I-2 Development Situation of Glucosamine in China

Figure I-2-1 Output of Glucosamine in China, 2002~2007, tonne

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From 2002~2007, China's output of glucosamine has been growing steadily by CAGR of 9.9%. The output in 2007 grew by 10% compared to that in 2006.

Table I-2-1 Capacity development of Glucosamine in China, 2003~2008

Year	Number of manufacturers	Total Capacit, t/a	Cap. Average, t/a
2003			
2005			
2008			

I-3.1 Summary of Chinese Glucosamine Manufacturers in 2008

Table I-3.2-2 Glucosamine production situation of the active manufacturers in China, 2008, tonnes

	GAH			GAS			NAG		
Abbreviation	**Capacity '08**	**Output '07**	**Output '06**	**Capacity '08**	**Output '07**	**Output '06**	**Capacity '08**	**Output '07**	**Output '06**
	500	200	200						
	600	400	450						
	300	80	80						
	350	180	200						
				250	60	50			
				200	100	80			
				100	35	40			
	300	200	150						
	300	100	80						

Total									

**This figure includes the output of the currently stopped manufacturers but who are not covered in the table.*

I-5 Trade Situation of Glucosamine in China

The Chinese glucosamine products have been exported to over 20 countries every year. North America, European Union, Japan, South Korea and other countries are the most important export destinations. The total export volume accounts for about 80% of the total production volume in China.

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1.5.5 Export Situation of 2007

Table I-5.5-1 Export volume and price of GAH, GAS and NAG in 2007, kg, USD/kg

Month	GAH		GAS		NAG		Total	
	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
Jan		8.68	225,400	6.92				8.14
Feb		8.51	173,320	6.74				8.11
Mar		8.31	50,650	6.68				8.31
Apr		8.58	112,384	6.99				8.77
May		8.50	51,675	6.46				8.86
Jun		8.23	200,600	6.73				7.95
Jul	508,365	8.63		7.04				8.72
Aug	585,722	8.54		6.52				8.51
Sep	412,690	8.42		7.13				9.21
Oct	297,200	8.30		6.40				8.33
Nov		8.66		6.76	34,090			9.91
Dec		8.54		6.70	37,435			9.43

I-6 Consumption Pattern and Situation in Each Segment

The glucosamine products produced in China now include the following two kinds; glucosamine hydrochloride (GAH) and glucosamine sulfate potassium chloride (GAS).

GAH is the main component of chondroitin sulfate. GAH can improve the synthesizing of mucopolysaccharides in human body and so can be used to cure osteoarthritis (OA). It has the evident diminish inflammation functions. It can also cure the cancer and used in cosmetic, feed additive and food additive.

GAS can be used as pharmaceutical stock to OA, heart disease, pneumonia and fracture. It

can be made into medicine tablets or capsules.

Currently, glucosamines are mainly used to treat OA, whenever it is made into drugs or health products. A synthetic analysis on the research reports from Medline, PubMed and other important data sources shows that the curative effects of GAS on OA is more evident and affirmative than that of GAH.

Glucosamine products produced in China are consumed in the following four fields.

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Table I-6-1 Consumption of glucosamine products produced in China, 2007.

	Quantity, t		**Percentage %**	
Consumption fields	**2005**	**2007**	**2005**	**2007**
Health care products	[redacted]	[redacted]	[redacted]	[redacted]
Pharmaceutical	[redacted]	[redacted]	[redacted]	[redacted]
Others	[redacted]	[redacted]	[redacted]	[redacted]
Total	[redacted]	[redacted]	[redacted]	[redacted]

II-1-3 Theoretical Model of Raw Material

To learn the process producing glucosamine hydrochloride and its cost, CCM has perused more than 100 relevant research papers and patents published between 1995 and 2008 about producing glucosamine hydrochloride. On the base of full understanding of the research papers and patents, CCM made the flow chart of the producing way by two steps and confirmed the theoretical unit consumption and unit cost of each raw material by two steps too.

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Table II-1-3-1 Theoretical consumption of raw materials to produce chitin* (industrial grade) from shell

	Jun-06			**Apr-08**		
Raw material	**Unit consumption** (kg/kg)	**Price** (RMB/kg)	**Unit cost (**RMB/kg)	**Unit consumption** (kg/kg)	**Price** (RMB/kg)	**Unit cost (**RMB/kg)
Shell of shrimp or crab (dry)	[redacted]	4.00	[redacted]	[redacted]	3.50	[redacted]
HCl (31%)	[redacted]	0.58	[redacted]	[redacted]	0.61	[redacted]
NaOH (solid, 96%)	[redacted]	2.20	[redacted]	[redacted]	3.06	[redacted]
$KMnO_4$ (Industrial, 99.3%)	[redacted]	16.50	[redacted]	[redacted]	11.70	[redacted]
$Na_2C_2O_4$ (99.0%)	[redacted]	40.00	[redacted]	[redacted]	43.20	[redacted]
Water	[redacted]	0.002	[redacted]	[redacted]	0.002	[redacted]
Total	*/*	*/*	[redacted]	[redacted]	*/*	[redacted]

II-1-4.2 Estimation on Manufacturing Cost

CCM usually calculates the manufacturing cost by integrating costs of raw materials, utilities, labor, packaging cost, depreciation and maintenance of equipment. When calculating manufacturing cost, CCM also reckons in cost for treating waste water in CCM's research.

1. Cost of raw material: CCM has already analyzed the cost of raw materials on the basis of breakeven price of chitin, which is RMB30.33/kg. As a result, the cost of raw materials is RMB71.33/kg glucosamine hydrochloride.

2. Utilities: Usually the utilities include water, electricity and steam. Since cost of water has already been reckoned in the cost of raw material, only cost of electricity and steam is included in utility cost in this research. CCM did not get the accurate consumption volume of electricity and steam, but after analyzing relevant info from literature and manufacturers, CCM estimated the total cost of electricity and steam for one tonne of glucosamine hydrochloride product to be around RMB1, 890.

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Table II-1-4.2-1 Estimation on manufacturing cost in producing glucosamine hydrochloride from chitin

No.	Item	Jun 06	Apr 08
		Unit Cost (RMB / kg)	Unit Cost (RMB / kg)
1	Raw Materials	[redacted]	[redacted]
2	Utilities	[redacted]	[redacted]
3	Labor	[redacted]	[redacted]
4	Packing	[redacted]	[redacted]
5	Manufacturing direct + indirect	[redacted]	[redacted]
	Total	[redacted]	[redacted]