Exp10Liquid Properties : Viscosity

1.Get the absolute viscosity of water at room temperature from literature and calculate the absolute viscosity of each liquid and solution.

(sol)

Wt.of empty pycometer: ?g

Wt.ofpycometer + water:?g

Wt.ofpycometer+acetone?g

查表 dwater：? g/mL

η water：?cp

計算：

(1) $V_{pycometer}$ = (Wt.ofpycometer + water -Wt.of empty pycometer)/d_{water} =? (mL)

(2) $d_{acetone}$ = (Wt.ofpycometer+acetone - Wt.of empty pycometer) /$V_{pycometer}$

(3)計算 Water (mol) = V・dwater / M 其中 M=18.02 (g/mol)

(4)計算 Acetone (mol) = V・dacetone / M 其中 M=58.08 (g/mol)

(5)計算 Acetone mol %in H_2O = $n_{acetone}/n_{acetone}+n_{H2O}$

(6)計算 5 個 sol'n (g) =(Wt.ofpycometer +sol'n - Wt.of empty pycometer(g))

計算 5 個 density (g/ml) = sol'n (g) / $V_{pycometer}$ (mL)

計算黏度(η) = η 1 / η 2 = d1t1 /d2t2 (d :density t:average time)

查表 η 1 H2O = a (cp)

舉例:20% of acetone = a / η 2 =d1(查表)T1(純水) / d2(上式計算)t2(average time)

得 5 個 η 2 =

2. Plot the viscosity-composition diagram for the acetone-water system.

(sol)

作圖 η (cp) VS. mole(%)

Acetone 莫爾百分率(%)						
黏度(η)						

Exp10

數據：

Wt.of empty pycometer：19.331 g

Wt.ofpycometer+ water：30.798 g

Wt.ofpycometer+acetone：28.424 g

d_{water}：0.9985g/mL

η_{water}：1.035 cp

計算：

$V_{pycometer}$=(30.798-19.331)÷0.9985=11.484(mL)

$d_{acetone}$= (28.424-19.331) ÷11.484 =0.7918 g/mL

數據：

Mole% (acetone in H_2O)	0	20	40	60	80	100
Volume of water (mL)	30	15	8	4	2	0
Volume of acetone (mL)	0	15	22	26	28	30
Wt.ofpycometer+sol'n(g)	30.798	30.036	29.435	28.979	28.715	28.424
Run1	8'38	11'90	9'53	7'35	6'31	5'54
Run2	8'32	11'94	9'47	7'38	6'32	5'60
Run3	8'37	12'00	9'56	7'40	6'22	5'53
Average time(sec)	8'36	11'95	9'52	7'38	6'28	5'56

計算：

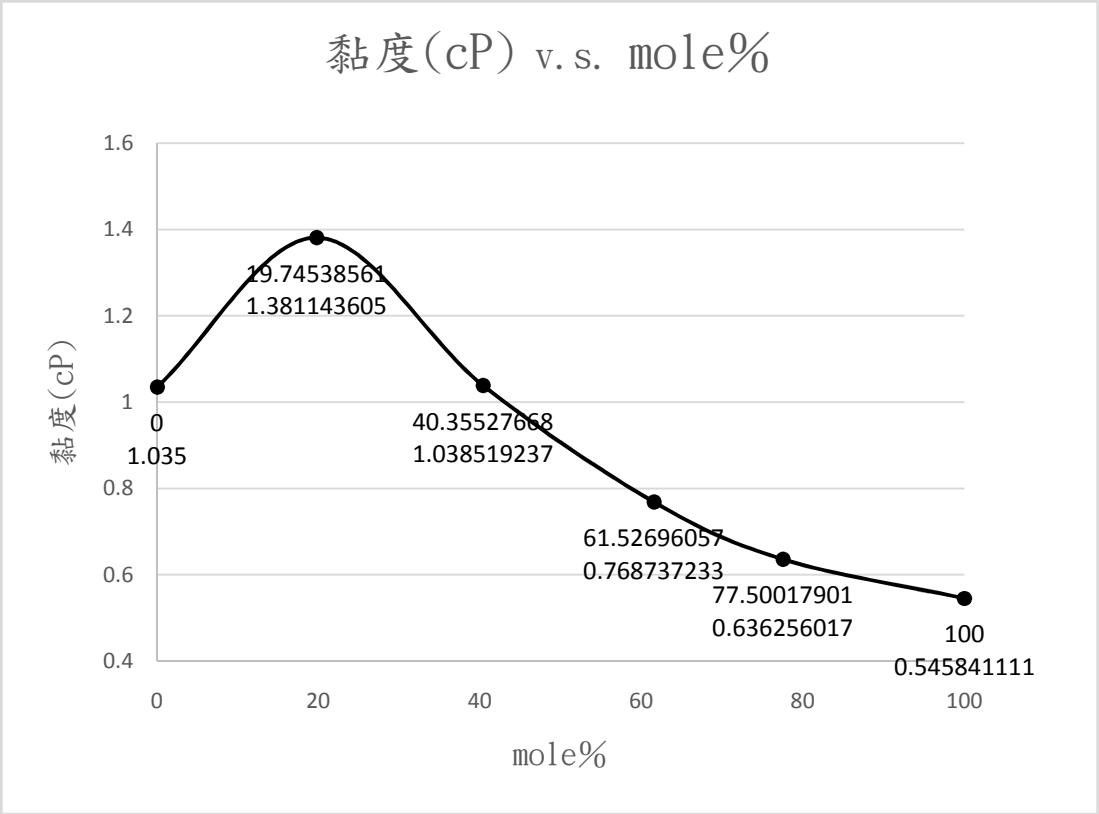
以 H_2O：acetone =15:15 為例

1. Mole%(acetone in H_2O)

   d_{H2O}= 0.9985(g/mL)　　MW_{H20} = 18.02 (g/mol)

   $d_{acetone}$= 0.7918(g/mL)　　$MW_{acetone}$ = 58.08 (g/mol)

$$\text{Mole\%}=\frac{\frac{15\times0.7918}{58.08}}{\frac{15\times0.9985}{18.02}+\frac{15\times0.7918}{58.08}}\times100\%=19.745\%$$



2. $d_{sol'n}(g/mol) = \frac{30.036-19.331}{11.484} = 0.9322(g/mol)$

3. viscosity

$\frac{\eta_1}{\eta_2} = \frac{d_1 t_1}{d_2 t_2}$, η_{water}：1.035 cp

$\frac{\eta_{sol'n}}{1.035} = \frac{0.9322\times11.95}{0.9985\times8.36} \longrightarrow \eta_{sol'n} = 1.381(cp)$