

Overview of Superabsorbent Polymer Development & Major SAP Producers

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Ian Davenport

**Founder and President of Davenport
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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 – 1st 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

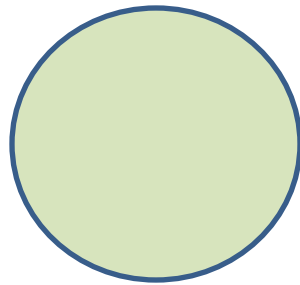
1st generation SAP has good absorbency BUT there was trade off between Capacity (CRC) and Absorbency under Load (AUL)

Improved CRC meant reduced AUL

Improved AUL meant reduced CRC

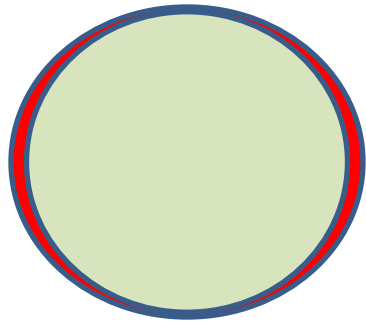
Development of SAP Diapers

1st 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)

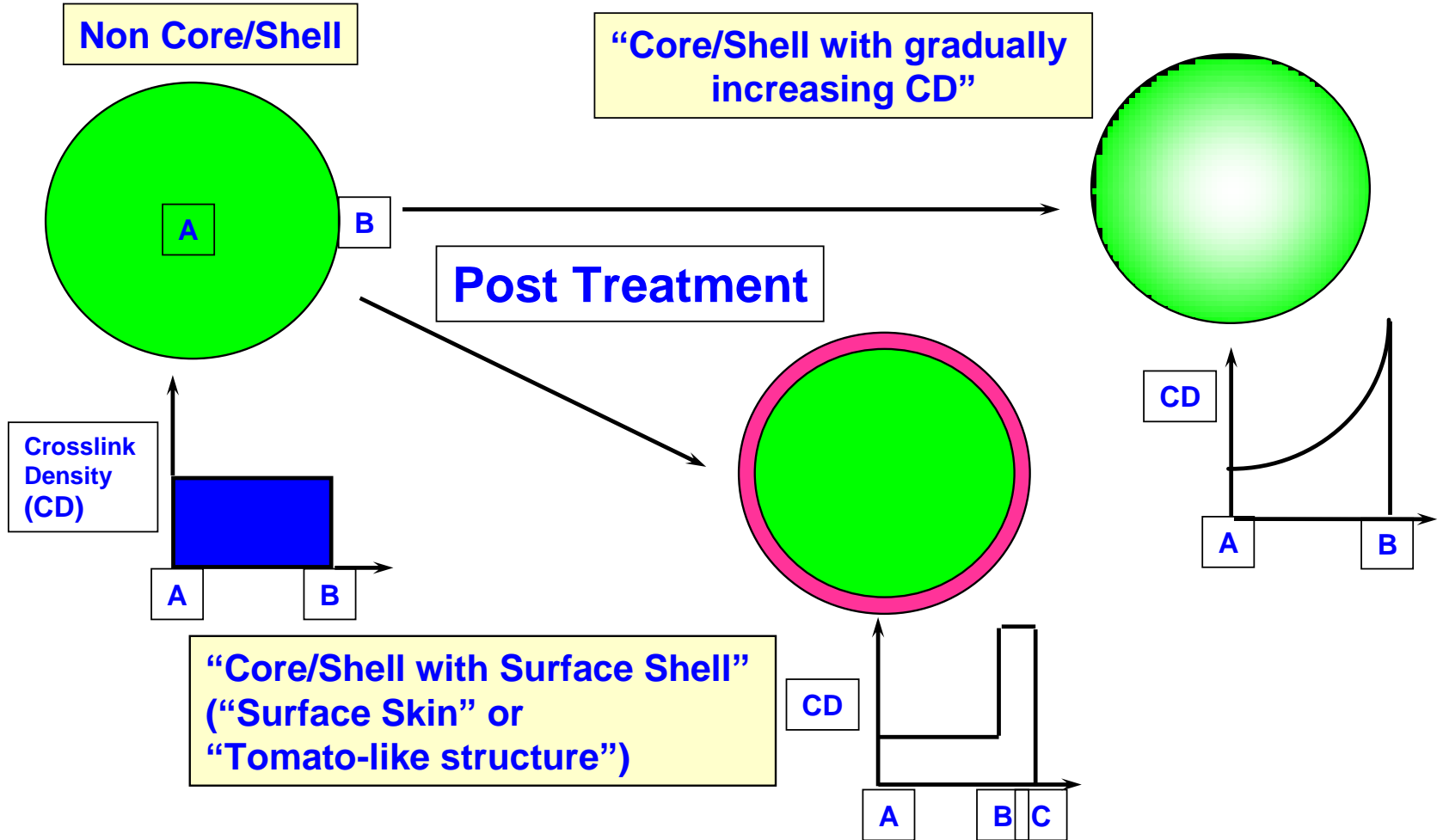


This allows much higher AUL while retaining capacity.

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 3rd, 4th, 5th generation have been given but all are improvements on 2nd 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:

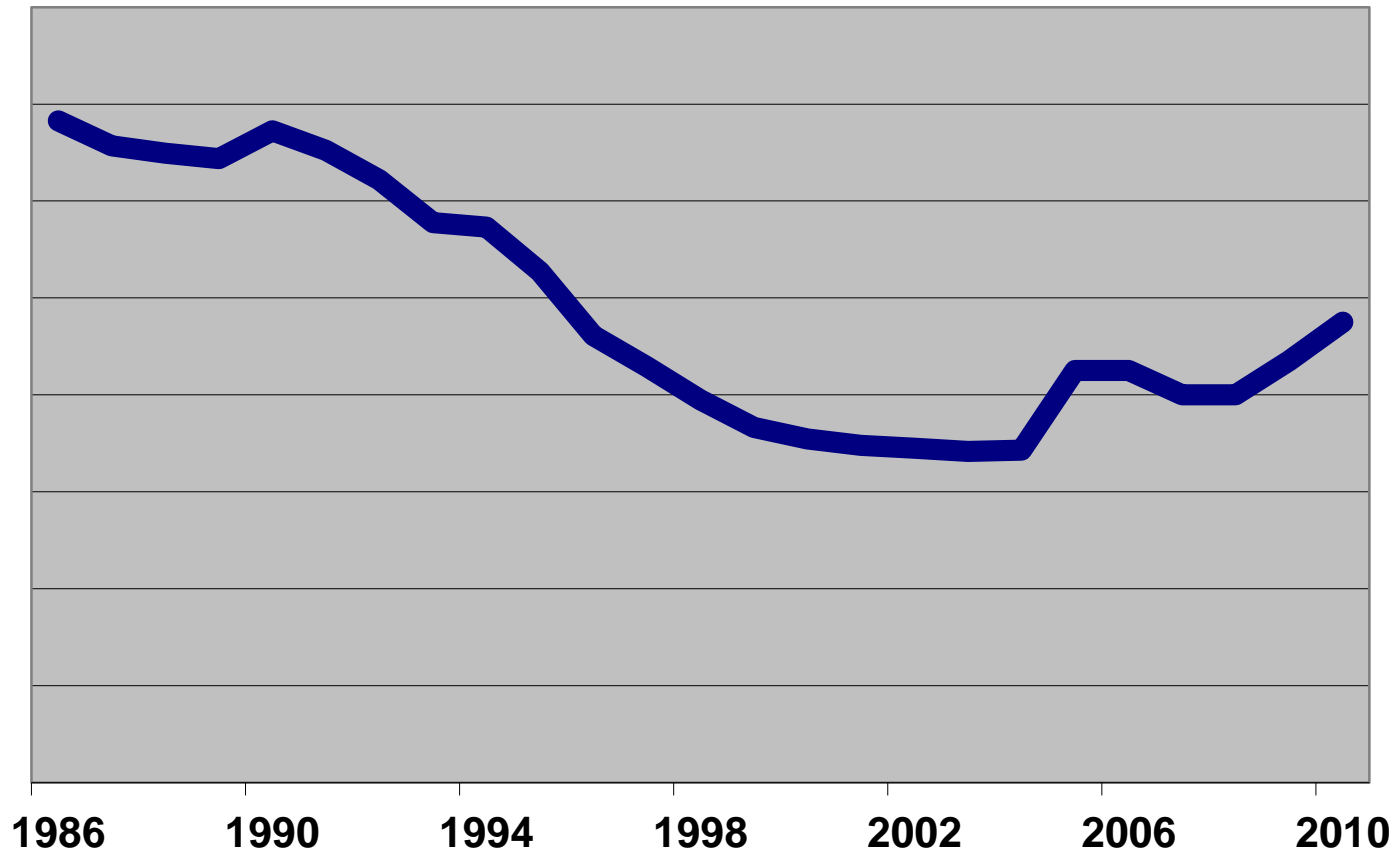
- 1) Stop other SAP producers making & selling their SAP type**
- 2) Stop competitors using such a type of SAP in an article such as a baby diaper**

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

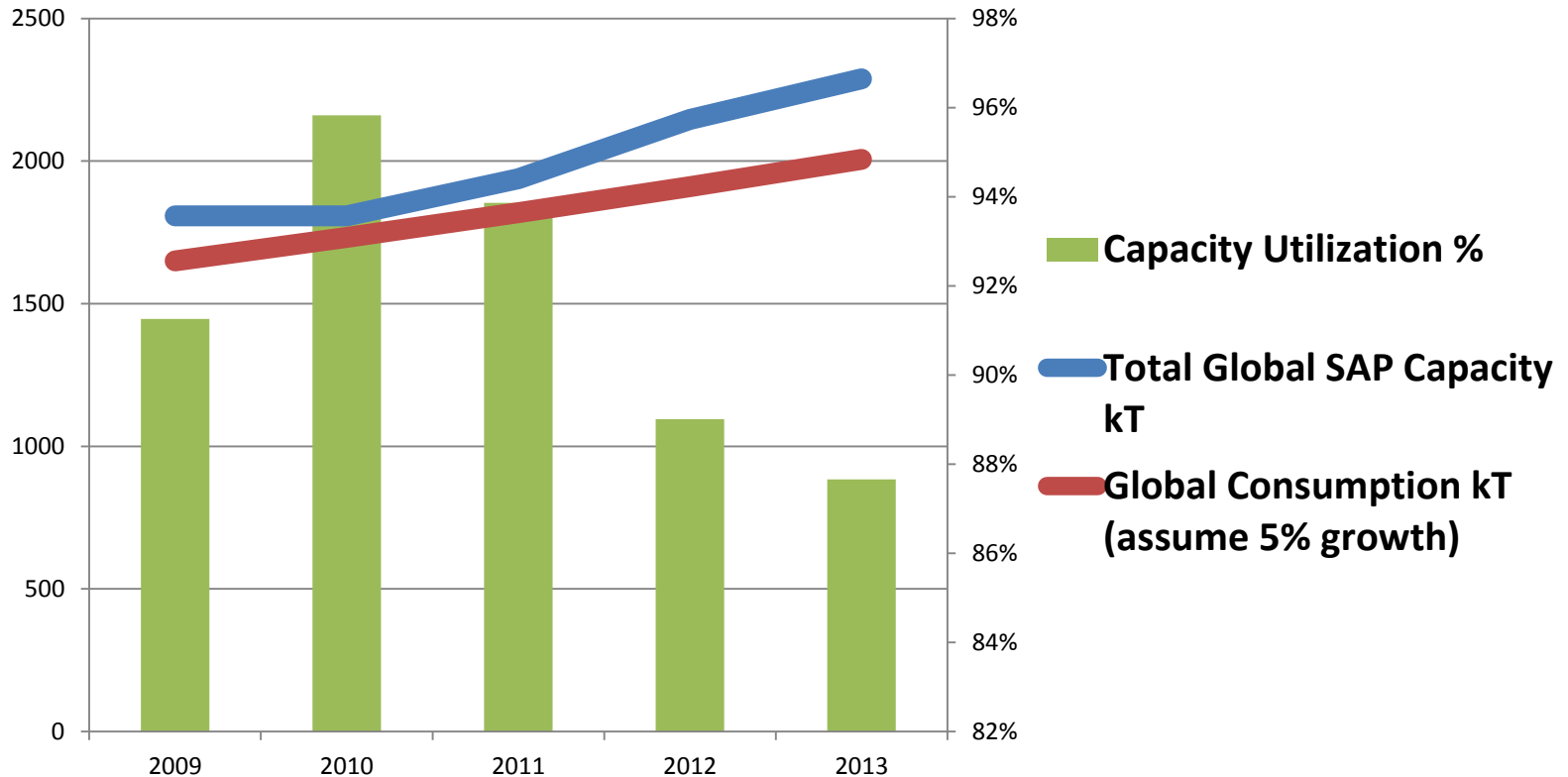
Global 2011 demand is about 1.7 million MT

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(C₃, 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

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

OPPORTUNITY

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

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 3rd 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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