

This project used Excel VBA Code to analyze the data using Raw Data Source which was stored in Excel format.

Includes:

1. Data Import & Extraction via referring to and switching between multiple workbooks.
2. Data Truncation and Preprocessing (cleaning) with error handler design for missing data.
3. Data (statistical) analysis with: User-defined functions for calculation purpose, Array/table for storing variables/data.
4. Data Visualization: Charts/Tables creation in required format, with the creation of templates for charts formatting, which can be used in the future projects.
5. GUI design: Designed a user-friendly graphical-user-interface (macro buttons) for executing the program.

The following graphs are for demonstration purpose:

- Original Data (partial)

Run Number: 1					
Comment: Normal opeartaion					
Mixture: Methanol-Water					
Reference water density at 25 °C:	998.07	kg/m <sup>3</sup>			
Steam			Cooling Water		
Percentage Reading	40.00	%	Percentage Reading	39.70	%
Steam temperature	109.95	°C	Inlet temperature	1.61	°C
Steam condensate temperature	96.32	°C	Outlet temperature	19.70	°C
Flow Rate	14.62	kg/h	Flow Rate	251.52	kg/h
Feed			Overhead		
Percentage Reading	60.00	%	Percentage Reading	34.14	%
% GC Area of MeOH	50.57	%	% GC Area of MeOH	98.8	%
Mixture Temperature	32.60	°C	Mixture Temperature	54.40	°C
Mass Concentration (MeOH fraction)	0.5039		Mass Concentration (MeOH fraction)	0.9800	
Mixture Density at the Temp.	889.4	kg/m <sup>3</sup>	Mixture Density at the Temp.	759.8	kg/m <sup>3</sup>
Water Flow Rate	21.23	kg/h	Water Flow Rate	11.95	kg/h
Mixture Flow Rate	20.04	kg/h	Mixture Flow Rate	10.43	kg/h
Bottoms			Reflux		
Percentage Reading	0.00	%	Percentage Reading	50.00	%
% GC Area of MeOH	10	%	% GC Area of MeOH	98.8	%
Mixture Temperature	0.00	°C	Mixture Temperature	53.50	°C
Mass Concentration (MeOH fraction)	0.1034		Mass Concentration (MeOH fraction)	0.9800	
Mixture Density at the Temp.	799.01	kg/m <sup>3</sup>	Mixture Density at the Temp.	760.71	kg/m <sup>3</sup>
Water Flow Rate		kg/h	Water Flow Rate	17.24	kg/h
Mixture Flow Rate	6.38	kg/h	Mixture Flow Rate	15.05	kg/h
			Reflux Ratio	1.44	
			% Overall Mass Balance	16.15	

- Data Import & Extraction via referring to and switching between multiple workbooks.

```
'1. refer to workbook and sheets by name
wblist(1) = "march6-TeamM5.xls"
wblist(2) = "march7-TeamT5.xls"
wblist(3) = "march8-TeamW7.xls"
shlist(1) = "run 1"
shlist(2) = "run 2"
```

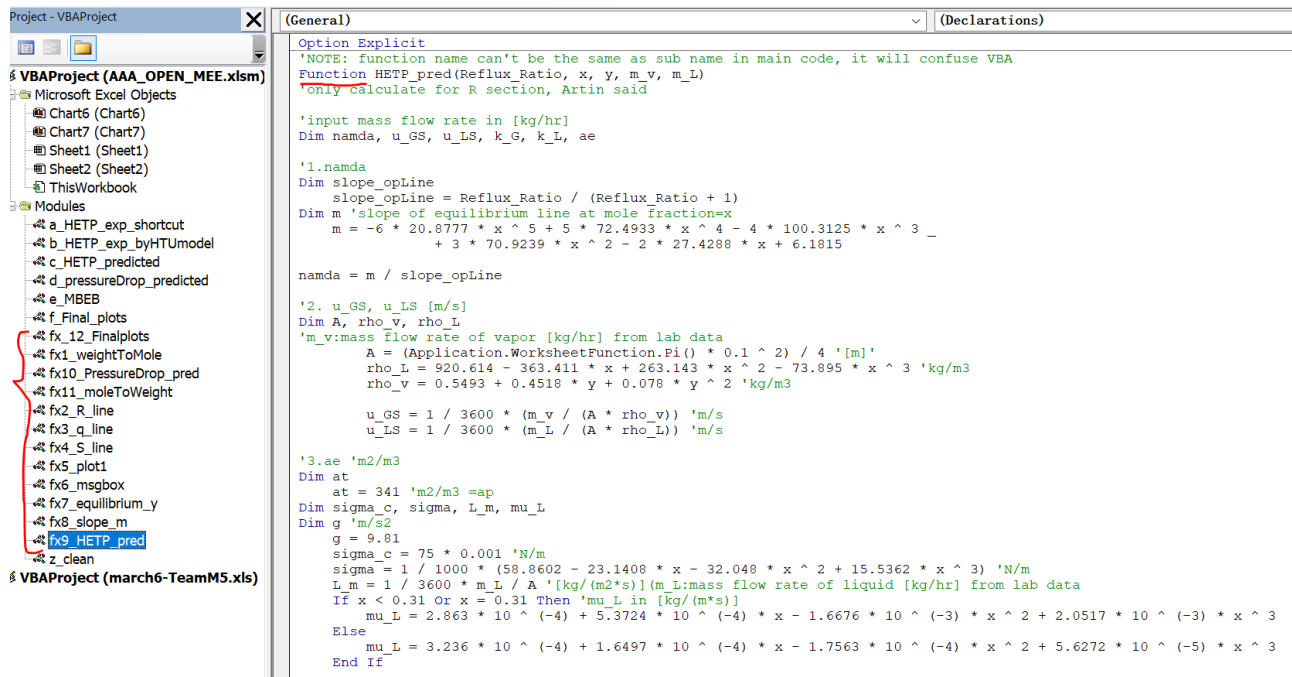
- Error Handler Design:

```
'3.1 calculate x at each sample point
Range("E43").Select
Range("E43") = "molefraction_x"
Dim msg2
msg2 = messagebox2(wB, sh)

'3.1.1 cal molefraction_x by call function fx1
ReDim molefraction_x(1 To 9, 1 To 1)
Dim i
For i = 1 To 9 'row
    On Error GoTo Assign0toMolefraction
    'if no error anymore, then run following code
    molefraction_x(i, 1) = molepercent(weightpercent_w(i, 1))
    On Error GoTo 0
Next i

'*****
'ERROR HANDLING SECTION
'*****
Assign0toMolefraction: 'the userdefined name of error handler
molefraction_x(i, 1) = molefraction_x(i - 1, 1)
Resume Next
```

- Data (statistical) analysis with: User-defined functions for calculation purpose, Array/table for storing variables/data.



The screenshot displays the VBA Project window for a project named 'VBAProject (AAA\_OPEN\_MEE.xlsm)'. The Project Explorer on the left shows the following structure:

- Microsoft Excel Objects
  - Chart6 (Chart6)
  - Chart7 (Chart7)
  - Sheet1 (Sheet1)
  - Sheet2 (Sheet2)
  - ThisWorkbook
- Modules
  - a\_HETP\_exp\_shortcut
  - b\_HETP\_exp\_byHTUmodel
  - c\_HETP\_predicted
  - d\_pressureDrop\_predicted
  - e\_MBE
  - f\_Final\_plots
  - fx\_12\_Finalplots
  - fx1\_weightToMole
  - fx10\_PressureDrop\_pred
  - fx11\_moleToWeight
  - fx2\_R\_line
  - fx3\_q\_line
  - fx4\_S\_line
  - fx5\_plot1
  - fx6\_msgbox
  - fx7\_equilibrium\_y
  - fx8\_slope\_m
  - fx9\_HETP\_pred** (highlighted with a red bracket)
  - z\_clean

The VBA Editor on the right shows the code for the 'HETP\_pred' function. The code includes comments and error handling:

```
Option Explicit
'NOTE: function name can't be the same as sub name in main code, it will confuse VBA
Function HETP_pred(Reflux_Ratio, x, y, m_v, m_L)
'only calculate for R section, Artin said

'input mass flow rate in [kg/hr]
Dim namda, u_GS, u_LS, k_G, k_L, ae

'1.namda
Dim slope_opLine
slope_opLine = Reflux_Ratio / (Reflux_Ratio + 1)
Dim m 'slope of equilibrium line at mole fraction=x
m = -6 * 20.8777 * x ^ 5 + 5 * 72.4933 * x ^ 4 - 4 * 100.3125 * x ^ 3 _
+ 3 * 70.9239 * x ^ 2 - 2 * 27.4288 * x + 6.1815

namda = m / slope_opLine

'2. u_GS, u_LS [m/s]
Dim A, rho_v, rho_L
'm_v: mass flow rate of vapor [kg/hr] from lab data
A = (Application.WorksheetFunction.Pi() * 0.1 ^ 2) / 4 '[m^2]
rho_L = 920.614 - 363.411 * x + 263.143 * x ^ 2 - 73.895 * x ^ 3 '[kg/m^3]
rho_v = 0.5493 + 0.4518 * y + 0.078 * y ^ 2 '[kg/m^3]

u_GS = 1 / 3600 * (m_v / (A * rho_v)) '[m/s]
u_LS = 1 / 3600 * (m_L / (A * rho_L)) '[m/s]

'3.ae 'm^2/m^3
Dim at
at = 341 '[m^2/m^3]
Dim sigma_c, sigma, L_m, mu_L
Dim g '[m/s^2]
g = 9.81
sigma_c = 75 * 0.001 '[N/m]
sigma = 1 / 1000 * (58.8602 - 23.1408 * x - 32.048 * x ^ 2 + 15.5362 * x ^ 3) '[N/m]
L_m = 1 / 3600 * m_L / A '[kg/(m^2*s)] (m_L: mass flow rate of liquid [kg/hr] from lab data)
If x < 0.31 Or x = 0.31 Then 'mu_L in [kg/(m*s)]
mu_L = 2.863 * 10 ^ (-4) + 5.3724 * 10 ^ (-4) * x - 1.6676 * 10 ^ (-3) * x ^ 2 + 2.0517 * 10 ^ (-3) * x ^ 3
Else
mu_L = 3.236 * 10 ^ (-4) + 1.6497 * 10 ^ (-4) * x - 1.7563 * 10 ^ (-4) * x ^ 2 + 5.6272 * 10 ^ (-5) * x ^ 3
End If
```

- Data Visualization: Charts/Tables creation in required format, with the creation of **templates for charts formatting**, which can be used in the future projects.

fx\_12\_Finalplots  
fx1\_weightToMole  
fx10\_PressureDrop\_pred  
fx11\_moleToWeight  
fx2\_R\_line  
fx3\_q\_line  
fx4\_S\_line  
fx5\_plot1  
fx6\_msgbox  
fx7\_equilibrium\_y  
fx8\_slope\_m  
fx9\_HETP\_pred  
z\_clean  
BAPProject (march6-TeamM5.xls)

```
Figure1 = Figure1.ChartType = xlXYScatter

'editing chart:
With Figure1

'insert series 1 to empty seriescollection
.SeriesCollection.NewSeries
.SeriesCollection(1).XValues = xRange1
.SeriesCollection(1).Values = y1.Value
.SeriesCollection(1).MarkerStyle = xlMarkerStyleCircle

'insert series 2 to empty seriescollection
.SeriesCollection.NewSeries
.SeriesCollection(2).XValues = xRange1
.SeriesCollection(2).Values = y2.Value
.SeriesCollection(2).MarkerStyle = xlMarkerStyleX

'insert series 3 to empty seriescollection
.SeriesCollection.NewSeries
.SeriesCollection(3).XValues = xRange1
.SeriesCollection(3).Values = y3.Value
.SeriesCollection(3).MarkerStyle = xlMarkerStyleDiamond
```

- GUI design: Designed a user-friendly graphical-user-interface (macro buttons) for executing the program.

