

Product Balance of Gas-Phase Chambers

Average for January 1943 to June 1944

Hours of operation: 682
 Injected material²: (17.7 P101/13.6 P102/22.3 P64
 1.2P9+18/45.2 P302): 12.95 t/hr; charge t/hr/m³: 0.942
 Fresh feed: (33.2 P101/24.5 P102/42.1P64) 10.94 t/hr; charge t/hr/m³: 0.497

Catch-pot product: 11.73 t/hr.
 Benzine (VT 330) 5.49 t/hr; yield t/hr/m³: 0.399

Product factor (benzine + gas + solutes : benzine): 1.243
 Hydrogen consumption per ton benzine: 0.0661 t H₂ = 860 m³ fresh gas
 (assumed value)

Hydrogen consumption per ton injected material: 0.0292 t H₂

Product obtained from 1029.2 t/kg injected material + H₂:

<u>Products:</u>	<u>Kg</u>	<u>% of Inject + H₂</u>
Catch-pot product (gas-free)	896.54	87.110
Benzine	426.40	41.430
Middle oil	470.14	45.680
Reaction water (pure)	12.56	1.220
Solutes in injection- and reac- tion water	5.45	0.530
NH ₃	3.84	0.373
H ₂ S	1.23	0.120
CO ₂	0.26	0.025
Phenols	0.12	0.012
Gases		
Free H ₂ in expansion gas:	4.60	0.447
Free H ₂ in expansion gas 11	3.75	0.364
Free H ₂ in expansion gas 12+16	0.85	0.083
Hydrocarbons (C = 2.502)	173.57	16.864
C ₁	18.83	1.830
C ₂	36.19	3.516
C ₃	51.50	5.004
C ₄ (normal)	40.77	3.961
C ₄ (iso)	8.45	0.821
C ₅	17.83	1.732
CO ₂	0.05	0.004
H ₂ S	1.54	0.150
NH ₃	2.05	0.199
	<u>1096.36</u>	<u>106.524</u>

² P101 boils up to 195°.

The high amount of hydrocarbons and accordingly the total yield of 106% is caused by washing out the sludge-phase chambers.

Chlorine Balance of The Sludge-Phase Chambers

Average for October 1943 to May 1944

(The balance is set up without consideration of the Cl contained in residue)

	Tons fresh feed + wash oil	16,051.937	
	% Cl in fresh feed + wash oil	0.101	
A)	Tons Cl in fresh feed + wash oil		16.376
	Tons gross catch-pot product	12,199.799	
	% Cl in gross catch-pot product	0.024	
B)	Tons Cl in gross catch-pot product		2.920
	Tons water in catch-pot product	22,742.875	
	% Cl in water	0.0003	
C)	Tons Cl in water in catch-pot product		<u>0.007</u>
	Tons Cl to be neutralized: A+(B+C)		13.449
	Theoretical consumption of soda	20.083 t	
	Amount of soda in charge	<u>11.641 t</u>	
	Deficiency of soda		8,442 t

In consideration of the chlorine content of the residue, the deficiency of soda added is considerably reduced.

Bag 2734 Target No. 30/4.11 - Bottror
Item 2.

Product Balance of Sludge-Phase Chambers

Average for January 1943 to June 1944

Hours of Operation: 721

Injected material: 37.20 t/h (47.6 P₄/13.4 P₅+6+15/3.4 P₁₀₃/35.6 P₇)

Fresh feed: 22.55 t/h (77.0 P₄/19.1 P₅+6+15/3.9 P₁₈, 65, 103)

Paste from B18/19: 23.75 t/h (73.1 P₄/22.4 P₅+6+15/ 4.5 P₁₈, 64, 65, 103)

Catch-pot product factor: 1.417

For 1 ton fresh feed there were used: 1.647 t inject, 0.0668 t H₂ (833 m³ fresh gas)

From 1066.8 kg. fresh feed + H₂, there were obtained:

<u>Product:</u>	<u>Kg.</u>	<u>% of fresh feed + H₂</u>	
Catch-pot product (gas-free):	709.53	66.511	
Benzine	85.71		8.034
Middle oil	207.03		19.407
Fuel oil	416.79		39.070
Sludge residue	164.84	15.453	
Reaction water (pure)	24.02	2.251	
Solutes in water of reaction and injected material:	8.74	0.819	
NH ₃	3.75		0.351
H ₂ S	2.20		0.206
CO ₂	2.41		0.226
Phenols	0.38		0.036
Gases:			
Free H ₂ in expanded gas	7.30	0.684	
Free H ₂ in expanded gas 4	3.15		0.295
" " " " " 1 + 21			
+ 23 + 31 + 33.	4.00		0.375
" " in 2 + 6 + 22 + 26	0.15		0.014
Hydrocarbons (C = 2,312)	110.28	10.337	
C ₁	16.58		1.554
C ₂	24.73		2.318
C ₃	32.08		3.007
C ₄ (normal)	25.59		2.399
C ₄ (iso)	3.85		0.361
C ₅	7.45		0.698
CO ₂	0.28	0.026	
H ₂ S	2.73	0.256	
NH ₃	0.77	0.072	
	<u>1028.49</u>	<u>96.409</u>	

Bag 2734 Target No. 30/4.11
Bottrop - Item 3.

Summary of Operation of Sludge-Phase Chambers for 1941 - 1944

Year	1941	1942	1943	Jan. 1944
Days of operation	314	357	361	
Composition of injected material:				
% pitch	52.0	49.7	47.6	50.4
% pitch distillate	17.6	15.4	12.3	13.9
% miscellaneous	1.27	3.0	3.7	3.7
% desludging recycle	29.0	31.4	36.2	32.3
% catalyst	0.13	0.13	0.16	0.24
Injected material:				
tons/month	19,602	24,335	28,040	17,172
total tons	215,622	292,028	332,650	
Fresh feed:				
tons/month	13,571	15,864	16,810	10,966
total tons	152,282	190,375	201,682	
Catch-pot product:				
tons/month	10,022	11,818	11,730	1,424
total tons	110,245	141,817	140,666	
Charge of fresh feed,				
tons/hr./m ³	0.480	0.443	0.371	0.437
Yield of catch-pot product,				
tons/hr./m ³	0.347	0.328	0.259	0.296
Product factor	1.38	1.35	1.43	1.48
Desludging residuum, t/mo.	7,632	10,072	13,070	7,644
" " , total t.	83,984	120,864	156,884	
Desludging discard, t/month	2,178	2,415	2,835	2,138
" " , total t.	23,964	28,982	35,212	
" " , % of fresh feed	16.1	15.4	17.5	19.5
Fresh gas, m ³ /month	10,875,169	12,105,792	13,770,000	9,705,000
" " , total tons	119,626,920	145,269,275	165,148,695	
Specific gravity, chamber inlet	0.357	0.345	0.348	0.277
Total hydrocarbon gas,				
Expanded gas, 1+2+3+6+21+22+23+26:				
m ³ /month	1,174,200	1,606,350	2,069,000	1,147,100
total m ³	12,916,100	10,276,200	24,829,000	
kcal/m ³	10,560	9,604	9,178	
m ³ /ton fresh feed	85	101.2	123.1	104.6
m ³ /ton injected mat.	60	64.4	73.8	66.8
specific gravity	0.879	0.855	0.981	0.965
Expanded gas 1+21,				
m ³ /ton catch-pot product	29.1	30.9	30.4	29.0
" 2+22, m ³ /t " " "	34.4	38.3	44.4	40.1
" 3/23, m ³ /t desludging re-cycle.	57.3	67.3	74.6	67.6
" 6+26, m ³ /t catch-pot prod.	6.9	5.9	5.6	4.0
Recycle expansion, m ³ /month	1,537,621	1,674,758	1,058,000	715,600
" " m ³ /ton fresh feed	109.6	109.5	63.0	65.2
" " " " inject	77.4	80.0	37.7	41.7

Summary of Operation of Sludge-Phase Chambers for 1941 - 1944 (continued)

Year	<u>1941</u>	<u>1942</u>	<u>1943</u>	<u>Jan. 1944</u>
Loss, (plant control):				
%, t/t inject	8.4	6.9	7.6	8.8
%, t/t fresh feed	12.2	10.9	13.2	14.4
Loss, (Calc. on hydro- carbon gas)				
%, t/t inject	4.8	8.7	7.6	7.8
%, t/t fresh feed	6.7	12.5	12.3	11.9

Summary of Operation of 700-atm. Gas-Phase Chamber 54-a - 1941 - 1944

Year	1941	1942 ^x	1943 ^x	Jan.-Mar. '44
Days of operation	299	292	310	91
Composition of Injected Mat.				
% A-Product	54.0	54.0	54.0	51.0
% B-Product	46.0	46.0	46.0	49.0
Injected Material:				
Tons per month	5,878	6,775	7,585	11,371
Total tons	70,540	74,522	83,426	34,113
Catch-pot product:				
Tons per month	5,386	6,021	6,815	10,189
Total tons	64,626	66,231	74,922	30,566
Benzine, tons/month	2,513	2,944	3,275	4,477
" , total tons	30,151	32,381	36,030	13,433
" , %	46.6	48.7	48.1	43.9
Middle Oil, tons/month	2,873	3,080	3,540	5,711
" " , total tons	34,475	33,879	38,922	17,133
" " , %	53.4	51.3	51.9	56.1
Charge: tons inject/hr./m ³	0.611	0.699	0.912	1.157
Yield: tons benzine/hr/m ³	0.260	0.305	0.410	0.452
Product factor	1.200	1.260	1.236	1.266
Fresh gas:				
m ³ /month	2,230,838	2,482,646	2,690,000	4,141,667
Total m ³	26,770,060	27,309,110	29,595,000	12,425,002
m ³ /ton inject	385.6	370.0	355	364
m ³ /ton benzine & product loss	767	677	664	755
Sp. gr. - chamber inlet	0.249	0.227	0.256	0.312
Total hydrocarbon gas:				
Expanded gas 11+12+16				
m ³ /month	837,117	1,022,500	1,321,000	2,016,633
total m ³	10,045,400	11,247,500	14,580,700	6,049,900
Expanded gas 11, m ³ /t				
catch-pot product	77.34	78.4	87.4	98.3
Expanded gas 12, m ³ /t catch				
pot product	72.5	90.2	98.0	95.1
" " 16, " "	6.9	4.6	8.6	5.0
Loss: % - t/t benzine prod. (operating control)	16.8	20.4	19.1	20.9
% - t/t inject (oper. control)	8.3	11.0	10.2	10.4
% - t/t inject (calc. from hydrocarbon gas)	15.7	16.7	19.5	18.6
% - t/t benzine & gasifi- cation (calc. from hydrocarbon gas)	26.7	28.2	35.4	30.9
Benzine in A-Product, % Wt. recovery	16.8	19.2	18.8	21.7

x = 11 months' operation.

Bag 2734 Target No. 30/4.11
Bottrop. Item 4.