Dissociation Constants (pKa)

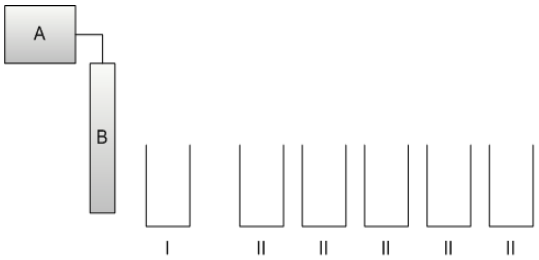
Custom made

Purpose

The dissociation constant is one of the important factors in the selection of an (alkanol)amine solution for acid gas removal or in the interpretation of the kinetic mechanism of the absorption of the acid gas in the (alkanol)amine solution. Dissociation constants can provide the following information: (1) a measure of the basic strength of the (alkanol)amine at a specific temperature and (2) a conventional acid gas removal plant is operated with an absorption/desorption cooling/heating cycle. In the absorber, the acid gas is (chemically) absorbed by the basic absorbent. At an elevated temperature in the desorber, the basic strength of the absorbent is reduced and the acid gas released. The basic strength is reduced as a result of less dissociation of the unprotonated absorbent at higher temperatures. Temperature-dependent dissociation constants provide the change in the reaction enthalpy which indicates the change of the basic strength of the absorbent within a given temperature range.

Experimental Setup

Based on electromotive force (EMF) measurements by the use of a well-described pH electrode.



P = atmospheric

T = (10 to 80) °C

Quantity needed: approx. 5 grams of (alkanol)amine

Results

Dissociation constants and derived thermodynamic properties for some (alkanol)amines are given below. These results give insight into the use of these specific (alkanol)amines as absorbents for acid gas removal.

Compound	Reference	$\Delta_r G^\circ_m$ / kJ · mol^{-1}	pK_a	$\Delta_r H^\circ_m$ / kJ · mol^{-1}
3-amino-1-Propanol (MPA)	[30]	56.85	9.96	53.6
MMEA	this work	56.20	9.85	44.4
PZ, 2nd group	this work	55.45	9.71	42.8
AMP	this work	55.24	9.68	52.2
MIPA	this work	53.94	9.45	48.8
MEA	this work	53.90	9.44	48.6
2-(2-aminoethoxy)ethanol (DGA)	[31]	53.74	9.42	50.2
HEPZ, 2nd group	this work	50.94	8.92	35.4
diethanolamine (DEA)	[32]	50.68	8.88	42.4
DIPA	this work	50.47	8.84	39.2
AEPD	this work	50.32	8.82	47.5
PZ, 1st group	this work	30.87	5.41	32.3

Compound	Reference	$\Delta_r G^\circ_m$ / kJ · mol^{-1}	pK_a	$\Delta_r H^\circ_m$ / kJ · mol^{-1}
TREA	this work	61.08	10.70	44.4
DEMEA	this work	55.64	9.75	36.2
DMMEA	this work	52.63	9.22	34.4
methyldiethanolamine (MDEA)	[2]	48.87	8.56	34.9
TEA	this work	44.07	7.72	31.3
HEPZ, 1st group	this work	22.68	3.97	21.2

Contact

E. S. Hamborg