CHAPTER IV

USAGE OF THE DEVELOPED SYSTEM AND DISCUSSIONS

The CAL developed in this research work is a simple simulator program including theoretical database for chemical engineering students and one who is interested in this field. This prototype can be run under Microsoft Windows Version 3.1 or later. Computers required for run the program must at least have 386DX microprocessors with 4 MB RAM and VGA monitors.

Usage of each module is designed with the same basis. Users can call the dialog boxes to input data via a menu. The results of calculation will be shown in new windows. This part will illustrate only Filtration Unit as an example.

4.1 Simulation Example

4.1.1 Data Input

When the Filtration Unit module is called, the first menu with a figure of plate-and-frame filter press will appear as shown in figure 4.1-1. The user can change menu to Thai language by selecting "Toggle Thai/Eng" item in Help menu.

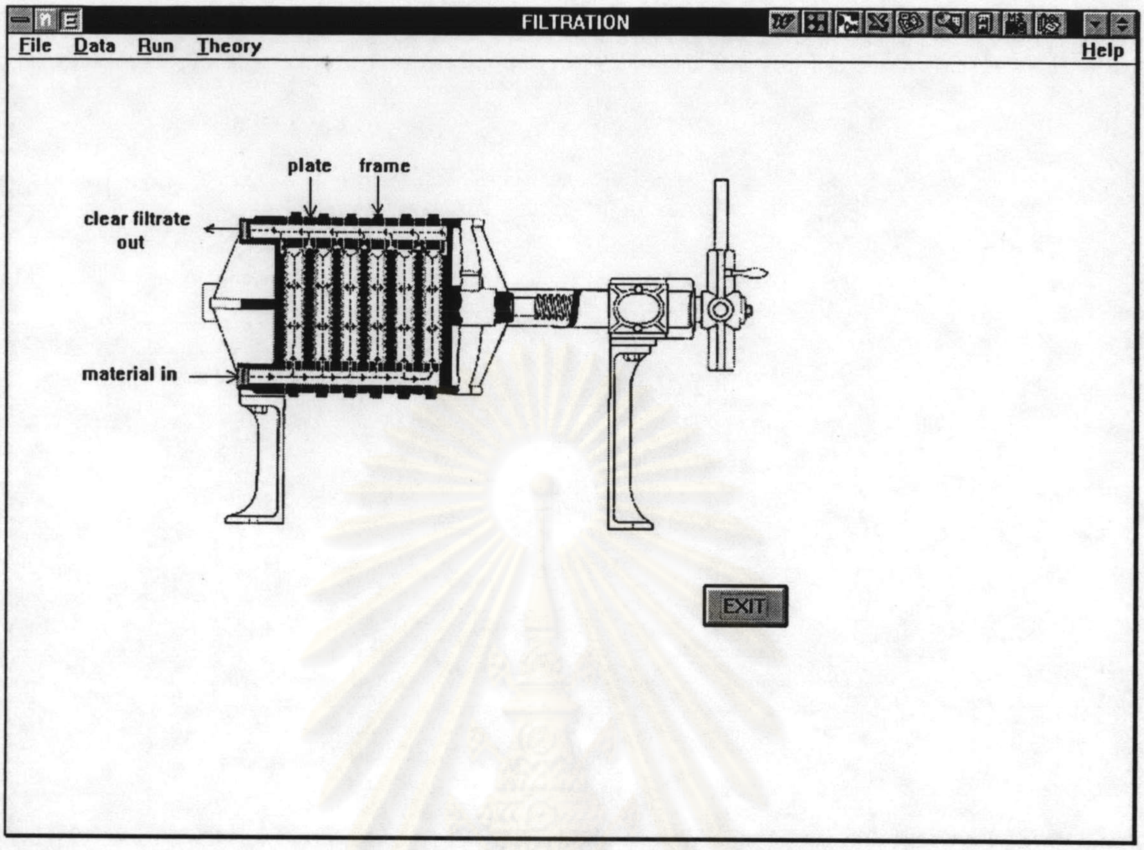


Figure 4.1-1 Menu-driven interface for Filtration Unit module.

The user must select all menu item in "Data" menu to input all data to calculate. It is not necessary to input consecutively. Tick mark (✓) will appear in front of the menu item that already selected. Figure 4.1-2 shows the dialog box that is used for inputting data.

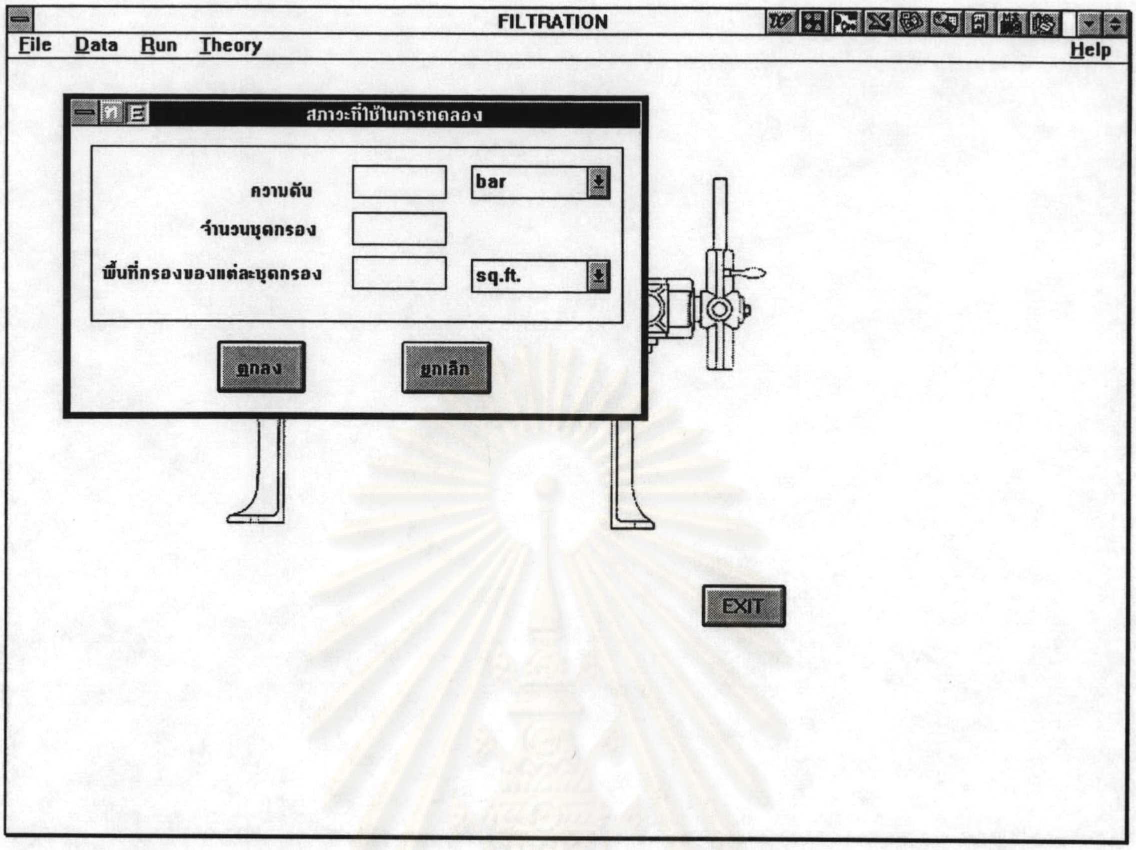


Figure 4.1-2 Dialog box for input data.

It is convenient to input the experimental data in a table as illustrated in figure 4.1-3. For this unit, the input table consists of three columns. The first column is consecutive order of data pair which must be filled in the second and the third columns. The user can input his data in either integer or floating point format.

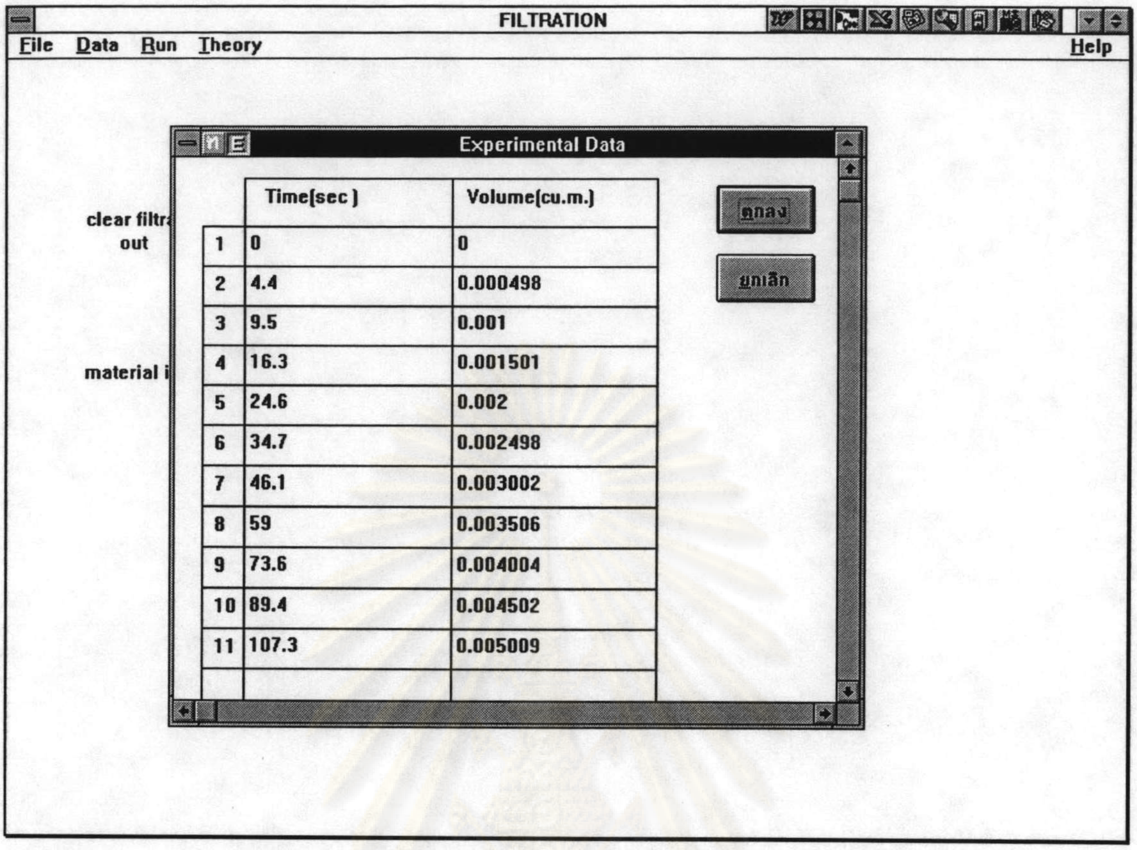


Figure 4.1-3 The experimental data table for input data.

4.1.2 The Results of Calculation

After all data are entered, the program will be ready to run. In “Run” menu, the user can select the “Check Data” to see all data input as shown in figure 4.1-4.

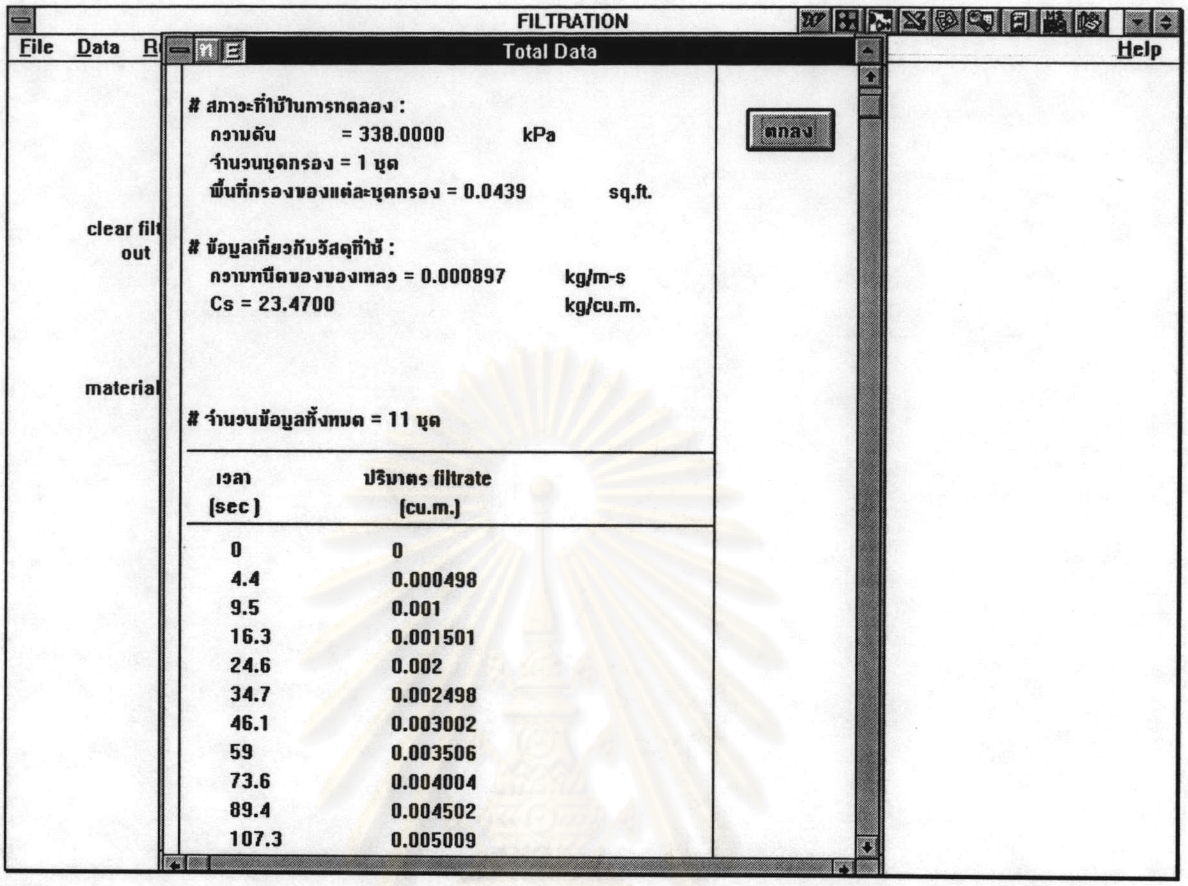


Figure 4.1-4 Check input data window.

The calculation results are displayed both in numerical and graphical as illustrated in figures 4.1-5 and 4.1-6. Furthermore, users can access the theory section by selecting the recommend button in these two windows.

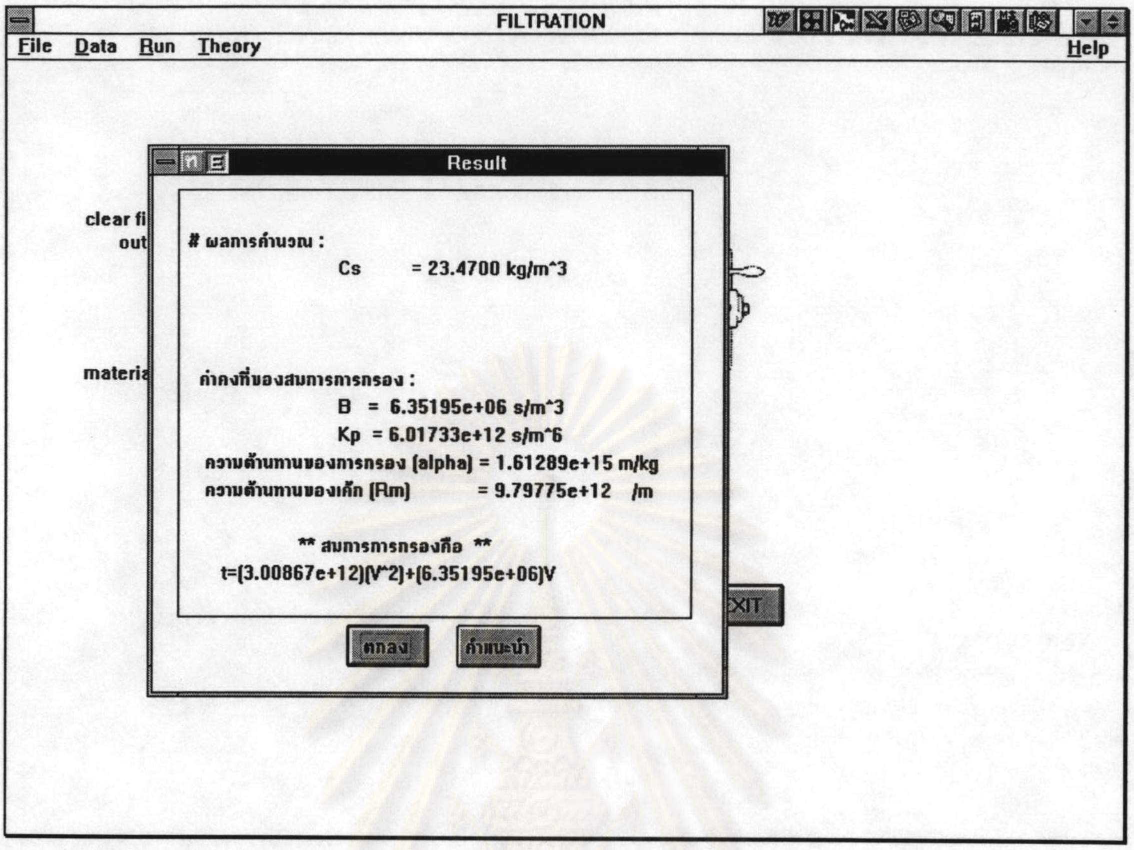


Figure 4.1-5 The numerical results for Filtration unit.

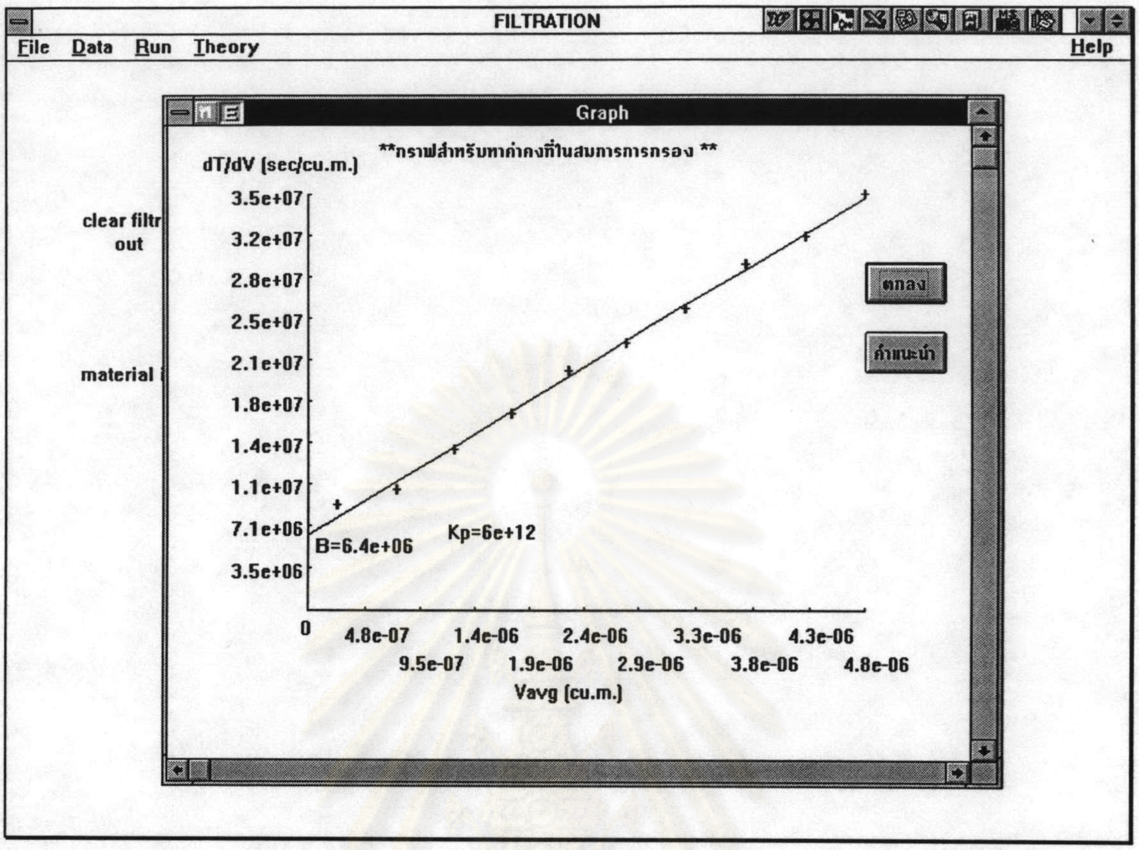


Figure 4.1-6 The graphical result for Filtration unit.

4.1.3 Theory Presentation

The user can access theory section by selecting "Theory" menu item in "Theory" menu. The contents of the selected unit will appear as shown in figure 4.1-7. Each topic has hypertext linked together. The users can obtain the detail of subjects wanted by clicking a mouse on the selected topic.

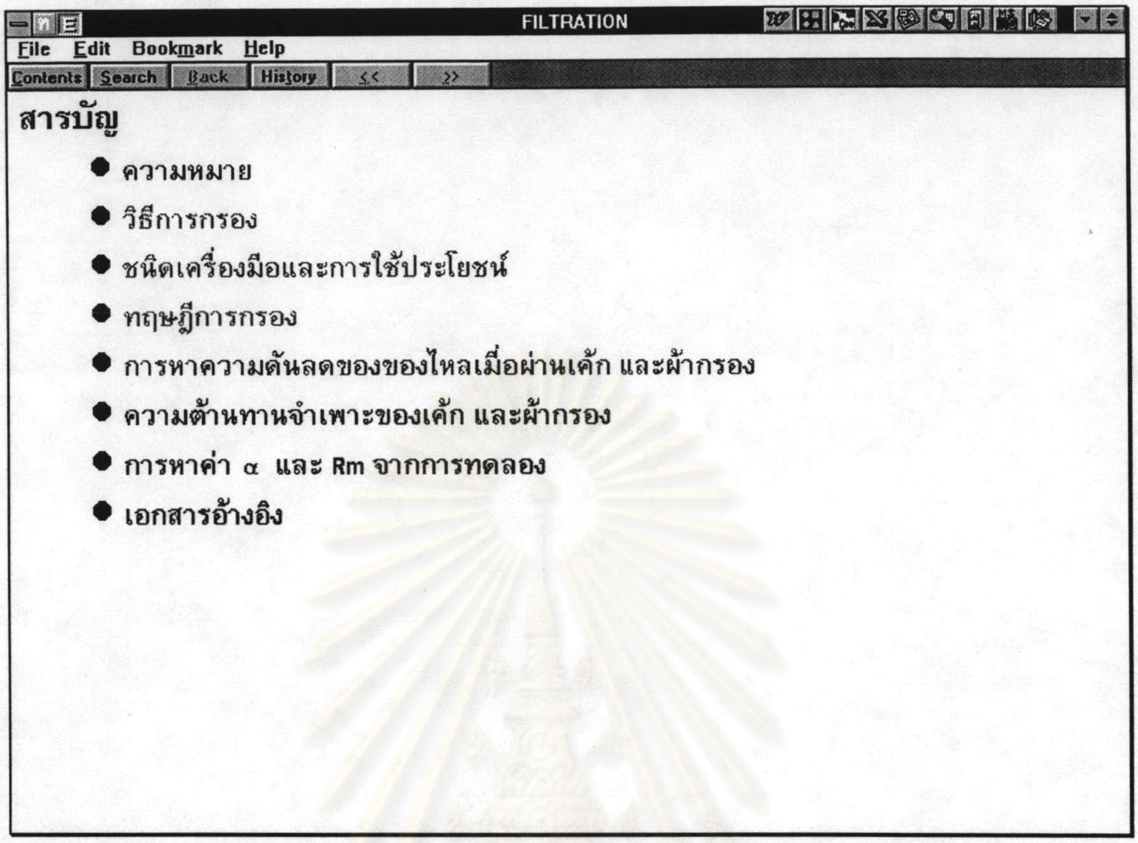


Figure 4.1-7 The contents of Filtration unit theory.

Furthermore, the user can also access the required topics by calling the search dialog box and input keyword to search as shown in figure 4.1-8.

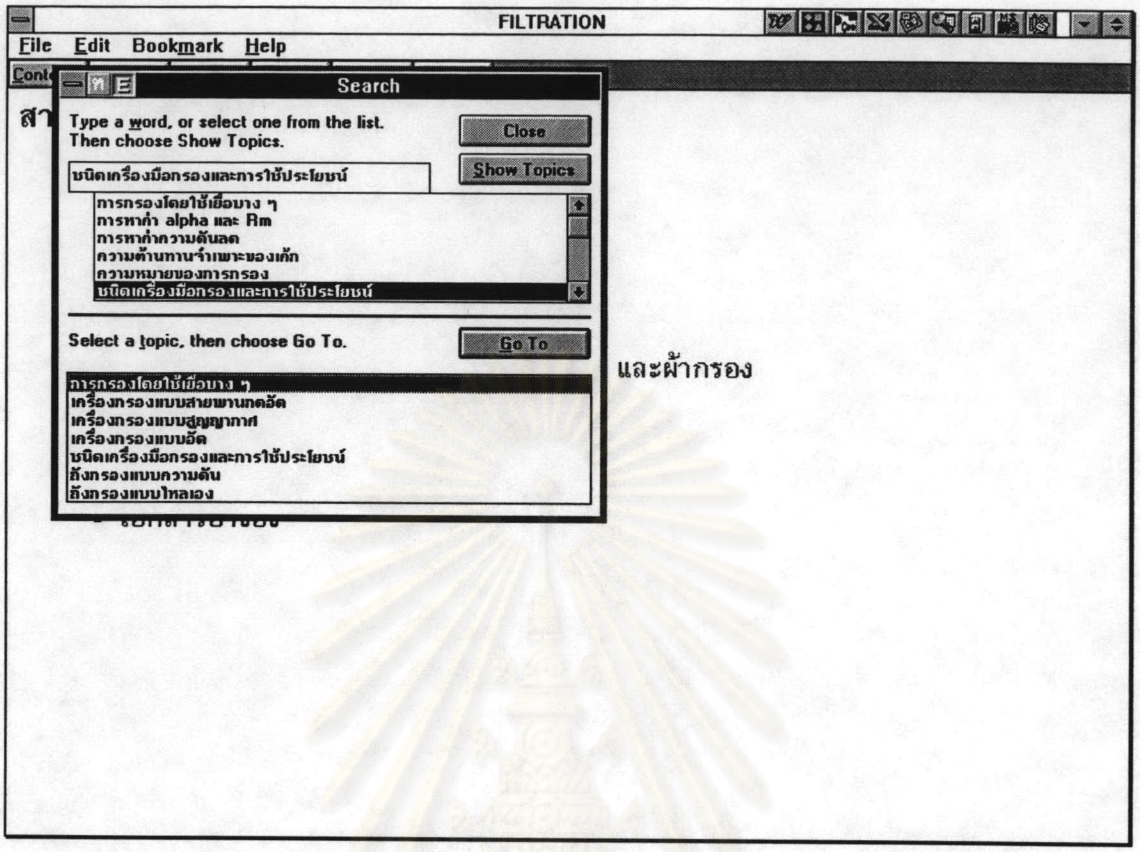


Figure 4.1-8 Search dialog box for Filtration unit in theory section.

There are many equations that are described in the theory section. These equations included in this CAL system consist of many hot spots. The user can click on the symbol to see nomenclature in pop-up windows as illustrated in figure 4.1-9.

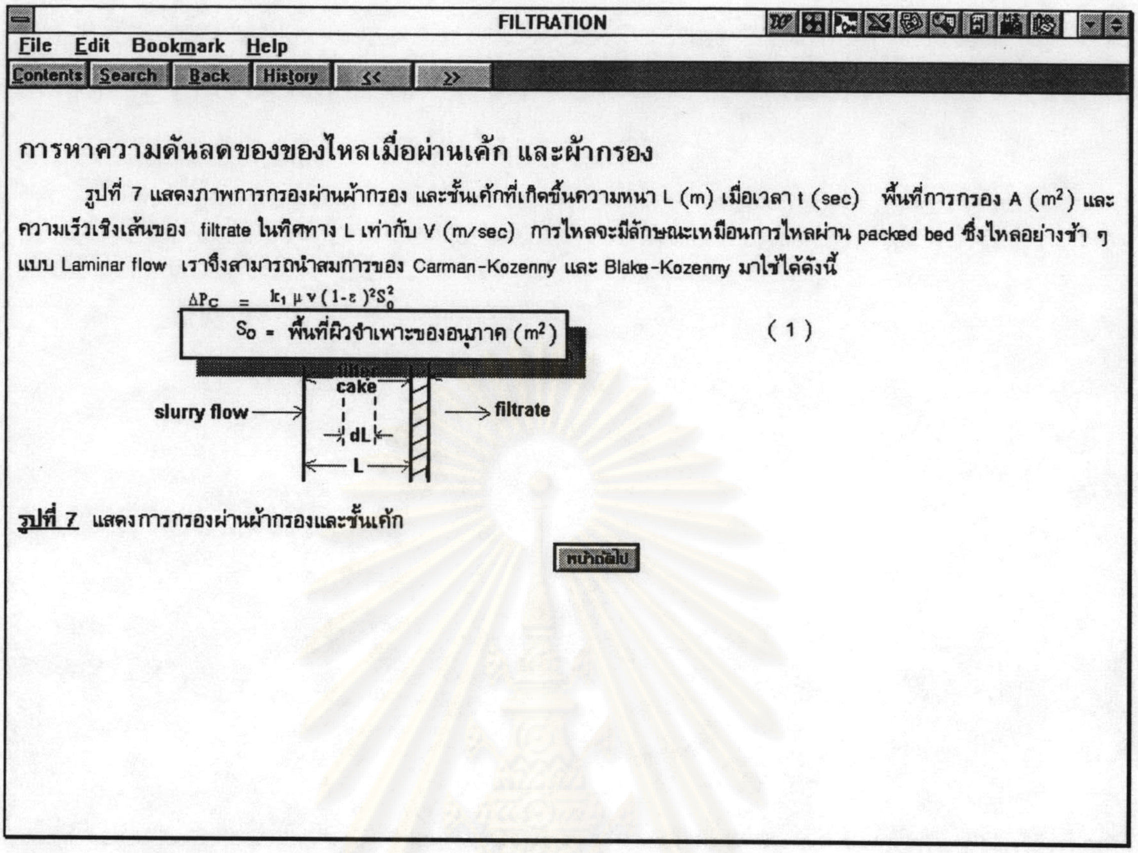


Figure 4.1-9 Pop-up window shown after click on the hot spot.

Usage of other modules is in the similar manner. Difference among each module is data input, results of calculation, and details in theory section. Table 4.1-1 shows the summary of input data and output data for each module in this system.

Table 4.1-1 The summary of input and output data for each module.

Unit Name	Data Input	Data Output
1. Filtration	- pressure and filter area - density and viscosity of fluid - slurry concentration - data between time and filtrate volume	- cake and filter media resistance - a basic equation for filtration rate in batch process

Table 4.1-1 (Continued)

Unit Name	Data Input	Data Output
2. Sedimentation	- particle size and density - fluid viscosity and density - total volume of fluid - total weight of particle - data between time and height of interface in batch settling test	- terminal velocity found by using difference methods: 1. from batch settling test 2. free settling velocity 3. hindered settling velocity 4. terminal velocity based on Stokes' law
3. Sieve Analysis	- particle density - sphericity and volume shape factor of particle - data between particle diameter and weight	- mass fraction of each increment - specific surface of mixture - number of particle per unit mass - average particle size
4. Efflux Time of a Tank	- density and viscosity of fluid - diameter of tank, valve, and pipe - the length of valve and pipe - data between time and fluid height in a tank, measured before fit a pipe	- equivalent length of valve - time and height of fluid in a tank with pipe fitting
5. Flow in Pipe	- density and viscosity of fluid that flow in pipe - pipe diameter - mass flow rate of fluid - density of fluid that used in pressure measurement - data between radius distance and height difference of pressure measuring fluid between pitot measuring point and pipe surface	- velocity distribution that calculate in 2 methods: 1. from theory 2. from measurement data

Table 4.1-1 (Continued)

Unit Name	Data Input	Data Output
6. Fluidization	- cross-section area of chamber - heater surface area - experimental data collected in 2 cases: case 1 : air flow rate, bed temp., air temp., bed height, and pressure drop case 2 : air flow rate, heater surface temp., bed temp., heater voltage and current	- the results depend on data input :- case 1 : superficial velocity case 2 : heat transfer rate and surface heat transfer coefficient
7. Mixing	- density and viscosity of liquid - diameter of tank and agitator - liquid height and revolutions per unit time used in agitation - NaOH weight and HCl concentration - volume of sample NaOH solution - data between time and volume of HCl used in titration	- concentration ratio between that time and final concentration - power used in agitation

Note : All output results is in SI unit system.

4.2 Discussion

4.2.1 Calculation Section

This CAL system was tested its accuracy of calculation by comparing with other sources, such as using Microsoft Excel package, and some of the examples in the reference books. All modules in this CAL system give the results agreeing well with those of other sources. Some values might be a very small difference as about ±0.03%.

SI system, the official international system of units, is used as a default unit in this research. Because this unit system is encountered in science and engineering nowadays.

The following parts will discuss about each module with example simulation results.

1) Filtration Unit

Two simulation examples are illustrated for this unit. Example 4.2.1 is an example problem from "Transport Process and Unit Operations" by Geankoplis, C. J. (1983) The other is a laboratory data carried out in the laboratory in department of Chemical Engineering, Faculty of Science, Chulalongkorn University.

<u>Example 4.2.1</u> Data for the laboratory filtration of $CaCO_3$ slurry in water at 298.2 K are reported in table 4.2-1 at a constant pressure of 338 kN/m^2. The filter area of the plate-and-frame press is 0.0439 m^2. The slurry concentration is 23.47 kg/m^3.

Table 4.2-1 Data for example 4.2.1.

time(s)	Volume(m^3)	time(s)	Volume(m^3)	time(s)	Volume(m^3)
0	0.000000	24.6	0.002000	73.6	0.004004
4.4	0.000498	34.7	0.002498	89.4	0.004502
9.5	0.001000	46.1	0.003002	107.3	0.005009
16.3	0.001501	59	0.003506		

The results for this example from this program, the calculation from MS Excel and the answer from the reference book is reported in table 4.2-2.

Table 4.2-2 The comparison of the results from the program with those from other sources in example 4.2.1.

	The program results	MS Excel		Ref. book	
		Results	%Difference	Results	%Difference
$B(S/m^3)$	6351.95	6351.951	0.00	5457	32.80
$K_p(s/m^6)$	6.01733E+06	6.01733E+06	0.00	6.28E+06	-8.37
$\alpha(m/kg)$	1.86810E+11	1.8687E+11	-0.03	1.95E+11	-8.40
$R_m(m^{-1})$	1.05427E+11	1.0546E+11	-0.03	9.09E+10	31.96

Note : $\%\text{Difference}=\dfrac{(\text{program result} - \text{comparison value})}{\text{the average of two values}} \times 100$

The results from this module is -0.03% different from that of MS Excel, but it is about 32.80% difference from the result in the reference book. This is due to the difference in finding slope and interception of linear relationship between V_{avg} and $\Delta t/\Delta V$ is a reason. This module bases on linear regression method to fit the data points. Data which plotted between V_{avg} and $\Delta t/\Delta V$ is illustrated in figure 4.2-1.

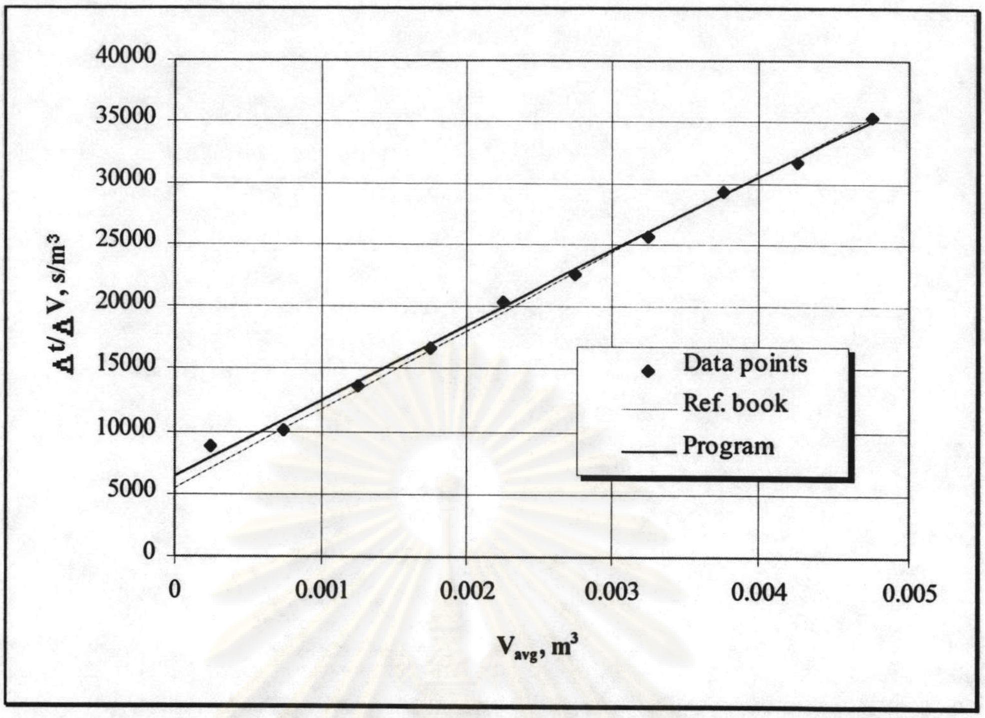


Figure 4.2-1 Determination of constants for example 1.1 by various methods.

Example 4.2.2 Press-and-frame filter press is operated at constant pressure of 186.314 kPa. The filter area is 0.08 m^2 and the slurry concentration is 86.14 kg/m^3. Filtrate viscosity is 8.94 kg/m-s. Data between time and filtrate volume are reported in table 4.2-3.

Table 4.2-3 Data for example 4.2.2.

time(min)	Volume(l)	time(min)	Volume(l)	time(min)	Volume(l)
0	0	0.4	4	1.46	8
0.08	1	0.54	5	2.07	9
0.15	2	1.1	6	2.5	10
0.27	3	1.27	7		

The result from this program and MS Excel is reported in table 4.2-4 with % difference. The plot for finding both constants (B and K_p) is shown in figure 4.2-2.

Table 4.2-4 The comparison of the results from program with another calculator for example 4.2.2.

	The program results	MS Excel	
		Results	%Difference
B(S/m^3)	3780	781.82	131.45
K_p(s/m^6)	1.08000E+06	2.84360E+06	-89.89
α(m/kg)	1.67283E+10	4.40451E+10	-89.89
R_m(m^{-1})	6.34280E+10	1.30392E+10	131.79

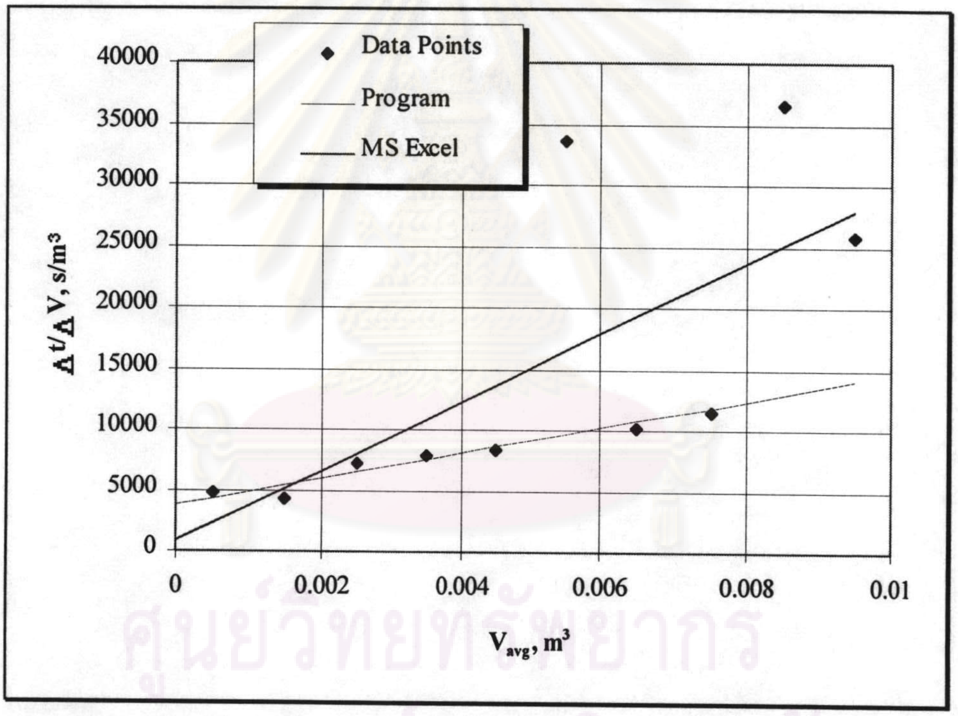


Figure 4.2-2 Determination of constants for example 4.2.2 by various methods.

The large difference between two methods is due to the different basis in calculations. The results from MS Excel is obtained using the entire data in regression to find both constants but this program uses only a partial range of data. From figure 4.2-2, we found that the relationship is not linear and more dispersed at higher V_{avg}. The reason is when the filtration time increases, more cake collected in frames causes an increases in cake resistance, so the filtrate volume decreases. This method is valid only in the initial range of data for regression to find filtration constants. This program will exclude especially the first point providing the coefficient of determination (r^2) more than 0.8. We select this value because we know that the relation between V_{avg} and $\Delta t/\Delta V$ for constant pressure filtration is linear, so it should have the value of r^2 approach to one. The value of r^2 higher than 0.8 indicates that 80 percent of the variation in $\Delta t/\Delta V$ is predicted by the regression line with Vavg.

The user can apply the results of this module in several purposes, such as :

1. The user can use the obtained basic equation for calculating filtration rate of batchwise operations, and then use the obtained results to predict the filtration time at a given filtration volume.

2. Because the filter media resistance (R_m) is constant for specific material, the user can find a new constant B from equation (2.1-12) when the operating condition is changed but filter media is the same.

3. For the incompressible cake, because the specific cake resistant (α) is constant, the constant K_p for a new operating condition with the same cake can be calculated directly from equation (2.1-11).

The specific cake resistance for the compressible cake will change with the pressure drop in the system. The empirical relation for specific cake resistance and pressure drop is given by

$$\alpha = \alpha_0(-\Delta P)^S \qquad (4.2\text{-}1)$$

where α_0 and S are constants. The value of S is usually between 0.1-0.8.

The user can find the value of α_0 and S by varying two pressure drop values with fixed another variables. The specific cake resistant for these two conditions can be calculated after finishing the experiment. Two variables system equations are set up by substitute the value of α and (-ΔP) in equation (4.2-1). The correlation between α and (-ΔP) is obtained, therefore the user can predict the value of α at a given pressure drop. Then the parameters in the basic equation for filtration rate in batch process for the system with the same cake and filter media can be predicted at various conditions.

2) Sedimentation Unit

The results from the sedimentation unit module are composed of four values of settling velocity calculated by various methods. An example 4.2.3 uses sample data obtained from the laboratory of department of Chemical Engineering, Faculty of Science, Chulalongkorn University.

Example 4.2.3 Data for batch settling test of $CaCO_3$ slurry in water ($\mu=1\times10^{-3}$ Pa.s, $\rho=998$ kg/m^3) are reported in table 4.2-5. The slurry is prepared from 35 g of $CaCO_3$ in 100 cm^3 of water. The density of $CaCO_3$ is 2260 kg/m^3. The particle diameter is 30 μm. The bulk viscosity of slurry is 1.00208×10^{-3} Pa.s.

Table 4.2-5 Batch settling test data for example 4.2.3.

time(min)	Height(cm)
0	59
1	56
2	51
4	38.5
6	26
8	15
10	10
14	8.25
18	7.5
25	6.5
30	6
35	6

The results from this program are as follows:

1. Terminal velocity from batch settling test = 0.000607688 m/s.
2. Free settling velocity = 0.000618321 m/s.
3. Hindered settling velocity = 0.00061833 m/s.
4. Terminal velocity based on Stokes'law = 0.00061838 m/s.

These results are the same as those from MS Excel using the same basis.

Linear regression method is applied in finding the initial slope. The result for batch settling test of example 4.2.3 is plot in figure 4.2-3.

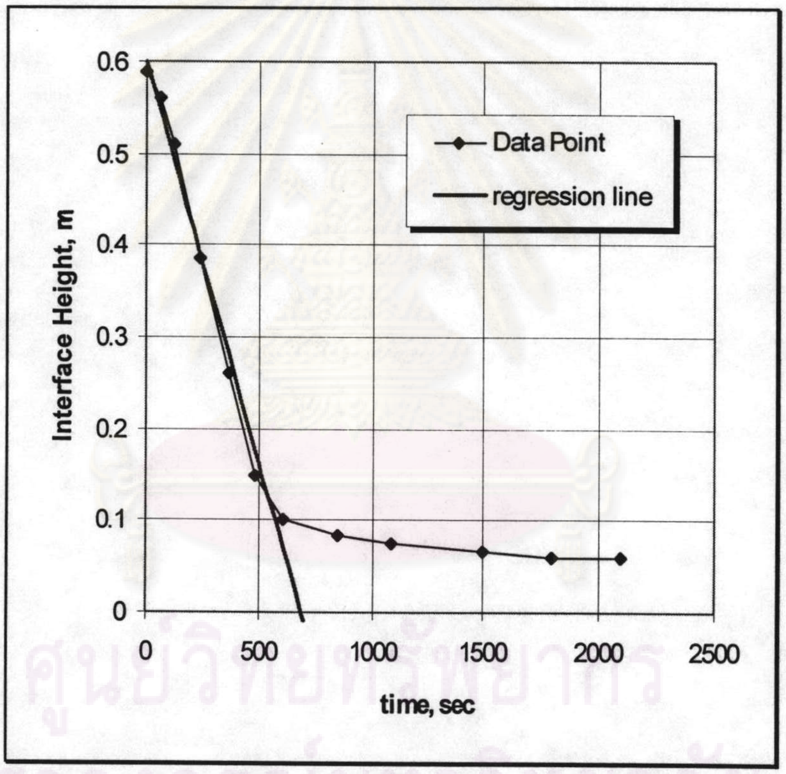


Figure 4.2-3 Graphical result of batch settling test for example 4.2.3.

It is known that the initial slope in batch settling process is constant and it will change rapidly when it reaches the critical point. From this point, we can determine a range before the compression zone by comparing the slope of consecutive data pairs. With the several trial-and-error tests, we found that slope difference less than 60 percent are acceptable in finding settling velocity. We assume that the initial slope and the slope near the critical point is different more than 60 percent.

We can compare the result from batch settling test and the equations from theory. The example shows that the velocity determined from both methods has a little difference because the concentration of slurry is rather low therefore the hindering effect is neglect.

3) Sieve Analysis Unit

The example data is applied from " Unit Operation of Chemical Engineering" by McCabe, W.L. et al. (1993).

Example 4.2.4 The screen analysis shown in table 4.2-6 is a sample of crushed quartz. The density of the particles is 2650 kg/m^3, and the shape factors are a=2, and Φ_S=0.571.

Table 4.2-6 Screen analysis for example 4.2.4.

Dp(mm)	W(g)
4.013	0.0251
2.845	0.125
2.007	0.3207
1.409	0.257
1.001	0.159
0.711	0.0538
0.503	0.021
0.356	0.0102
0.252	0.0077
0.178	0.0058
0.126	0.0041
0.089	0.0031

The result from this program is the same as that from MS Excel.

- Specific surface of mixture, $A_w = 3.307$ m^2/kg.
- Volume-surface mean diameter, $D_s = 0.001199$ m.
- Arithmetic mean diameter, $D_n = 0.0001829$ m.
- Mass mean diameter, $D_w = 0.00169$ m.
- Volume mean diameter, $D_v = 0.0004833$ m.
- Number of particle per unit mass, $N = 1.672\times10^6$ kg^{-1}.

The fractional-distribution plot for screen analysis in example 4.2.4 is shown in figure 4.2-4.

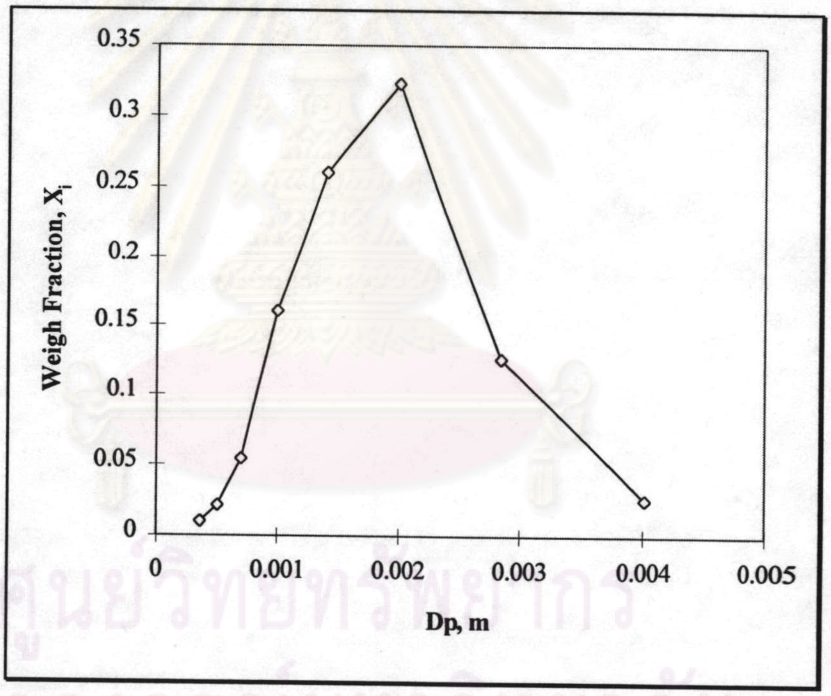


Figure 4.2-4 Fractional-distribution plot for example 3.

Various average diameters are obtained from this program. The most common one is the volume-surface mean diameter. For this case, each average diameter is widely different from other values, because this mixture contains a various sizes of particles. The samples consisting of uniform particles will have the same values of average diameters.

Result from this program can be used for characterizing mixtures solid particles. It is useful in many unit operations, such as crushing, drying, solid-fluid reacting and dust collecting.

4) Efflux Time of a Tank Unit

The result from this module is the efflux time of a tank with a pipe fitting. The example data is shown in example 4.2.5.

Example 4.2.5 Water (μ= 0.000895 Pa.s, ρ= 998 kg/m^3) is transferred from a storage tank through a valve. Tank diameter is 0.1498 m, valve diameter is 0.018 m and pipe diameter is 0.0177 m. The length of valve is 0.118 m. The collected data for the system is shown in table 4.2-7. The efflux time after fit 0.3 m PVC pipe is reported in table 4.2-8.

Table 4.2-7 Data between time and liquid level in tank for example 4.2.5 (before fit a pipe).

H(cm)	t(sec)
100	0
90	2.27
80	4.59
70	6.84
60	9.13
50	11.93
40	14.95
30	18.1
20	21.24

The result of the program is shown in table 4.2-6 compared with the efflux time that received from the laboratory.

Table 4.2-8 The comparison of efflux time from this program and the experimental values.

H(cm)	$T_{program}$	T_{exp}	%Error
100	0	0	0.00
90	2.10928	2.84	25.73
80	4.31213	5.49	21.45
70	6.62096	8.36	20.80
60	9.05107	11.24	19.47
50	11.6218	14.25	18.44
40	14.3581	17.41	17.53
30	17.293	20.83	16.98
20	20.4721	24.44	16.24

Note : $\%Error = \frac{(T_{exp}-T_{program})\times 100}{T_{exp}}$

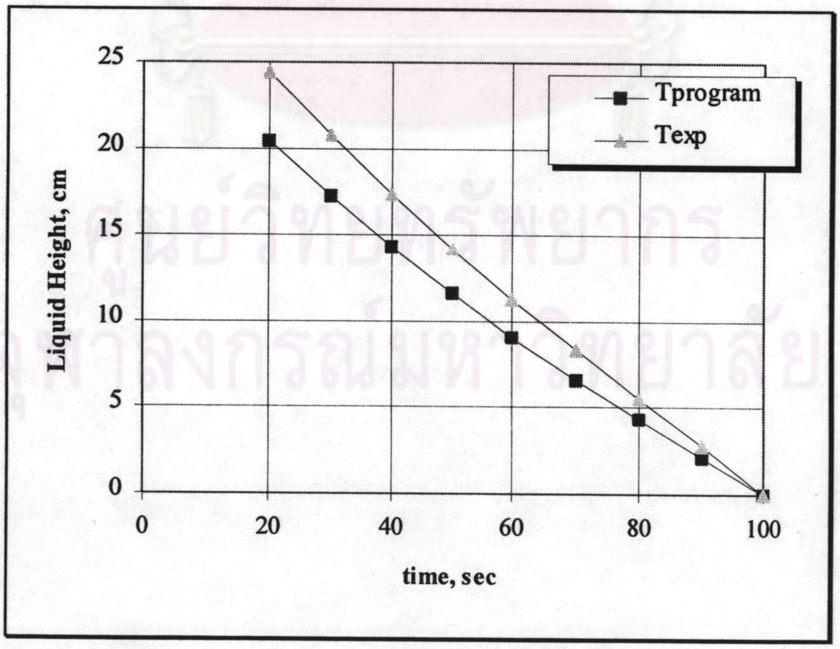


Figure 4.2-5 The efflux time of a tank in example 4.2.5.

The difference between the experimental data and that from program is due to the fact that the equations used to find the efflux time are derived using many assumptions as mentioned in chapter 2. Friction in the pipe must be taken into consideration to correct the calculation results.

5) Flow in Pipe Unit

This unit module is used to determine the velocity distribution in a cylindrical pipe in two approaches – both theoretically and experimentally. The example 4.2.6 is data collected from laboratory of department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University.

Example 4.2.6 The velocity distribution for oil (μ=1.0175 Pa.s, ρ=920 kg/m^3) in a pipe with 19 mm inside diameter is investigated. Mercury (ρ=13,550 kg/m^3) is filled in the glass tube for measuring pressure drop in the pipe. Data between the position of pitot tube in pipe and the height difference in glass tube of Mercury between the measure point at the pipe wall and pitot position are reported in table 4.2-9. The mass flow rate of oil is 0.29253 kg/sec.

Table 4.2-9 Experimental data for example 4.2.6.

Distance from the pipe centered (m)	**Height Difference of Mercury in glass tube(cm)**
1.00E-03	1.9
2.00E-03	1.8
3.00E-03	1.6
4.00E-03	1.4
5.00E-03	1.2
6.00E-03	0.9
7.00E-03	0.5
8.00E-03	0.1
9.00E-03	0.1

Result from the program agrees well with that from another calculation method using MS Excel, as shown in table 4.2-10 and figure 4.2-6.

Table 4.2-10 The result for example 4.2.6.

r(m)	u(r) Exp	u(r) theory
1.00E-03	2.262216	2.217184
2.00E-03	2.201879	2.142657
3.00E-03	2.075952	2.018445
4.00E-03	1.941875	1.844548
5.00E-03	1.797827	1.620966
6.00E-03	1.556964	1.3477
7.00E-03	1.160492	1.024749
8.00E-03	0.518988	0.652113
9.00E-03	0.518988	0.229792

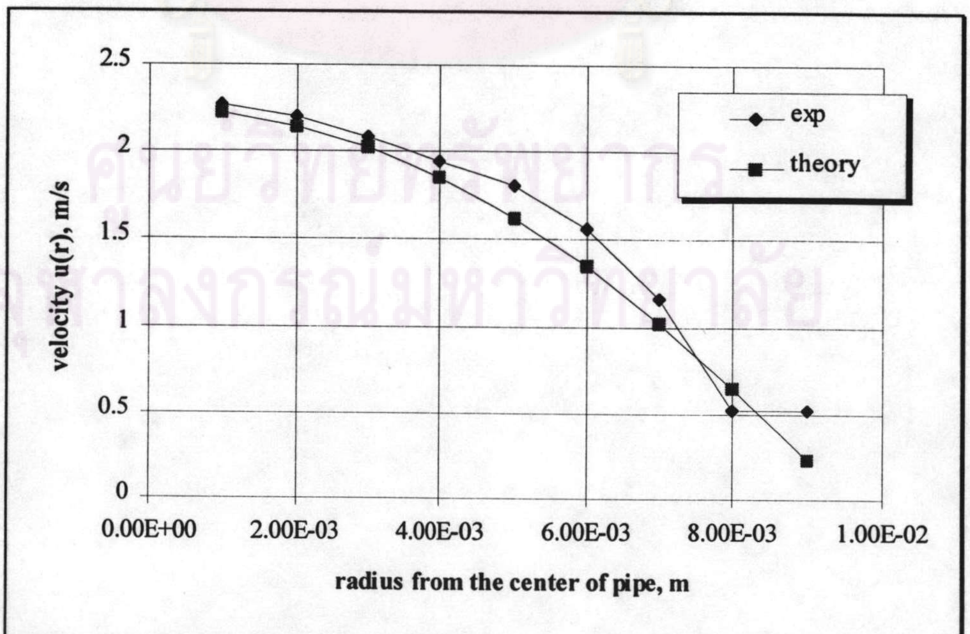


Figure 4.2-6 Graphical result for example 4.2.6.

This program provides two calculation results of velocity distribution in order to compare these two values easier. In this case, the difference is observed. This is due to an error in measuring.

6) Fluidization Unit

The calculation module for this unit are composed of two cases. Examples 4.2.7 and 4.2.8 are both sample cases from the laboratory. The "Fluidisation and Fluid Bed Heat Transfer Unit", used in laboratory, has the cross-section area of chamber and surface area of heater equal to 8.66×10^{-3} m^2 and 1.6×10^{-3} m^2 respectively.

Example 4.2.7 The relation between superficial velocity with bed height and bed pressure drop can be found from data in table 4.2-11.

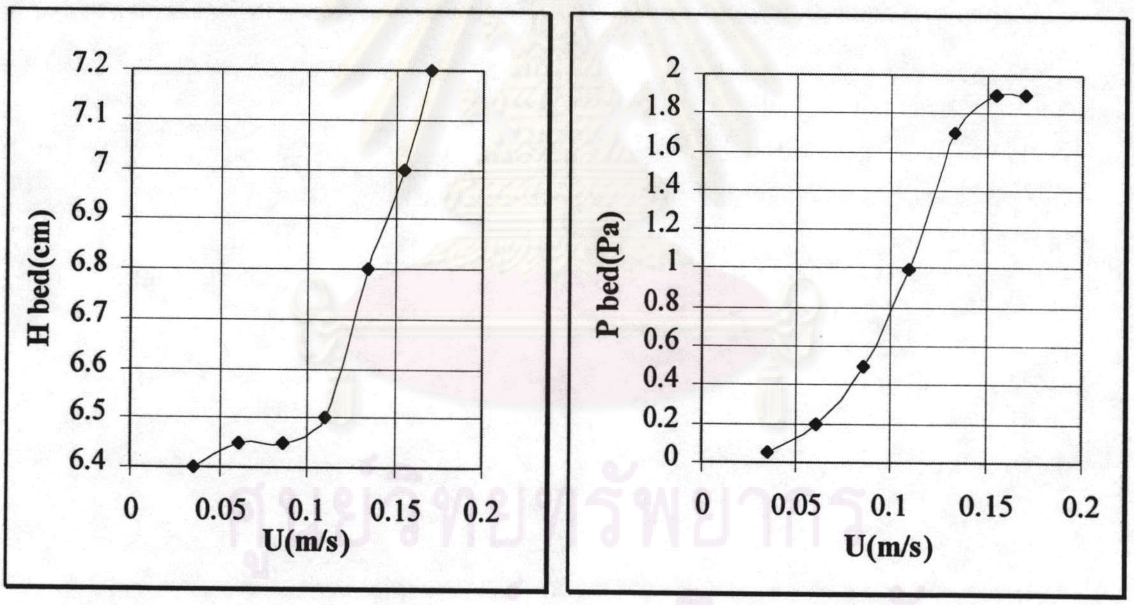
Table 4.2-11 Data for example 4.2.7.

Air velocity(l/s)	Bed temp. (K)	Air temp.(K)	H bed(cm)	P bed(Pa)
1.414	317	305	7.2	1.9
1.291	317	305	7	1.9
1.118	317	305	6.8	1.7
0.913	318	305	6.5	1
0.707	320	305	6.45	0.5
0.5	323	305	6.45	0.2
0.289	322	305	6.4	0.05

Superficial velocity is obtained from this program and MS Excel is the same as reported in table 4.2-12, and plotted in figure 4.2-7.

Table 4.2-12 The result for example 4.2.7.

Air velocity(l/s)	U(m/s)
1.414	0.169704
1.291	0.154942
1.118	0.134179
0.913	0.109921
0.707	0.085655
0.5	0.061144
0.289	0.035232



(a) (b)

Figure 4.2-7 Graphical result for example 4.2.7.

It is convenient to explain this phenomena by using graphical results. Figure 4.2-7 (a) indicates that bed height at the low velocity has a little change. Bed height increases with an increase in velocity after the fluidization begins. Considered the pressure drop in bed in figure 4.2-7 (b), one will see that pressure drop increases with an increase in velocity until fluidization begins. After this point the pressure drop across the bed will be constant.

Example 4.2.8 Data in table 4.2-13 is used for investigation the relation between air velocity through bed with heat transfer coefficient.

Table 4.2-13 Data of example 4.2.8.

Air velocity (l/s)	**Heater temp. (K)**	**Bed temp. (K)**	**Heater current (A)**	**Heater voltage (V)**
1.414	428	331	0.8	45.6
1.291	428	330	0.77	42.35
1.118	428	327	0.71	35.5
0.913	428	344	0.52	18.72
0.707	428	335	0.38	10.64
0.5	428	333	0.32	7.36
0.289	428	332	0.32	7.36

The result for example 4.2.8 is shown in table 4.2-14 and figure 4.2-8.

Table 4.2-14 The result of example 4.2.8.

Air velocity(l/s)	**Heat transfer rate(Watt)**	**Heat transfer coeff.(W/m^2-K)**
1.414	36.48	235.0515
1.291	32.6095	207.9688
1.118	25.205	155.9715
0.913	9.7344	72.42857
0.707	4.0432	27.17204
0.5	2.3552	15.49474
0.289	2.3552	15.33333

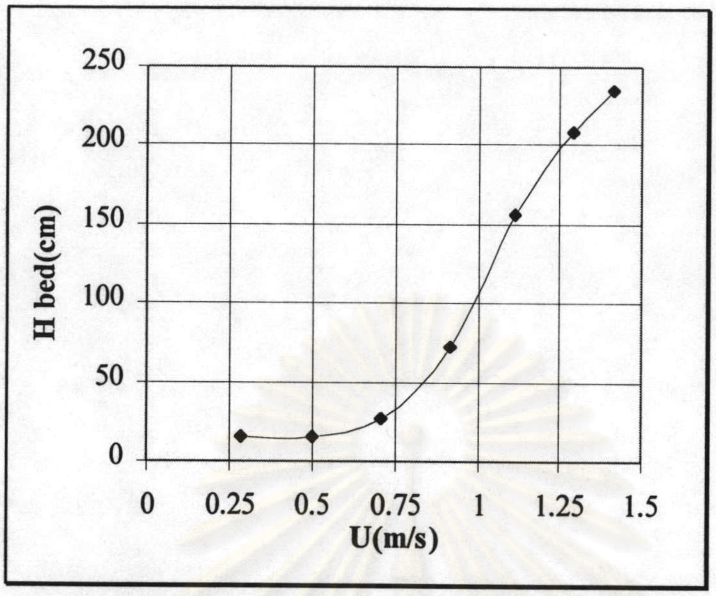


Figure 4.2-8 Graphical result for example 4.2.8.

Users can use the graphical result from this program to explain this phenomena. The result shown in figure 4.2-8 indicates that surface heat transfer coefficient will increase with an increase in air velocity. Because when the air velocity is increased, the void in bed also increases, therefore heat can be distributed around in bed better.

7) Mixing Unit

This module provides the resident time distribution and power consumption in agitation of liquids. Database for standard configuration power curve is included in this unit calculation module. Laboratory data are used in example 4.2.9.

Example 4.2.9 NaOH 39.98 g is mixed with water in mixing tank. The diameter of tank is 0.2 m. This system is a standard configuration so the height of water in tank must be equal to tank diameter. Diameter of agitator is 0.07 m. The viscosity and density of NaOH solution are 0.009 kg/m-s and 997.1 kg/m^3, respectively. A 0.129 M HCl solution is used for titration with NaOH sample. The sample volume is equal to 25 ml. Data between time and volume of HCl solution used in titration are reported in table 4.2-15.

Table 4.2-15 Data of example 4.2.9.

time(s)	V_{HCl}(ml) used in titration
0	0
30	12.5
60	21.2
90	23
120	27.9
150	30.75
180	32
210	32

The results of example 4.2.9 obtained from this program agree well with those from another calculating method. The numerical and graphical results of this system is shown in table 4.2-16 and figure 4.2-9.

Table 4.2-16 The result of example 4.2.9.

time(s)	C_i/C_0 ratio	Energy(Joule)
0	0.0000	0.0000
30	0.4056	60.8738
60	0.6880	121.7476
90	0.7464	182.6214
120	0.9054	243.4952
150	0.9979	304.3690
180	1.0384	365.2428
210	1.0384	426.1166

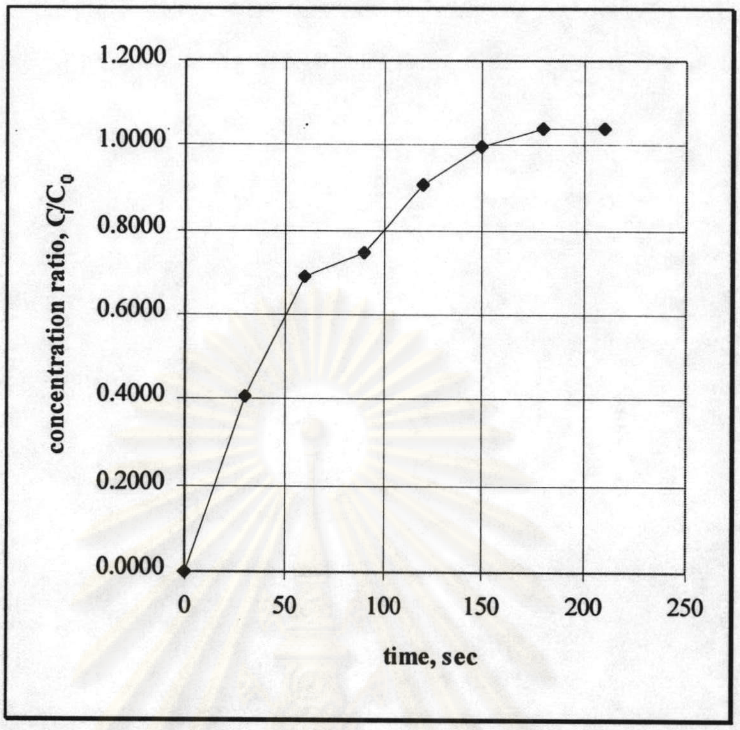


Figure 4.2-9 Graphical result for example 4.2.9.

These results indicate that the energy consumption increases with time and the concentration ratio (C_i/C_0) will approach unity finally. In this problem, the concentration ratio is higher than unity due to the error in titration.

Power consumption in agitation is an important factor in design mixing tank system.

4.2.2 Theory Section

The user can use this section like a book, because it provides an elementary knowledge in Chemical Engineering Unit Operations. The user can access this section in two ways. The first is calling the content of the theory by selecting "theory" menu item. The second is selecting the recommend button in the result windows to see recommend in discussing the result. Many colorful and graphic images will attract the learners. Each topic is separated systematically, therefore it is easy to learn. It has also keywords and hot spots that can help users to save a lot of time in searching the interesting topic. The list of references are also included in this section.

The user can access the interesting topic in several ways as follows:

1. Hot spot

Hot spots are characterized by

- green underlined text
- green dotted underlined text
- the hand cursor on the hot spot
- the high-light when press Ctrl+Tab

Hot spots are placed in many positions, such as on the keyword text, equations, and pictures.

2. Keyword

The search dialog box is used for searching topic by using keywords. The user can type or select a keyword from a list in search dialog as shown in figure 4.1-8.

3. Contents button

This button is used when the user want to see contents in the selected unit. From the contents, the user can access any topics by clicking mouse on the topic.

4. Browse buttons

The browse button is the button which is labeled by ">>" and "<<". They are used for quick moving forward and backward to any topics in the selected unit.

5. Back button

This button is used when the user want to see the back topic.

6. History button

When the user press history button, the "Windows Help History" window will appear as shown in figure 4.2-10. The user can select the history topic to see the topic again.

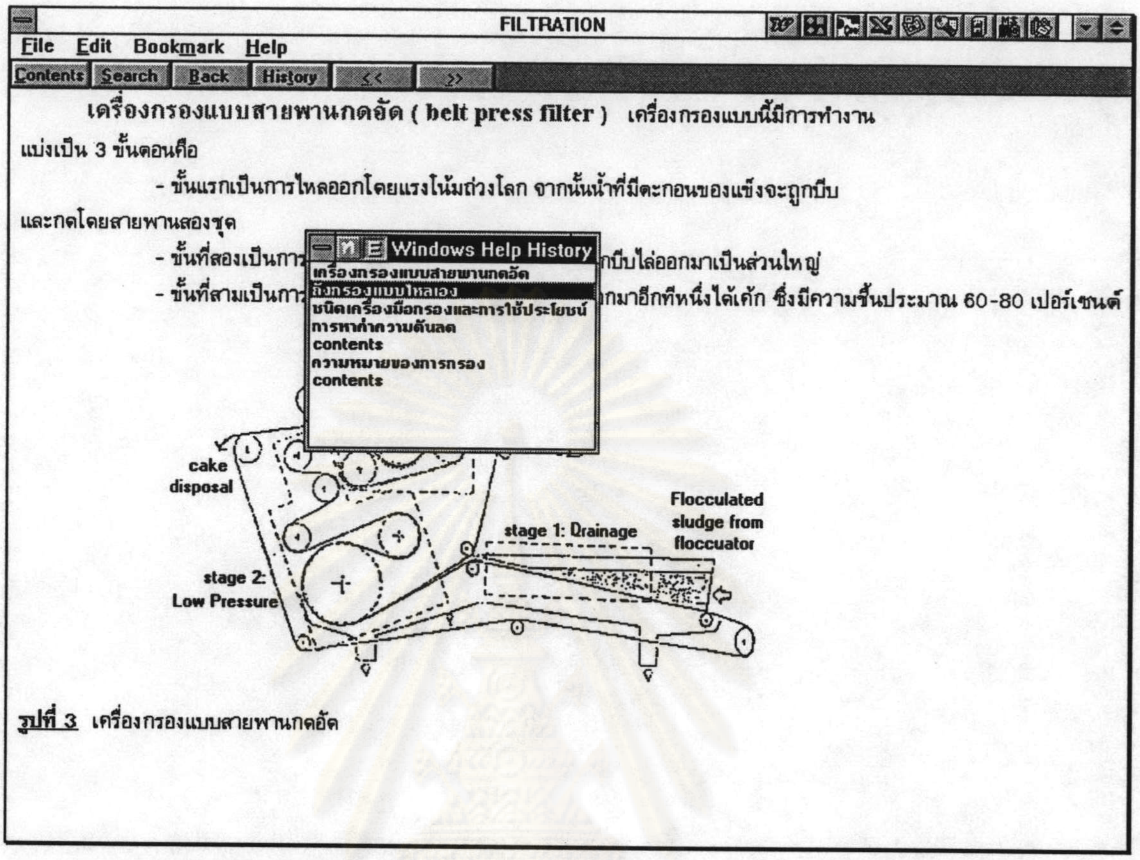


Figure 4.2-10 Theory section of Filtration Unit with "Windows Help History" windows.

This section is developed by using Help Compiler, therefore it can be used like a Window Help. The resource accompanying with Window Help, such as menu and buttons on the menu bar, can be applied to this section.