

INTRODUCTION

The coefficient of activity is a factor used in thermodynamics to account for deviations from good behaviour in a mixture of chemical substances. In a good mix, the minimal interactions between each pair of chemical compounds are the same (or similarly macroscopically, the enthalpy conversion of the solution and the volume difference in mixing is zero) and, as a result, compound structures may be directly exposed to light concentrations or compressive components. For example Raoult's law. Deviations from a positive view are shared by adjusting the focus to the activity coefficient.

$$\ln(\gamma_1) = -\ln(x_1 + \Lambda_{12}x_2) + x_2 \left(\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1} \right)$$

$$\ln(\gamma_2) = -\ln(x_2 + \Lambda_{21}x_1) - x_1 \left(\frac{\Lambda_{12}}{x_1 + \Lambda_{12}x_2} - \frac{\Lambda_{21}}{x_2 + \Lambda_{21}x_1} \right)$$

Where Lemda1 and Lemda2 can be calculated for diffently for different System using relation

$$\Lambda_{12} = \frac{v_2}{v_1} \exp\left(-\frac{\lambda_{12}}{RT}\right) \quad \Lambda_{21} = \frac{v_1}{v_2} \exp\left(-\frac{\lambda_{21}}{RT}\right)$$

Water and Methanol System

ANTOINE EQUATION:

$$\log_{10}(P) = A - (B / (T + C))$$

P = vapour pressure (bar)

T = temperature (K)

A for water = 8.07131

B(w)=1730.630

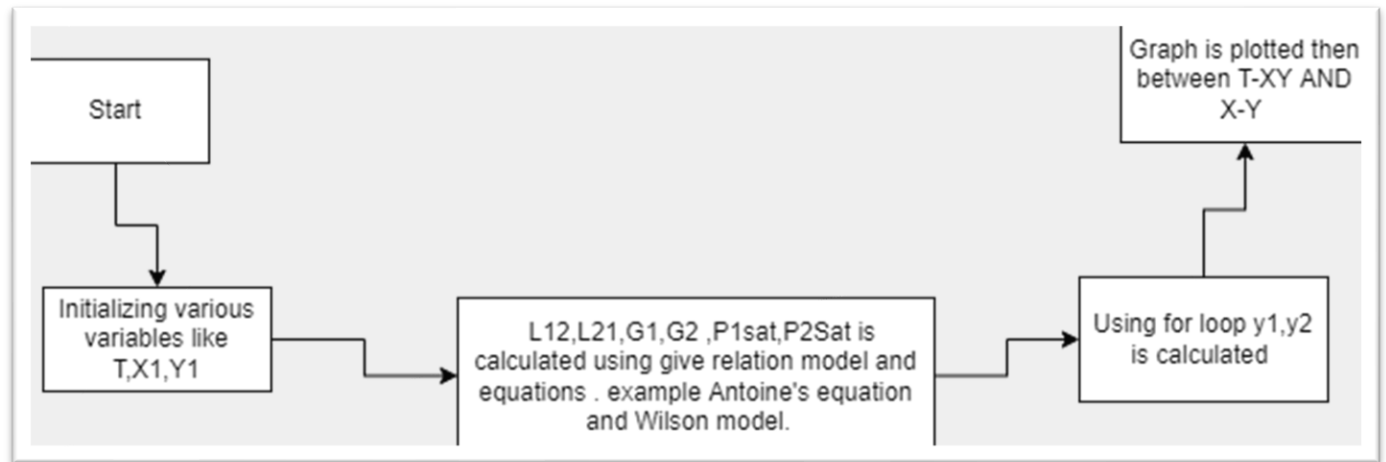
C(w)=-233.426

A for Methanol = 8.08097

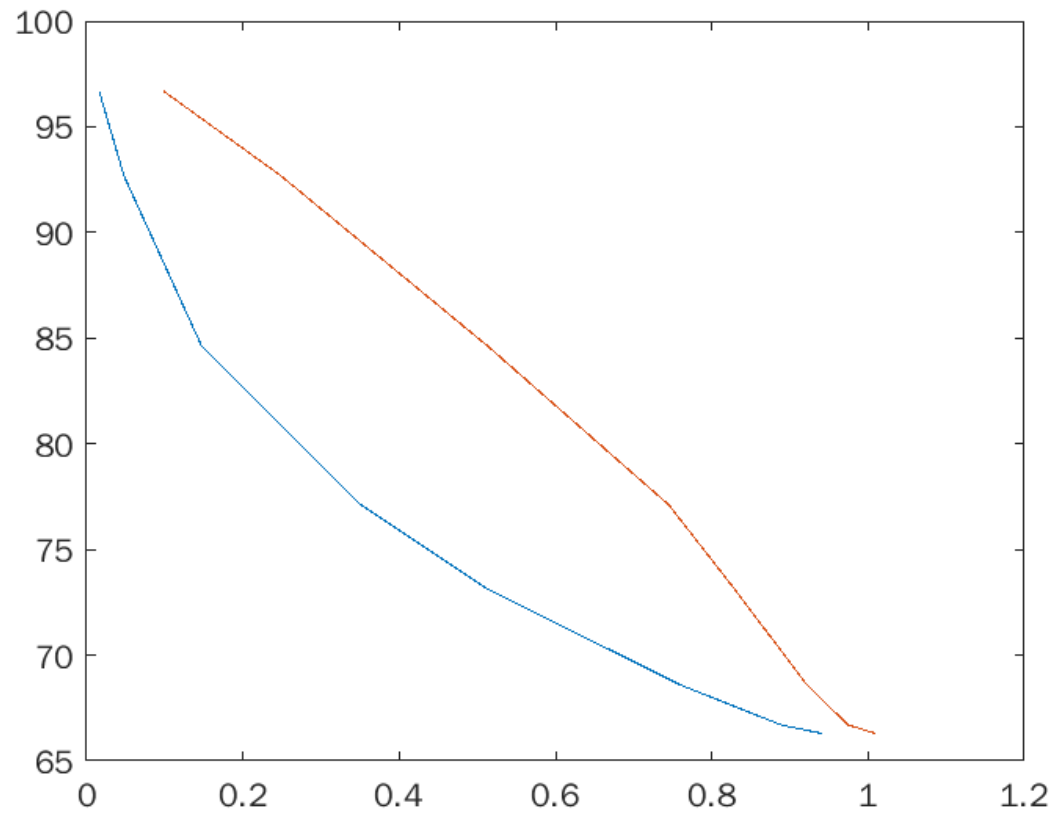
B(m)= 1582.271

C(m)= 239.726

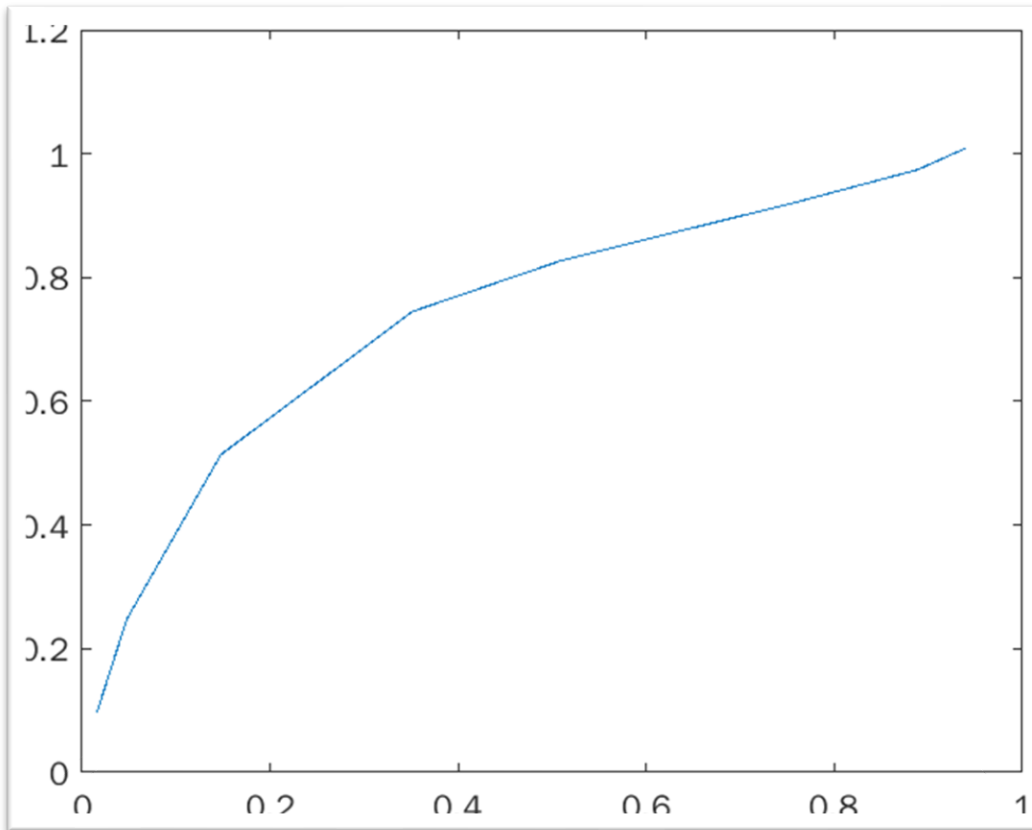
LOGIC OF THE CODE



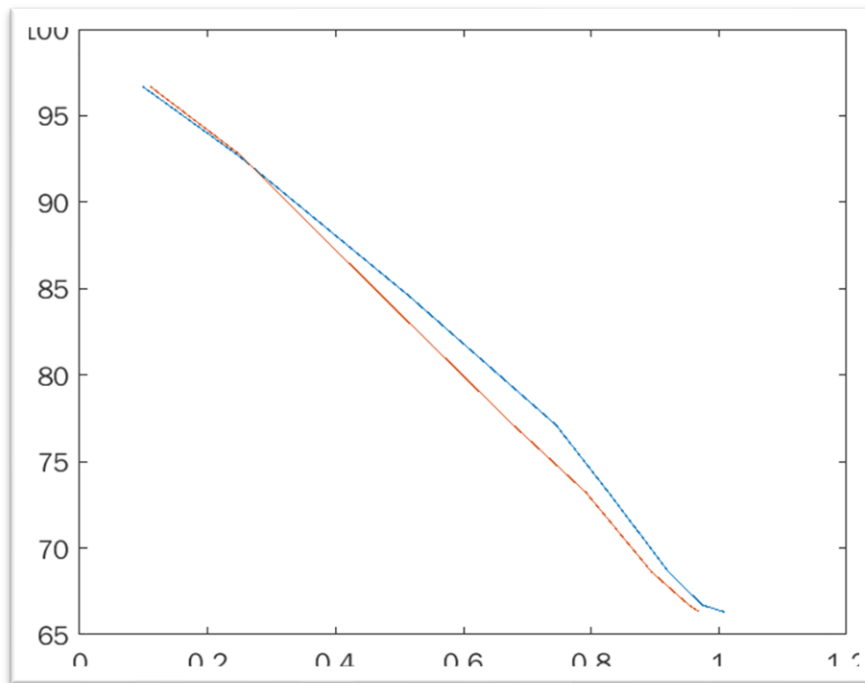
OBTAINED T X,Y GRAPH BY USING WILSON MODEL .



OBTAINED X-Y GRAPH BY USING WILSON MODEL .



Comparing T –Y,Y(experimental) GRAPH BY USING WILSON MODEL .



Explanation :-

Red line in the above diagram show the experimental data and blue line represents theoretical data which is calculated using equations of Wilson model .

As on comparing we cannot see much difference thus we can say that Wilson model actually calculates activity very accurately.

MATLAB CODE

```
%given experimental data
clc; clear all; close all
T = [96.70 92.70 84.60 77.10 73.20 68.60 66.70 66.30];
X1 = [0.0159 0.0476 0.1475 0.3515 0.5097 0.7595 0.8889 0.9408];
y1e = [0.1100 0.2521 0.4716 0.6786 0.7923 0.8953 0.9536 0.9702];
y1 = zeros(1,8);
y2 = zeros(1,8);
X2 = 1-X1;
a12 = 26.3731;
a21 = 551.6333;
v1 = 40.73;
v2 = 18.07;
R = 8.314 ;
%antoine const
Ac = [8.08097 1582.271 239.726 8.07131 1730.630 233.426];
Pr = 760 ;
for i = 1:8
    L12 = v2/v1 * exp(-a12/(R*T(1,i)));
    L21 = v1/v2 * exp(-a21/(R*T(1,i)));
    G1 = exp(-log(X1(1,i) + X2(1,i)*L12)+X2(1,i)*(L12/(X1(1,i)+X2(1,i)*L12) -
    L21/(X2(1,i)+X1(1,i)*L21)));
    G2 = exp(-log(X2(1,i) + X1(1,i)*L21)+X1(1,i)*(L21/(X2(1,i)+X1(1,i)*L21) -
    L12/(X1(1,i)+X2(1,i)*L12)));
    P1sat = 10^(Ac(1)-Ac(2)/(T(1,i)+Ac(3)));
    P2sat = 10^(Ac(4)-Ac(5)/(T(1,i)+Ac(6)));
end
```

```
y1(1,i) = X1(1,i)*G1*P1sat/Pr;  
y2(1,i) = X2(1,i)*G2*P2sat/Pr;
```

```
end
```

```
plot(X1,y1);
```

```
plot(X1,T, '-');
```

```
hold on;
```

```
plot(y1,T);
```

```
hold off;
```

```
plot(y1,T, '-');
```

```
hold on;
```

```
plot(y1e,T);
```

```
hold off;
```

For plotting different plot Just comment off the different the different section of plot.