

Minimization of Losses in MF Production Section at RCF LTD., THAL

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Abstract-This losses are taking place in the Methyl Formate section of the process of Formic Acid plant at Rashtriya Chemicals & Fertilisers Ltd., Thal Unit. To minimize these losses in MF production section a flash vessel for separation was suggested after pressure reduction valve in the process. Due to this suggestion daily production of MF increased from 30 tpd to 36 tpd.

Index Terms- Minimization, Dissolved Gases, Flash Vessel.

1. INTRODUCTION

Nitrogen is available in plenty in atmosphere almost free of cost. However for availability of Hydrogen various precious and rare sources like coal, naphtha and natural gas are utilized. Naphtha is used for production of hydrogen gas by cracking process. Cracking mainly yields hydrogen gas and carbon monoxide gas.

Carbon monoxide gas which is poisonous gas, but if utilized to produce a value added byproduct, which will in turn reduce the cost of hydrogen and ammonia. Hence using carbon monoxide together with methanol for manufacture of formic acid in fertilizers plant can be a useful value addition.

At Rashtriya Chemicals & Fertilisers Ltd. Thal unit, the above mentioned route of production of formic acid is used. The process used in this unit for production of formic acid is posing a problem of pressurized distillation column where Methyl Formate and Methanol are separated. This leads to overload of overhead condensers and venting and hence losses of valuable products is taking place.

So to minimize these losses flash vessel was introduced before distillation column n after pressure reduction valve, which in case increased the production of Methyl Formate from 30 tpd to 36 tpd.

2. METHOD

Following are the solutions discussed for the problem which was studied in the plant.

2.1. By using flash vessel

By using gas liquid separator the mixture of unreacted gases can be separated which are entrapped in liquid stream. Thus the gases separated can be recycled back from gas liquid separator to reactor.

2.2. By introduction of turbine

As the process is at very high pressure of 29 kg/cm² so this high pressure can be used to drive a turbine for doing useful work.

Thus the problem of over pressurizing of distillation column can be solved and losses can be arrested or avoided. But the second method cannot be used as the gas in the pressurized line is not totally saturated.

3. SIMULATION & RESULTS

The feasibility of flash vessel was verified using UNISIM simulation software.

Table 1. Simulation Results

Properties	Unit	CO Feed	Methanol Feed	To Reactor
Vapour Frac	-	1	0	0.11158502
Temp	°C	25	75	67.5366055
Press	kg/cm ² g	29.2	29.2	29.2
Molar Flow	kmol/hr	36.0574	248.5412	284.59857
Mass Flow	kg/hr	1010	7963.732	8973.73176
Liq vol Flow	m ³ /hr	1.26347	10.00821	11.2716755
Heat Flow	kcal/hr	-954731	-13992962	-14947693
Std Gas Flow	Nm ³ /hr	808.19	--	--

Table 2

Properties	Unit	Rec Vap	Rec Liq	Mix
Vapour Frac	-	1	0	2.87E-02
Temp	°C	90	90	90
Press	kg/cm ² g	29.2	29.2	29.2
Molar Flow	kmol/hr	7.45975	252.285	259.7445
Mass Flow	kg/hr	216.031	8757.67	8973.704
Liq vol Flow	m ³ /hr	0.26827	10.6527	10.92102
Heat Flow	kcal/hr	-214804	-1E+07	-1.5E+07
Std Gas Flow	Nm ³ /hr	167.203	--	--

Table 3

Properties	Unit	To Sep	VVP	LP feed
Vapour Frac	-	7.98E-02	1	0
Temp	°C	83.901	83.901	83.90098
Press	kg/cm ² g	4	4	4
Molar Flow	kmol/hr	259.744	20.7364	239.008
Mass Flow	kg/hr	8973.7	679.111	8294.594
Liq vol Flow	m ³ /hr	10.921	0.82209	10.09892
Heat Flow	kcal/hr	-1.5E+07	-826984	-1.4E+07
Std Gas Flow	Nm ³ /hr	--	464.786	5357.126

Table 4

Properties	Unit	CO out	MF MEoH
Vapour Frac	-	1	0
Temp	°C	88	84.2477
Press	kg/cm ² g	4	4
Molar Flow	kmol/hr	0.420234	238.588
Mass Flow	kg/hr	11.77113	8282.82
Liq vol Flow	m ³ /hr	1.47E-02	10.0842
Heat Flow	kcal/hr	-10925.2	-1E+07
Std Gas Flow	Nm ³ /hr	9.419125	5347.71

Table 5

Properties	Unit	MeOH Liq-2	MF prod-2
Vapour Frac	-	0	0
Temp	°C	99.18977	58.0057
Press	kg/cm ² g	2.5	1.5
Molar Flow	kmol/hr	216.7715	21.8164
Mass Flow	kg/hr	6972.828	1309.99
Liq vol Flow	m ³ /hr	8.749133	1.33507
Heat Flow	kcal/hr	-1.2E+07	-2E+06
Std Gas Flow	Nm ³ /hr	4858.716	488.992

4. CONCLUSION

After doing process simulation it was confirmed that introduction of flash vessel for removal of dissolved gases leads to increased production of Methyl Formate and also enhances the production of Formic Acid. Using this simulation we will try to minimize upsets taking place in the distillation column.

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