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## APPENDICES

### Appendix A. Physical property of diethylamine (DEA)

Physical properties of diethylamine such as formula weight, specific gravity, and boiling point are illustrated in this appendix. Additional data of vapor pressure up to 1 atm are also included. *Robert, H. P. (6<sup>th</sup> Eds.). (1984). Perry's Chemical Engineers' Handbook. Malaysia: McGraw-Hill, Inc.*

#### Physical Properties:

Name	: Diethylamine
Formula	: $(C_2H_5)_2NH$
Formula weight	: 73.14
Specific gravity	: 0.712 at 15°C referred to water at 15 °C
Boiling point (°C)	: 55.5

#### Vapor Pressure of Diethylamine, up to 1 atm:

Temperature (°C)	Vapor Pressure (mmHg)
-33.0	10
-22.6	20
-11.3	40
-4.0	60
6.0	100
21.0	200
38.0	400
55.5	760

**Appendix B.** Kinetic data for determining reaction order with respect to diethylamine concentration at 250 °C.

Run No.	Concentration of DEA (ppm)	Concentration of O <sub>2</sub> (vol %)	Reaction rate, r (10 <sup>-7</sup> ) *
1	1,000	21	11.54
2	2,000	21	15.10
3	3,000	21	19.70
4	4,000	21	23.84
5	5,000	21	27.60
6	6,000	21	29.72
7	7,000	21	33.05
8	8,000	21	36.53
9	9,000	21	38.20
10	10,000	21	39.35

**Appendix C.** Kinetic data for determining reaction order with respect to diethylamine concentration at 265 °C.

Run No.	Concentration of DEA (ppm)	Concentration of O <sub>2</sub> (vol %)	Reaction rate, r (10 <sup>-7</sup> ) *
1	1,000	21	18.26
2	2,000	21	23.88
3	3,000	21	30.40
4	4,000	21	35.58
5	5,000	21	41.14
6	6,000	21	45.23
7	7,000	21	49.09
8	8,000	21	52.79
9	9,000	21	55.86
10	10,000	21	59.15

**Appendix D.** Kinetic data for determining reaction order with respect to oxygen concentration at 250 °C.

Run No.	Concentration of DEA (ppm)	Concentration of O <sub>2</sub> (vol %)	Reaction rate, $r$ ( $10^{-7}$ ) *
1	2,000	10	11.39
2	2,000	15	11.98
3	2,000	20	11.54
4	2,000	25	11.66
5	2,000	30	11.48
6	2,000	35	11.94

**Appendix E.** Kinetic data for determining reaction order with respect to oxygen (O<sub>2</sub>) concentration at 265 °C.

Run No.	Concentration of DEA (ppm)	Concentration of O <sub>2</sub> (vol %)	Reaction rate, $r$ ( $10^{-7}$ ) *
1	2,000	10	18.35
2	2,000	15	18.52
3	2,000	20	18.21
4	2,000	25	18.61
5	2,000	30	18.41
6	2,000	35	18.50

**Appendix F.** Kinetic data for determining apparent activation energies.

Run No.	Reaction temperature (°C)	Reaction rate $r (10^{-7})^*$	Kinetic region
1	250	11.81	Chemical kinetic
2	265	19.99	
3	275	26.75	
4	280	61.80	Pore difussion
5	290	73.12	
6	295	78.00	
7	300	239.21	Mass transfer
8	330	264.30	
9	350	278.20	

\* units of the reaction rate,  $\text{gmoles CO}_2 \cdot \text{g}^{-1} \text{catalyst} \cdot \text{sec}^{-1}$





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