

I-4 Production technology of Carnitine in China

1-4.1 Production technology

There are many methods to produce Carnitine, including extracting from foods (meat or milk), chemical method, enzymatic conversion, microbial fermentation, etc. Currently, asymmetric synthesis of L-Carnitine is hot in the research of production technology.

Table I-4.1-1 Comparison of production technologies of Carnitine in China

Items	Chemical synthesis	Enzymatic conversion	Microbial fermentation	Asymmetric synthesis
Raw materials	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Production process	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Yield	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Chiral separation	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
R&D investment	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Pollution	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Market situation	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Development trend	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

I-7 Import and export of Carnitine and its derivatives in the recent three years

I-7.2 Export situation of Carnitine and its derivatives

From 2005~2007, the export volume is [REDACTED] tonnes, [REDACTED] tonnes and [REDACTED] tonnes. The top 4 export manufacturers are:

[REDACTED]
 [REDACTED]
 [REDACTED]
 [REDACTED]

These 4 manufacturers account for [REDACTED] of China's total export volume in 2005, 2006 and 2007.

From 2005~2007, the price was relatively stable. The lowest price appeared in 2005 and 2006.

The major export destinations are [REDACTED]. The [REDACTED] are both the major destinations always since 2005.

Table I-7.2-3 Export price of Carnitine in 2007 (Quantity (kg); Price (USD/kg))

Month	L-Carnitine Fumarate		L-Carnitine Tartrate		L-Carnitine base		L-Carnitine HCl		Acetyl-L-Carnitine HCl	
	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price	Quantity	Price
Jan	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	28.00
Feb	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	23.12
Mar	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	27.69
Apr	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	28.00
May	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Jun	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Jul	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Aug	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Sep	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Oct	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Nov	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Dec	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]
Total	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

I-8.1 Consumption pattern

Table I-8.2-1 List of some L-Carnitine end users in food area in China, 2008

No.	English Name	Product	Carnitine specie used, per 100g	Comment
1	[REDACTED]	[REDACTED]	L-Carnitine 35.3g	[REDACTED]
2	[REDACTED]	[REDACTED]	L-Carnitine tartrate 17.6g	[REDACTED]
3	[REDACTED]	[REDACTED]	L-Carnitine 13.0g	[REDACTED]
4	[REDACTED]	[REDACTED]	L-Carnitine Tartrate	[REDACTED]
5	[REDACTED]	[REDACTED]	L-Carnitine Tartrate	[REDACTED]
6	[REDACTED]	[REDACTED]	L-Carnitine 6.0mg~9.0mg	[REDACTED]
7	[REDACTED]	[REDACTED]	L-Carnitine Tartrate	[REDACTED]
8	[REDACTED]	[REDACTED]	L-Carnitine 190mg	[REDACTED]
9	[REDACTED]	[REDACTED]	L-Carnitine 4.8g	[REDACTED]

	[REDACTED]			[REDACTED]
10	[REDACTED]	[REDACTED]	L-Carnitine 7.11g	
11	[REDACTED]	[REDACTED]	L-Carnitine 48.5g	[REDACTED]
12	[REDACTED]	[REDACTED]	L-Carnitine 12.95g	[REDACTED]
13	[REDACTED]	[REDACTED]	L-Carnitine 10.2g	[REDACTED]
14	[REDACTED]	[REDACTED]	L-Carnitine 17.6g	[REDACTED]
15	[REDACTED]	[REDACTED]	L-Carnitine 20g	[REDACTED]
16	[REDACTED]	[REDACTED]	L-Carnitine Tartrate	[REDACTED]
17	[REDACTED]	[REDACTED]	L-Carnitine	
18	[REDACTED]	[REDACTED]	L-Carnitine	
19	[REDACTED]	[REDACTED]	L-Carnitine	[REDACTED]
20	[REDACTED]	[REDACTED]	L-Carnitine	
21	[REDACTED]	[REDACTED]	L-Carnitine	
22	[REDACTED]	[REDACTED]	L-Carnitine	
23	[REDACTED]	[REDACTED]	L-Carnitine	
24	[REDACTED]	[REDACTED]	L-Carnitine	
25	[REDACTED]	[REDACTED]	L-Carnitine	
26	[REDACTED]	[REDACTED]	L-Carnitine	

II Benchmarking of Carnitine

II-3.1.2 Profit estimation of Carnitine

- Raw material costs estimation

Based on the information mentioned above, we understand that NEPG produce L-Carnitine from DL-intermediate and its production process of L-Carnitine is similar to our model 2. We made some emendations of the model and the raw material costs are shown in the following table.

Table II-3.1.2 -1 Estimation on raw material consumption of L-Carnitine in NEPG in July 2008

No.	Materials	Consumption, kg / kg	Price, RMB/kg	Unit Cost, RMB/kg
1			16.00	
2			2.85	
3			0.65	
4			3.50	
5			6.30	
6			36.50	
7			4.40	
8			0.0025	
9	Calcium Carbonate		14.00	
10	Calcium Chloride		4.00	
	Total			

- **Estimation of manufacturing costs**

Table II-3.1.2-2 Estimation on manufacturing cost of L-Carnitine in NEPG in July 2008

No	Item	Unit Cost RMB / kg L-Carnitine
1	Raw Materials	
2	Utilities	
	Water	
	Electric power	
	Steam	
3	Labor	
4	Packing	
5	Manufacturing direct + indirect*	
	Total	