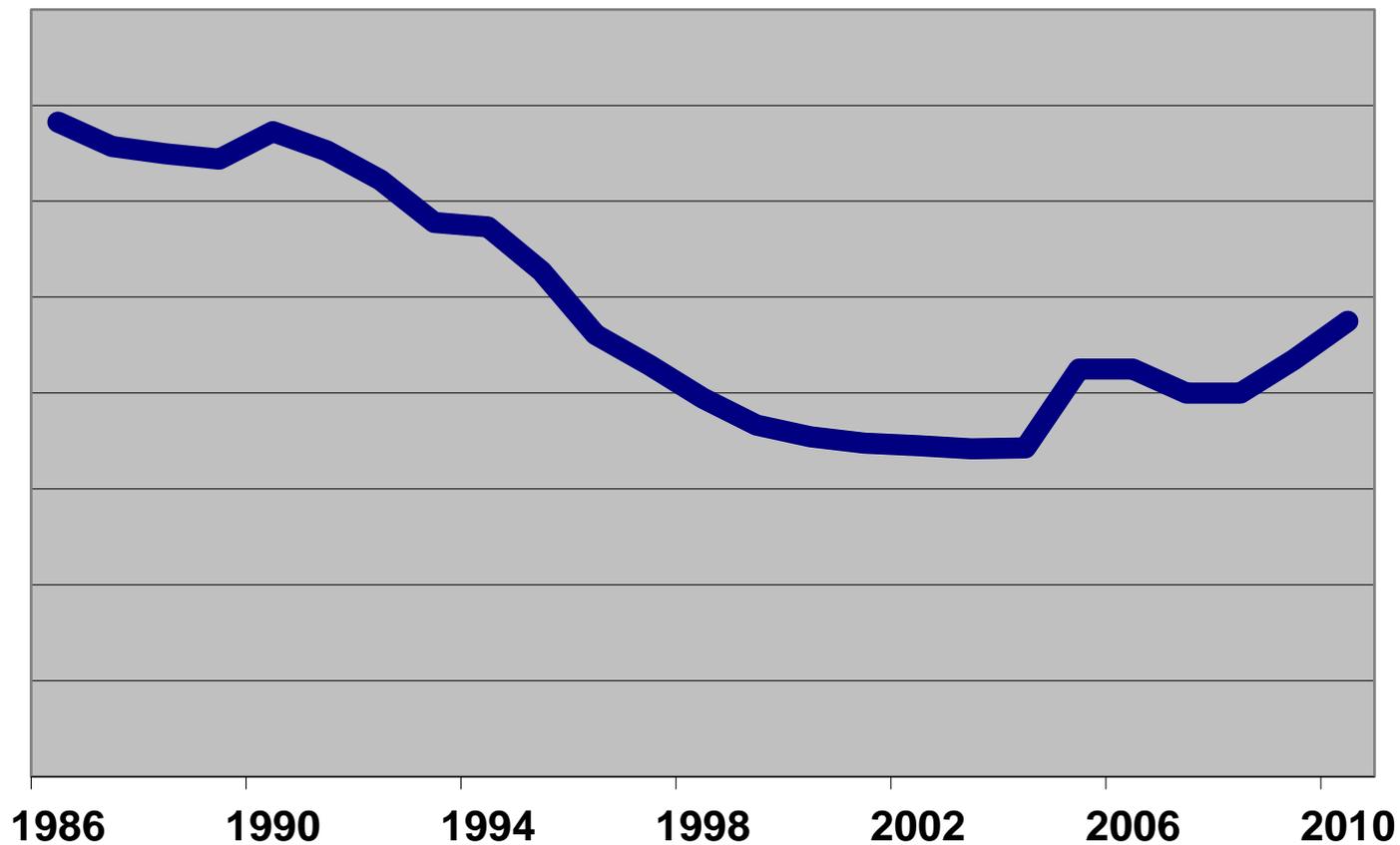
- 1) Stop other SAP producers making & selling their SAP type**
- 2) Stop competitors using such a type of SAP in an article such as a baby diaper**

# SAP Supply Demand

**Historical SAP over capacity and falling prices – producers building ahead of demand & lower costs due to economies of scale as production plants became bigger (< 10; 20; 30; 60 kT trend)**

**Global shortage of Acrylic Acid 2005 and again in 2010 plus high Propylene costs stopped the trend to lower prices. SAP demand exceeded capacity in 2010.**

# SAP – US Pricing



# SAP Supply Demand

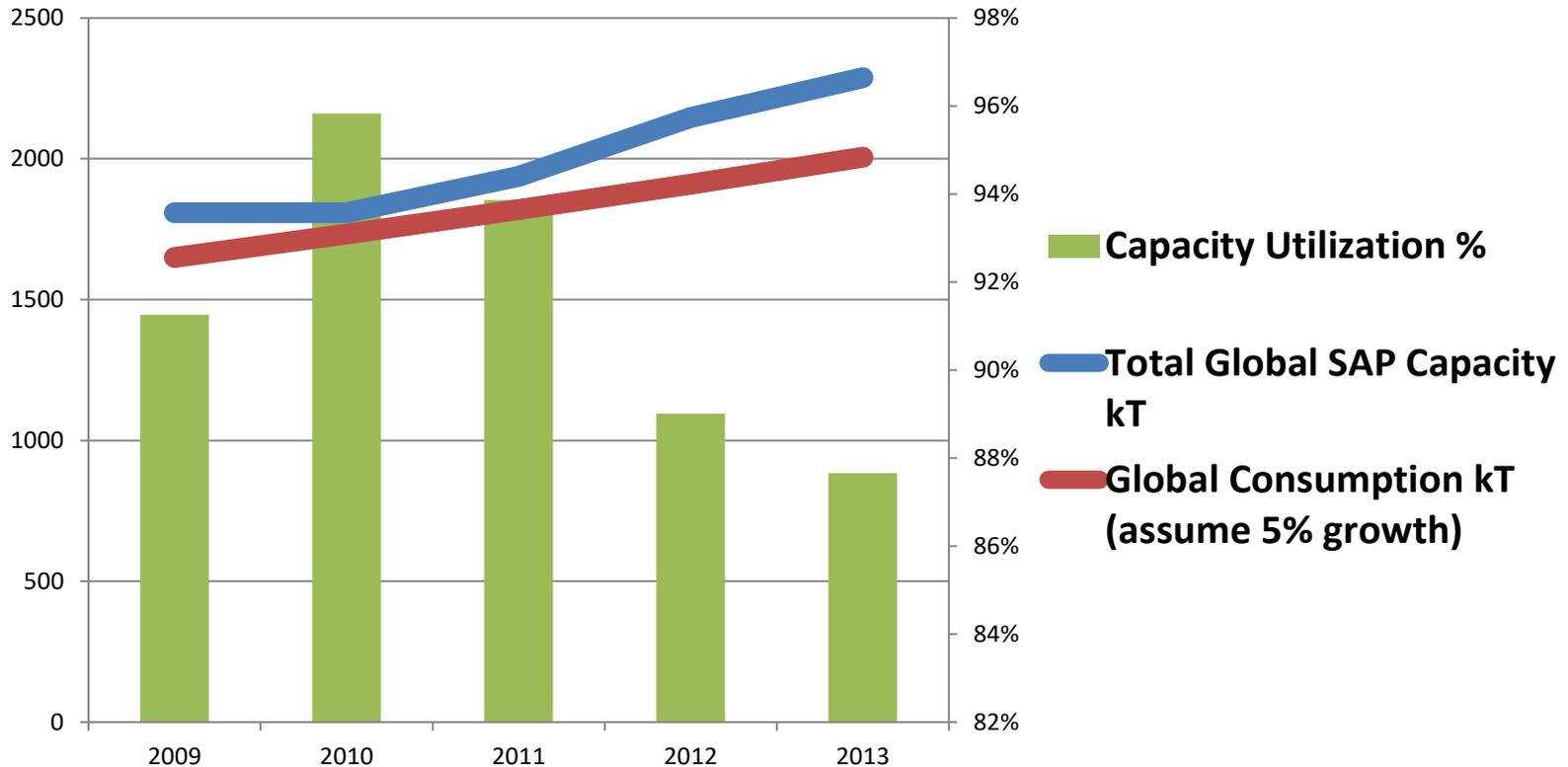
**Global 2011 demand is about 1.7 million MT**

**End of year 2011 capacity is 2.1 million, effective 90%**

**Chart assumes 100% of 2010 capacity available in 2011**

**90% = 'sold out' to allow for downtime, maintenance**

# SAP Supply Demand



**Assumes 100 kT Yixing Danson capacity by end 2011; does not include future Danson expansions**

# SAP Producer SWOT Analysis

**S = Strength**

**W = Weakness**

**O = Opportunity**

**T = Threat**

**Compare 'Big 3' with Yixing Danson**

**BASF**

**Evonik**

**Nippon Shokubai**

**Yixing Danson**

# SWOT (1) BASF

## STRENGTH

VERBUND Integration(C<sub>3</sub>, AA, Ester, SAP)  
= LOW COST (no transport raw material)  
Global (EU, US, Thailand)  
Customer relations PG, KC, SCA, FQ etc.  
Financially strong  
Consistent strategy

## WEAKNESS

Hard to find!

## OPPORTUNITY

Grow with customers globally  
Study Malaysia, Brazil, China production

## THREAT

Overconfidence  
Slow to add capacity in China

# SWOT (2) Evonik

## STRENGTH

Large capacity in US, EU  
Low cost to operate process  
Customer relations PG, KC, etc.  
Capable and experienced people

## OPPORTUNITY

Grow with customers globally  
Saudi Arabia production can be low cost  
base for sales in ME and Asia

## WEAKNESS

No production in Asia  
Own CAA but not GAA production  
GAA transport cost to SAP plant  
2 SAP plants in each of US & EU = extra  
fixed costs

## THREAT

Slow to add capacity in Asia/ China

# SWOT (3) Nippon Shokubai

## STRENGTH

Strong Acrylic Acid integration  
Global production Japan, China, US, EU  
P&G relationship almost 30 years  
Experienced people

## WEAKNESS

Purchase Propylene  
> 50% sales (estimate) to P&G  
Other customers low priority  
> 60% of capacity in Japan (single plant is vulnerable)  
Rely on 3<sup>rd</sup> parties for non P&G sales

## OPPORTUNITY

New factory Indonesia - SE Asia growth  
Develop new customers

## THREAT

Loss of share at P&G

# SWOT (4) Yixing Danson

## STRENGTH

Acrylic Acid Supply (Taixing Jurong)  
Lowest capital per kT of capacity  
Willing to invest fast in growth capacity  
Fast decision making  
Well respected in China  
Fast to learn and adapt

## WEAKNESS

Freight & Duty cost to US & EU  
Late entry to SAP production  
Uncertain product consistency  
Missing relationships with major buyers  
Lack of understanding of buyer behavior  
All new staff – a lot to learn

## OPPORTUNITY

New player for major customers to leverage  
Can avoid mistakes of competitors  
No history – no preconception – ‘blank slate’

## THREAT

Over confidence (“we build and customers will buy!”)  
May underestimate R&D effort & time needed to create latest generation SAP

# Why Danson?

## Customers need

- partner for **GROWTH**
- supplier willing to **INVEST**

# DANSON must:

- **Be humble & patient to learn**
- **Build deep relationships with major customers**
- **Invest in training of all staff**
- **Respect patents and invest to patent new Danson developments**
- **Be consistent and *patient***

# Conclusions

**Diapers and SAP will continue to evolve**

**SAP global market will continue to grow minimum 5% with China, SE Asia at much higher rates**

**SAP Supply/ Demand is Balanced to tight (but changing!!)**

**There is a real opportunity for Yixing Danson to succeed globally**

# **Danson intend to add capacity to grow sales both domestic and export**

**2012            80kT**

**2013            80kT**

**2014            80kT**

# THANK YOU

To Danson and to Mr. Sun Liping for inviting me to make this presentation in the city of Xiamen

To all of you in the audience for listening

## QUESTIONS?

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