CHEMICAL PROFILE: SAP

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USES

Superabsorbent polymers (SAP) are able to absorb and retain large volumes of water and aqueous solutions. They are key ingredients in disposable diapers, feminine hygiene and adult incontinent products. Almost 90% of SAP output is used in personal care applications. About 77% of global acrylic SAP is used in diapers, 9% in adult incontinent products, 4.2% in feminine napkins, 4% in agriculture, 1% in construction, 0.8% in adhesives, 0.4-0.6% each in packaging, hospital draw sheets, cable and waste treatment. Acrylic SAP is also used in petroleum, batteries and some 20 other applications.

SUPPLY/DEMAND

Global annual capacity stood at 2.34m tons in 2013, split between Asia Pacific, Japan, the US and Western Europe with capacities of 949,000 tons, 631,000 tons, 561,000 tons and 544,000 tons, respectively. China had a capacity of 440,000 tons.

The consumption pattern in Asia Pacific, the US, Western Europe, Japan, Latin America, Asia/Middle East, Mexico, Eastern Europe, Australia/New Zealand and Africa was 39.8%, 19.3%, 18.2%, 6.2%, 6%, 3.2%, 2.4%, 2.1%, 1.3% and 1.2% respectively. There is a high volume of export/import flow between various world regions with Japan and China topping the list with net exports of 280, 000 tons and net imports of 250,000 tons, respectively.

PRICING

The price of SAP depends on absorption under load, fluid uptake rate, residual monomer content, polymer extractables, acquisition rate and gel strength which varies from one producer to another. Cross-linked homopolymer acrylic SAP prices in the first quarter of 2014 were negotiated between $2.9-3.1/kg in the US, €2.07-2.22/kg in Germany and ¥15.5-16.7 in China.

TECHNOLOGY

Superabsorbent polymers are now commonly made from the polymerization of acrylic acid blended with sodium hydroxide in the presence of an initiator and cross-linking agent to form a polyacrylic acid, sodium salt. This polymer is the most common type of SAP made in the world today. SAP are made using one of three primary methods: (1) gel polymerization, (2) suspension polymerization or (3) solution polymerization. Each process has certain advantages over the others and there are trade-offs between them. All yield a consistent quality of product.

In gel polymerization glacial acrylic acid, water, cross-linking agent and UV initiator are blended and placed either on a moving belt or in large tubs. The liquid mixture then goes through a long chamber with a series of strong UV lights. The UV radiation drives the polymerization and cross-linking reactions. The resulting "logs" are sticky gels containing 60-70% water. The logs are shredded or ground and placed in various sorts of driers. Additional cross-linking agent may be sprayed on the particles' surface; this "surface cross-linking" increases the product's ability to swell under pressure -- a property measured as absorbency under load. Another round of heating causes a reaction that yields the final cross-linked product. The gel polymerization method is currently the most popular method for making the sodium polyacrylate superabsorbent polymers now used in baby diapers and other disposable hygienic articles. Almost 87% of world capacity is based on this type of polymerization.

Suspension polymerization is practiced by only a few companies because it requires a higher degree of production control and product engineering during the polymerization step. This process suspends the water-based reactant in a hydrocarbon-based solvent. The net result is that the suspension polymerization creates the primary polymer particle in the reactor rather than mechanically in post-reaction stages. Addition of cross-linking agents can also be made during, or just after, the reaction stage. These particles are marking by a true spherical shape and most have a large intercalated void volume that affords rapidly fluid uptake and/or the ability to handle more viscous liquids.

Solution based polymerization is commonly used today for SAP manufacture of co-polymers -- particularly those with the toxic acrylamide monomer. This process is efficient and generally has a lower capital cost base. The solution process uses a water based monomer solution to produce a mass of reactant polymerized gel. The polymerization's own reaction energy is used to drive much of the process, helping reduce manufacturing cost. The reactant polymer gel is then chopped, dried and ground to its final granule size. Solution polymers offer the absorbency of a granular polymer supplied in solution form. For example, this chemistry can be applied directly onto wires & cables, though it is especially optimized for use on components such as rolled goods or sheeted substrates.

OUTLOOK

Demand for SAP has been rising steadily for three decades. Global demand growth is forecast at 6%/year to 2018, the highest growth rates being expected in Asia Pacific (10%) and Asia/Middle East (8%). The growth in other regions of the world will be less than 3%/year.

TASNEE in Saudi Arabia and Nippon Shokubai in Indonesia added 140,000 tons new capacity in 2014. Additional 549,000 tons is in the pipeline for 2015-2016. In spite of the increased capacity in 2013, demand for SAP outpaces supply globally. This shortage can be partially attributed to an accident at Nippon Shokubai’s Himeji workshop in 2012 that subsequently led to the shutdown of 320,000 tons in September 2012. Although a portion of this operation was restarted in June 2013, it is currently only able to make 180,000 tons per year. To compensate for this shortage, Nippon Shokubai accelerated its expansion in Tennessee, adding 40,000 tons last year and bringing its total U.S. capacity to 100,000 tons. Nippon Shokubai has also been expanding its Far East presence with a 90,000-ton plant in Indonesia. So far about 30,000 tons of that capacity is up and running.

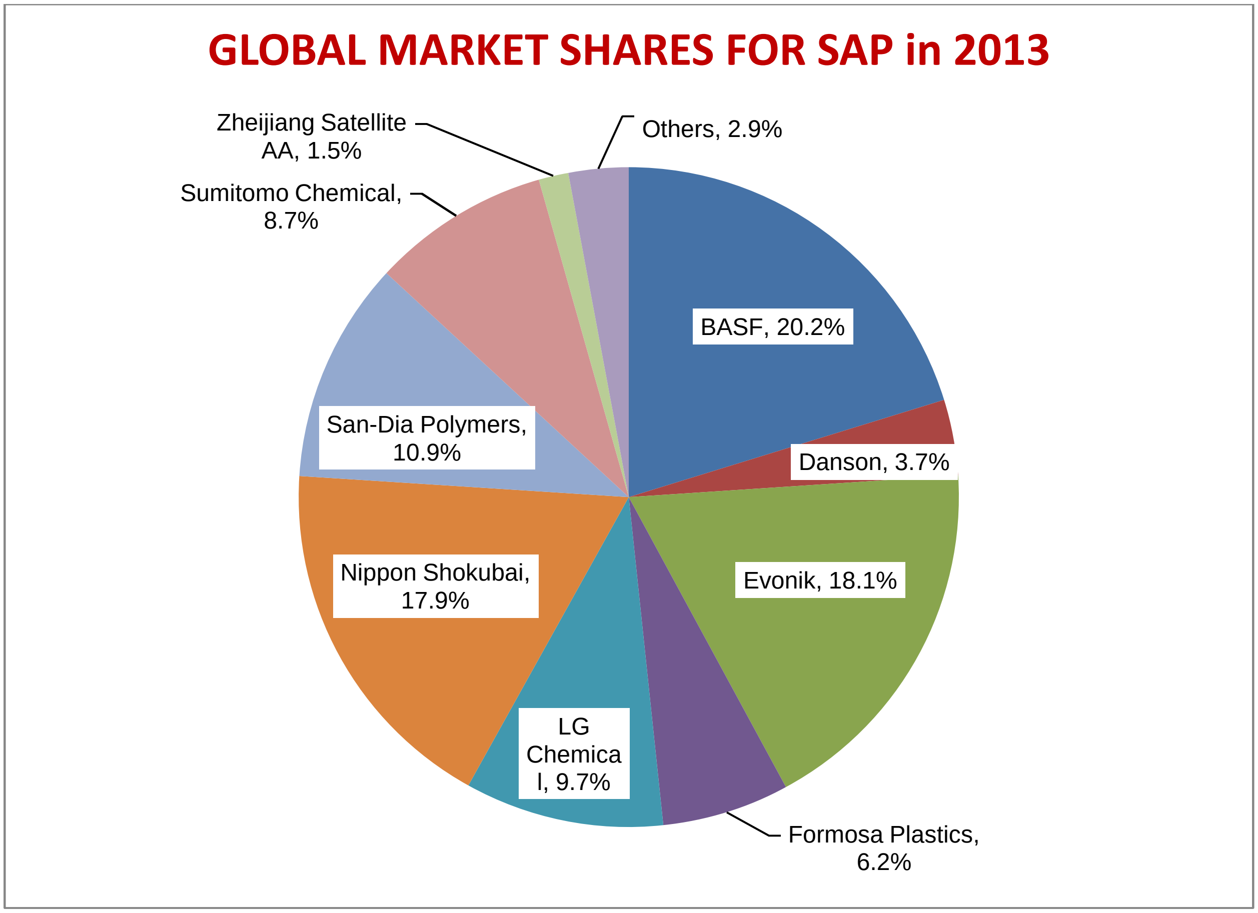
MAJOR GLOBAL SAP CAPACITY, '000 TONS/YEAR*

Company	Location	Capacity
BASF	Map Ta Phut. Thailand	20
	Freeport, TX, USA	235
	Antwerp, Belgium	235
BASF-Petrobras	Guaratingueta, Brazil(1)	60
BASF-Sinopec	Nanjing, China(2)	60
Danson	Taixing, China	120
Evonik	Grayville, LA, USA	110
	Greensboro, NC, USA	116
	Krefeld, Germany	120
	Geffen, Germany	80
Formosa Plastics	Linyuan, Taiwan	110
	Ningbo, China	45
High Smart Commodity	Zhongshan, China	20
Kao	Two locations, Japan	10
LG Chemical	Kiruchan, South Korea(3)	244
	Gincheon, South Korea	36
Nippon Shokubai	Cilegon, Indonesia(4)	30
	Zhangjiagang, China(5)	30
	Himeji, Japan	320
	Houston, TX, USA	100
	Antwerp, Belgium	60
Quanzhou Licheng	Quanzhou, China	20
San-Dia Polymers	Nantong, China(6)	150
	Nagoya, Japan	130
Sumitomo Chemical	Pulau Sakra, Singapore	69
	Befu, Japan(7)	170
	Carling, France	47
	Yeosu, South Korea(8)	59
TASNEE-Evonik	Al Jubail, Saudi Arabia(2)	80
Xitao Polymer	Beijing, China	10
Zheijiang Satellite AA	Zhejiang, China	35

(1) to start in **2014;** (2) started 4-5/2014; (3) expansion to 360 kt late 2015; (4) expansion to 90 kt in 2014

(5) expansion to 60 kt in 2016; (6) expansion to 230 kt in 7/2015; (7) expansion to 210 kt 4/2015; (8) to start in 5/2016

* over 10 kt



For more information about market and site-specific/technology-specific investment and production cost data for SAP and some 1000 more chemicals, please send your inquiries to trantech@chemplan.biz.