

Integration of Heat Exchangers, Compressor, and Steam Reutilization for Energy Efficiency Improvement in Thermal Systems of Dimethyl Ether (DME) Production

Fikri Wijaya^{1*}, Gisela Fortunata Putri¹, Citra Puspita Sukmajati¹, Anggita Martha Dewi¹,
Widya Meilinda Nuri Asyhari²

¹Department of Chemical Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang, Indonesia.

²Department of Chemical Engineering, Sepuluh Nopember Institute of Technology, Surabaya, Indonesia

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Table S1. Energy stream of modified process

	Unit	E-01	Q-C1	Q-R1	Q-C2	Q-R2	E-04	E-05	E-02	E-03
Heat Flow	<i>kJ/h</i>	2568.956	2752157	86863.1	189473.8	292475	197363.1	54.51686	324199.1	249108.9

Table S2. Mass and energy balances of the modified process

Stream no	Unit	Methanol	2	17	Steam-Out (1)		7	8	10	DME	12	C-02	Methanol (2)	Water	16	Steam-In	6	3	4	5	11	Steam-Out (2)
Total Phase Properties																						
Vapour Fraction		0	0	0	0,521925		1	1	0	0	0	5,00E-09	0	0	0	1	1	0	1	1	0	0,711034
Temperature	C	30	30,05898	35,48305	179,8886		392,1472	180,0039	167,3646	43,43021	82,15106	120,6359	35,13053	50	35,50026	273,8889	392,6062	30,34046	180	250,5127	82	179,8888
Pressure	bar	1,01325	1,01325	15,5	9,999291		9	9	9,11925	9,11925	1,01325	2,0265	2,0265	1,2	15,5	10	14,84415	7,01325	7,005809	15,19875	9,11925	9,999291
Molar Flow	kgmole/h	77,61458	78,73623	1,121652	166,527		78,73623	78,73623	38,01097	40,72526	38,01097	36,88847	1,122507	36,88847	1,122507	166,527	78,73623	78,73623	78,73623	78,73623	38,01097	166,527
Mass Flow	kg/h	2483,838	2509,802	25,96376	3000		2509,814	2509,814	690,5878	1819,226	690,5878	664,6011	25,98668	664,6011	25,98668	3000	2509,814	2509,802	2509,802	2509,802	690,5878	3000
Heat Flow	kJ/h	-1,9E+07	-1,9E+07	-301714	-4,2E+07		-1,5E+07	-1,6E+07	-1E+07	-8368493	-1,1E+07	-1E+07	-301987	-1E+07	-301933	-3,9E+07	-1,5E+07	-1,9E+07	-1,5E+07	-1,5E+07	-1,1E+07	-4,1E+07
Molecular Weight		32,00221	31,87607	23,14778	18,0151		31,87622	31,87622	18,16812	44,6707	18,16812	18,0165	23,15058	18,0165	23,15058	18,0151	31,87622	31,87607	31,87607	31,87607	18,16812	18,0151
Std Gas Flow	STD_m3/h	1835,153	1861,674	26,52083	3937,436		1861,674	1861,674	898,748	962,9258	898,748	872,207	26,54104	872,207	26,54104	3937,436	1861,674	1861,674	1861,674	1861,674	898,748	3937,436
Vapor Phase Properties																						
Mass Flow	kg/h	0	0	0	1565,776		2509,814	2509,814	0	0	0	3,32E-06	0	0	0	3000	2509,814	0	2509,802	2509,802	0	2133,102
Molecular Weight		0	0	0	18,0151		31,87622	31,87622	0	0	0	18,02473	0	0	0	18,0151	31,87622	0	31,87607	31,87607	0	18,0151
Mass Density	kg/m3	0	0	0	4,782379		5,186411	7,614422	0	0	0	1,115651	0	0	0	3,960881	8,548309	0	5,927266	11,12742	0	4,782377
Actual Gas Flow	ACT_m3/h	0	0	0	327,4053		483,9211	329,6131	0	0	0	2,98E-06	0	0	0	757,4073	293,6035	0	423,4334	225,5512	0	446,0339
Z Factor		0	0	0	1		1	1	0	0	0	1	0	0	0	1	1	0	1	1	0	1
Cp/Cv		0	0	0	1,186649		1,125597	1,150281	0	0	0	1,252177	0	0	0	1,275594	1,125351	0	1,175322	1,157733	0	1,186649
Viscosity	cP	0	0	0	0,014951		0,020187	0,0131	0	0	0	0,012819	0	0	0	0,019088	0,020309	0	0,009669	0,011833	0	0,014951
Mass Heat Capacity	kJ/kg-C	0	0	0	2,93421		2,337594	1,996473	0	0	0	2,290463	0	0	0	2,136176	2,341671	0	1,748585	1,914488	0	2,934206
Thermal Conductivity	W/m-K	0	0	0	0,031262		0,054951	0,031889	0	0	0	0,026116	0	0	0	0,041643	0,055393	0	0,025949	0,033117	0	0,031262
Liquid Phase Properties																						
Mass Flow	kg/h	2483,838	2509,802	0	0		0	0	0	1819,226	0	0	0	0	0	0	0	2509,802	0	0	0	0
Molecular Weight		32,00221	31,87607	0	0		0	0	0	44,6707	0	0	0	0	0	0	24,20463	31,87607	0	0	0	0
Mass Density	kg/m3	781,0748	781,5787	0	0		0	0	0	584,7688	0	0	0	0	0	0	1344,702	781,6211	0	0	0	0
Actual Volume Flow	m3/h	3,180026	3,211196	0	0		0	0	0	3,111017	0	0	0	0	0	0	0	3,211021	0	0	0	0
Viscosity	cP	0,508704	0,508031	0	0		0	0	0	0,081458	0	0	0	0	0	0	0,133983	0,50622	0	0	0	0
Mass Heat Capacity	kJ/kg-C	3,620249	3,620297	0	0		0	0	0	2,600752	0	0	0	0	0	0	2,475892	3,621162	0	0	0	0
Thermal Conductivity	W/m-K	0,178407	0,181415	0	0		0	0	0	0,134582	0	0	0	0	0	0	0,228787	0,181299	0	0	0	0
Surface Tension	dyne/cm	28,91334	29,34518	0	0		0	0	0	12,13488	0	0	0	0	0	0	0	29,3003	0	0	0	0

Composition																						
Comp Mole Frac (Methanol)		0,99717	0,983356	0,027411	0		0,003181	0,003181	0,000907	0,005304	0,000907	1,00E-04	0,027412	1,00E-04	0,027412	0	0,003181	0,983356	0,983356	0,983356	0,000907	0
Comp Mole Frac (H2O)		0,00283	0,014233	0,803336	1		0,504321	0,504321	0,994092	0,047192	0,994092	0,9999	0,803237	0,9999	0,803237	1	0,504321	0,014233	0,014233	0,014233	0,994092	1
Comp Mole Frac (diM-Ether)		0	0,002411	0,169252	0		0,492498	0,492498	0,005001	0,947505	0,005001	3,92E-12	0,169352	3,92E-12	0,169352	0	0,492498	0,002411	0,002411	0,002411	0,005001	0