



DOW CHEMICAL U.S.A.

Merene

August 9, 1977

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HCl PURIFICATION, COSORB PROCESS

Based on the available information supplied by Richard Durham, very preliminary design flow sheets, equipment sizing and capital cost estimates have been made for this process.

The feed, containing 0.3% C_2H_2 by volume as an impurity, and 50 ppm H_2O is first dried to ~ 1 ppm H_2O , the C_2H_2 is then absorbed on the Cosorb. No data was available for the C_2H_2 remaining in the purified gas.

The dryer is designed on a 200 hour cycle, 2% final water loading. The absorbers are on a 48 hour cycle, 70% efficiency.

Disposal of the desorbed C_2H_2 (~ 2000 lb/day) is a problem. A burner and scrubber were added to the design, again, without enough data for proper design.

The utilities requirements were estimated at an average of 600 lb/hour nitrogen, 100 lb/hour steam and 150,000 Btu/hour fuel. Since the process is not continuous, the demand varies during the cycle with peaks of 300% the average. This is only a rough estimate.

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The catalyst cost was taken as the cost of the raw materials only. The total cost is \$370,000 (this alone is more than the equipment cost for the HgCl_2 process).

The catalyst preparation plant or catalyst handling and disposal facilities are not included at this time. The complexity of this system led us to estimate just the absorber first. The equipment cost is \$650,000. The capital cost estimate was \$3.0M.

Material of construction is carbon steel although monel probably will be necessary for the dryer section. Prices were taken from the Dow Estimating Guide.

Numerous assumptions were necessary to supplement the incomplete data. The list of assumptions may not be regarded as a complete one as a number of assumptions were made as process flow sheets were generated.

The cost of the catalyst preparation plant was not estimated because 1) data was even more scarce than for the absorption plant, 2) the absorption plant compares unfavorably to the HgCl_2 process.

Difficulties in operation of this system, both HCl purification and catalyst preparation, are anticipated due to the requirements for inert atmosphere, complete dryness and the non-continuous nature of the process.

Attached is a breakdown for the design and cost in each case including:

- A) Assumptions
- B) Process Conditions
- C) Flow Sheets
- D) Equipment Sizing and Drilling
- E) Capital Cost Estimate



Carlos M. Moreno
Research and Development

Attachments

jmd

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ASSUMPTIONS

1. Inlet C_2H_2 concentration is 0.3% by volume. Inlet H_2O concentration is 50 ppm.
2. Dryer final loading: 2% by weight maintaining less than 1 ppm H_2O . Dryer dimensions: $L/D = 2$ for a pressure drop of ~ 10 psi.
3. Absorber efficiency is 60%. C_2H_2 exit concentration not specified. Assumed given by equilibrium conditions, and satisfactory for our purposes at 1 min residence time. $L/D = 1.6$ for a pressure drop of ~ 10 psi.
4. C_2H_2 disposal not defined. Burner and scrubber added and estimated from existing units.
5. Residual C_2H_2 concentration in absorber after regeneration not defined.
6. Dryer and absorber regeneration requirements for heat and nitrogen estimated from average values.
7. Material of construction is carbon steel.
8. No special site preparation necessary.
9. Prices as per Dow Estimating Guide.
10. Price of catalyst as cost of raw materials only.
11. Catalyst preparation, handling facilities and disposal not considered.

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PROCESS CONDITIONS

Location: Vinyl Plant

Feed Conditions: 0.5M lb/day at 220 psig, 14°F, 0.3% C₂H₂ by volume,
50 ppm H₂O

Product Conditions: ~ 200 psig temperature varies with cycle C₂H₂
content, not defined, assumed given by equilib-
rium conditions

Dryer Cycle: 200 hours, 26 sec residence time, 2% final loading

Absorber Cycle: 48 hours, 1.2 min residence time

Equipment Cost

Dryers and Absorbers	234,000	
Compressors	173,000	
Exchangers	93,000	
Scrubber and Burner	<u>150,000</u>	

650,000

Analyzers	30,000	30,000
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Catalysts

AW 300	23,400
Zeolon	265,650
Cosorb Solution	80,277
Catalyst Preparation	<u>-0-</u>

369,327

1,059,327

Utilities:

Nitrogen	600 lb/hour
30 lb Steam	100 lb/hour
Fuel	150,000 Btu/hour

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EQUIPMENT

D 401 A-B Dryers	240 psia 93 cu ft packed vol 4'D x 12'L Carbon Steel	36,000
A 401 A-B-C Absorber	240 psia 643 cu ft packed vol 8'D x 16'L Carbon Steel	198,000
C 401 Compressor	160 psia 400°F inlet 180 psia 400°F outlet 700 cu ft/min inlet	35,000 7,000
Motor	TEFC 200 hp	
Gear Box		8,000
C 402 Compressor	160 psia 200°F inlet 180 psia 200°F outlet 3400 cu ft/min	85,000
Motor	TEFC 800 hp	18,000
Gear Box		20,000
H 401 Heater	Gas fired, 240 psia 400°F 625 sq ft Carbon Steel	10,000
H 402 Heater	240 psia 200°F 625 sq ft Carbon Steel	8,000
E 401 Cooler	180 psia 400°F 750 sq ft Carbon Steel	20,000
Motor	150 hp TEFC	4,500
E 402 Cooler	180 psia 200°F 2500 sq ft Carbon Steel	38,000
Motor	100 hp TEFC	3,000
S 401 Scrubber System		50,000
B 401 Burner System		100,000

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NEWTON'S FACTORED METHOD

DATE: 0777

PRODUCTION RATE: 20888.0 LB/HR, OR 156.660 MM LB/YR AT 100.0 % CA

ITEM	COST (M\$)	
PLANT EQUIPMENT	650.0	
FOUNDATIONS	39.2	
STRUCTURES	97.5	
EQUIPMENT ERECTION	97.5	
PIPING	487.5	
INSULATION	73.1	
PAINTING	32.5	
FIRE PROTECTION	6.5	
SAFETY EQUIPMENT	6.5	
INSTRUMENTATION	95.0	
ELECTRICAL	34.5	
OTHER SPECIAL COSTS	0.0	
TOTAL INSTALLATION COSTS	989.8	
BASE COST = EQUIPMENT + INSTALLATION		1619.8
SALES TAXES	56.7	
FREIGHT COSTS	10.4	
CONTRACTOR'S FEE	290.9	
TOTAL TAX, FREIGHT, & FEES	358.1	
TOTAL CONTRACT COST		1977.9
ENGINEERING	197.8	
CONTIGENCIES	296.7	
TOTAL ENGINEERING & CONTIGENCIES	494.5	
PROCESS UNIT INSTALLED COSTS		2472.4
BUILDINGS & FURNISHINGS	0.0	
SITE PREPARATION	20.0	
SHIPPING FACILITIES(RAIL SPURS INCL)	0.0	
STORAGE TANKS (NOT INCL ABOVE)	0.0	
UTILITY SUPPLY FACILITIES	0.0	
COOLING TOWER AND WATER SUPPLY	0.0	
WASTE DISPOSAL	0.0	
OTHER FACILITIES NOT INCLD ABOVE	370.0	
TOTAL ADDITIONAL FACILITIES	390.0	
ENGINEERING & CONTIGENCIES	97.5	
TOTAL COST ADDITIONAL FACILITIES	487.5	
TOTAL PLANT COST		2959.9
CONSTRUCTION ESCALATION	34.0	
TOTAL PROJECT COST - CURRENT		2993.9

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