

N,N-DIMETHYLANILINE FROM ANILINE BY LIQUID PHASE METHYLATION

RAW MATERIAL AND UTILITY COST, US ¢/LB

	<u>UNIT COST</u>	<u>CONSUMPTION/LB</u>	<u>¢/LB</u>
RAW MATERIALS			
ANILINE	50.99 ¢/LB	0.7857 LB	40.06
CAUSTIC SODA (50%)	11 ¢/LB	0.009 LB	0.10
METHANOL	1.06 \$/GAL	0.08124 GAL	8.61
SULFURIC ACID	1.86 ¢/LB	0.009 LB	<u>0.02</u>
GROSS RAW MATERIAL COST			48.79
UTILITIES			
COOLING WATER	10.66 ¢/1000 GAL	17 GAL	0.18
ELECTRICITY	5.76 ¢/KWH	0.083 KWH	0.48
STEAM	1049 ¢/1000 LB	4.03 LB	<u>4.23</u>
TOTAL			4.89

PROCESS SUMMARY

The continuous process shown below is based on patents assigned to New Japan Chemical and Shell Development. Preheated aniline and methanol are fed continuously into a reactor maintained at 210°C and 6.0 atm and filled with N,N-dimethylaniline containing 2% sulfuric acid. Vapor is partly condensed and refluxed to keep a constant liquid level in the reactor. The bulk of the vapor is condensed and then rectified to recover unreacted methanol, which is recycled for reaction. The bottom product from rectification is decanted to remove water, and then fractionated to recover residual water and aniline at the top, and heavy ends at the bottom. N,N-dimethylaniline vapor is withdrawn a few plates above the bottom and condensed as the product. A small liquid stream is withdrawn from the reactor to be combined with feed to the methanol column. At the same time, a small stream of makeup sulfuric acid is added to the reactor. Conversion is nearly 100%, and selectivity to N,N-dimethylaniline is 98%. Product yields on aniline and methanol are 97.8% and 98.1%, respectively.

REFERENCE: PEP Report 76B P.132-142 (YCY)

**SRI CONSULTING
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LOCATION : U.S.
PEP COST INDEX-U.S. : 718

N,N-DIMETHYLANILINE

CAPACITY, MILLION POUNDS	<u>2</u>	<u>4</u>	<u>8</u>
INVESTMENT, US \$ MILLION			
BATTERY LIMITS	3.5 (0.45)	4.8 (0.5)	6.7
OFF SITES	<u>2.1</u>	<u>3</u>	<u>4.3</u>
TOTAL FIXED CAPITAL	5.6 (0.46)	7.7 (0.51)	11
PRODUCTION COSTS, US ¢/LB			
RAW MATERIALS	48.79	48.79	48.79
BY PRODUCT CREDITS	0.00	0.00	0.00
UTILITIES	<u>4.89</u>	<u>4.89</u>	<u>4.89</u>
VARIABLE COSTS	53.68	53.68	53.68
MAINTENANCE MATERIALS	4.19	2.86	2.02
OPERATING SUPPLIES	3.64	1.82	0.91
OPERATING LABOR (2/SHIFT)	36.35	18.18	9.09
MAINTENANCE LABOR	2.79	1.91	1.35
CONTROL LABORATORY	<u>7.27</u>	<u>3.64</u>	<u>1.82</u>
TOTAL DIRECT COSTS	107.92	82.09	68.87
PLANT OVERHEAD	37.13	18.98	9.81
TAXES AND INSURANCE	5.61	3.86	2.75
DEPRECIATION	<u>28.05</u>	<u>19.30</u>	<u>13.74</u>
PLANT GATE COST	178.71	124.23	95.17
G + A, SALES, RES., 15 %	43.91	30.44	22.86
PRODUCTION COSTS			
AT 100% CAPACITY	222.62	154.67	118.03
AT 75% CAPACITY	279.59	188.99	140.13
AT 50% CAPACITY	393.52	257.62	184.34
PRODUCT VALUE (COST + 25 %/YR ROI BEFORE TAXES), US ¢/LB			
AT 100% CAPACITY	292.74	202.92	152.37
AT 75% CAPACITY	373.09	253.32	185.92
AT 50% CAPACITY	533.77	354.12	253.02