A New Tool
for Simulation of Tanks and Columns
with Bubble Mixing Based on VisiMix Turbulent
Software

User's Guide and Application Example

Step 1

The tool start window is shown in Fig. 1.

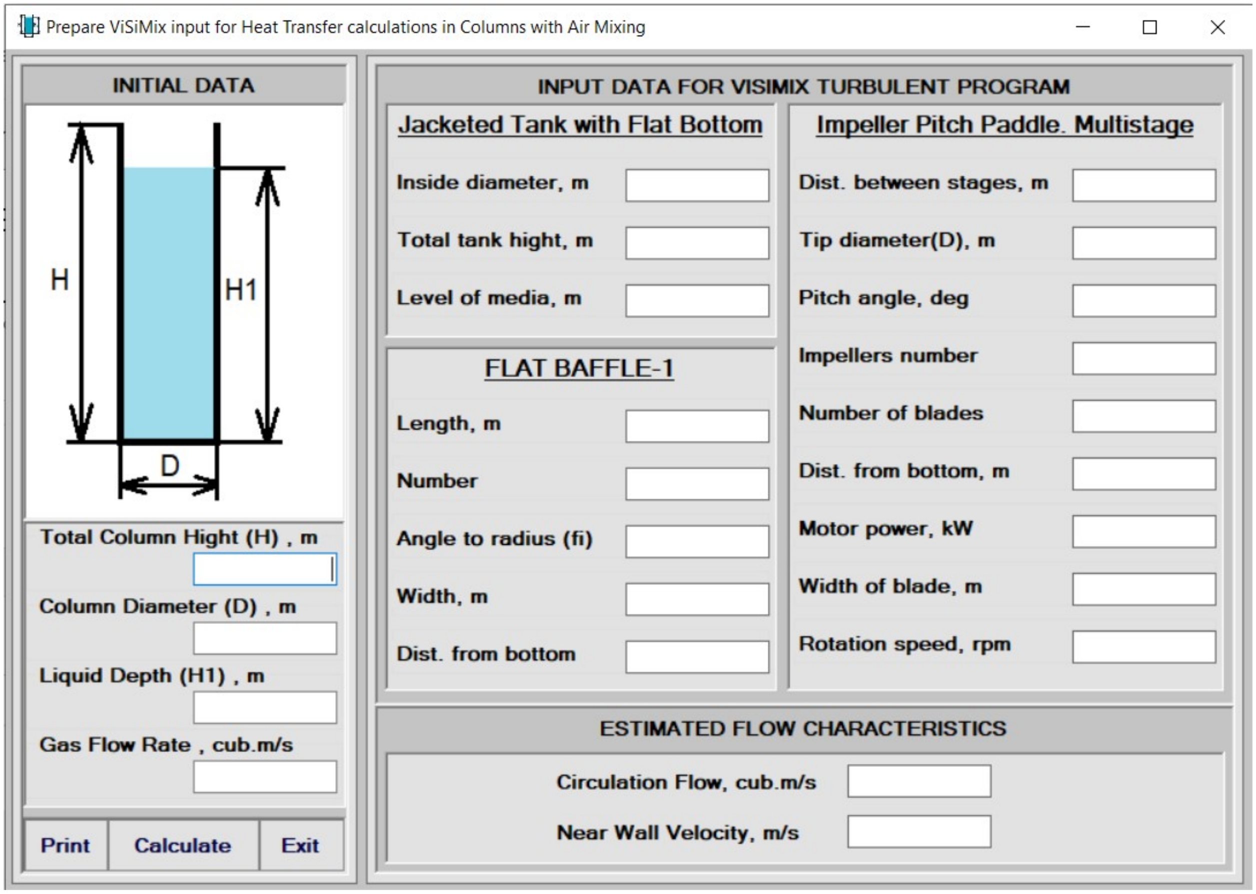


Figure 1

Enter column basic geometry characteristics and feed flow rate of bubbling gas into the left-hand side box and click "**Calculate**" button. Design characteristics of the "equivalent" reactor configured as a bubble mixing tank or column are calculated and displayed in the right-hand side box as shown in Fig. 2.

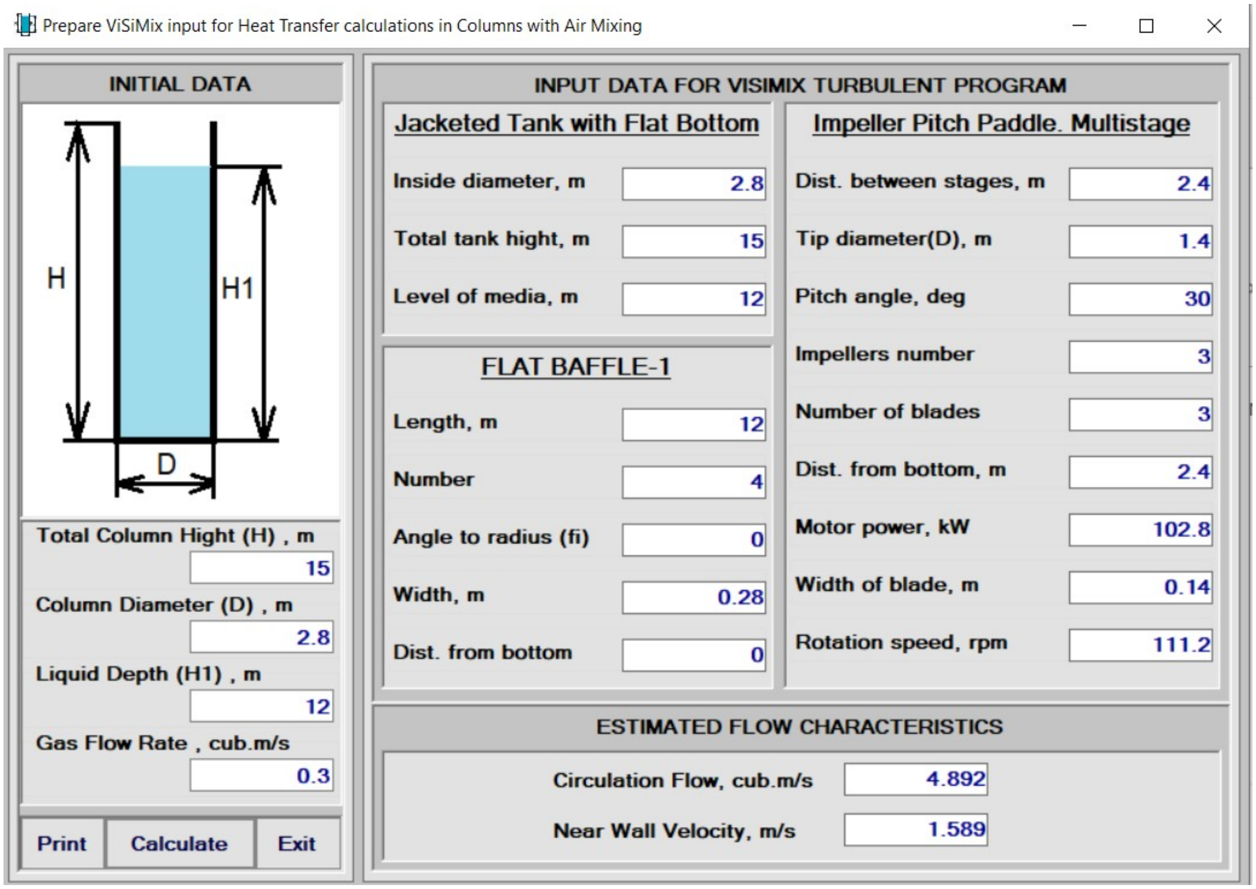


Figure 2

Enter these characteristics as input data for VisiMix Turbulent program. Internal circulation flow rate and near-wall velocity in your bubble column are estimated and displayed in the bottom right-hand side box.

Step 2

Open VisiMix Turbulent program and start a new project using VisiMix menu.

The tank type selection window is displayed as shown in Fig. 3. Select flat-bottom tank with your type of jacket.

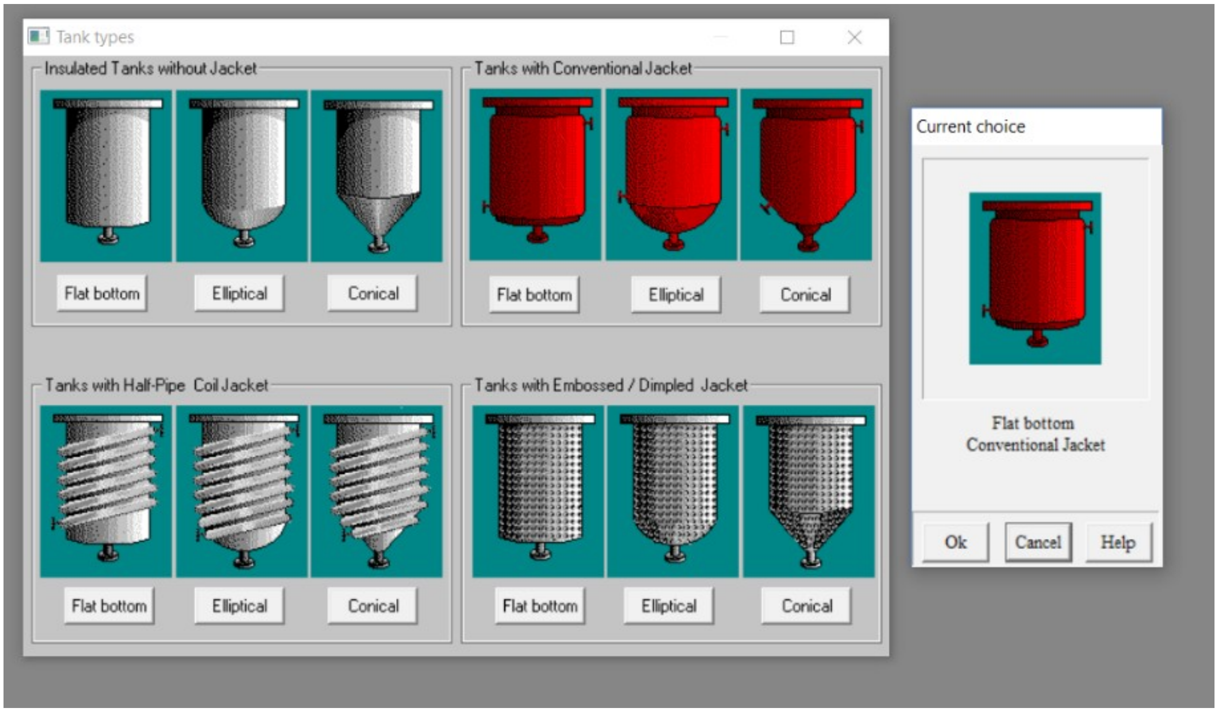


Figure 3. Tank Type Selection

Press OK. The input window for tank geometry is displayed, see Fig. 4. Enter the three input tank characteristics (inside diameter, total tank height and level of media) shown in Fig. 2. The total tank volume and volume of liquid in the tank are calculated and displayed also.

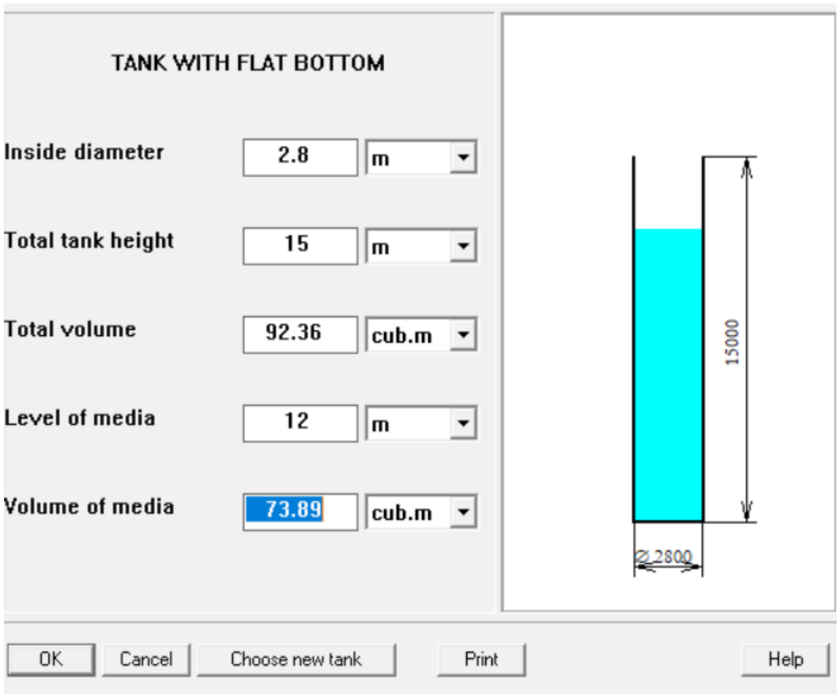


Figure 4. Tank Geometry Input Window

Press OK. The baffle type selection window is displayed as shown in Fig. 5. Select "Flat baffle – 1."

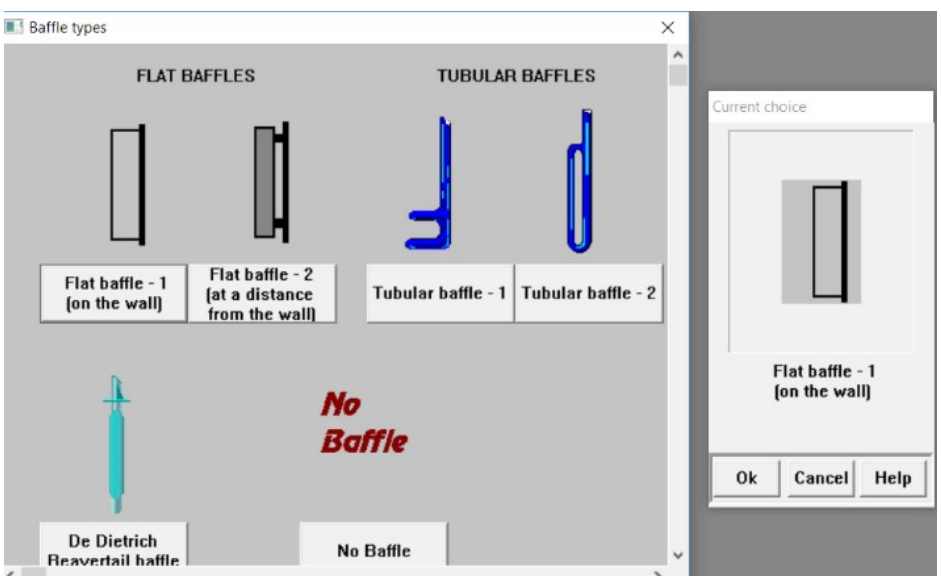


Figure 5. Baffle Type Selection

Press OK. The window for entering baffle geometry is displayed as shown in Fig. 6. Enter baffle details shown in Fig. 2.

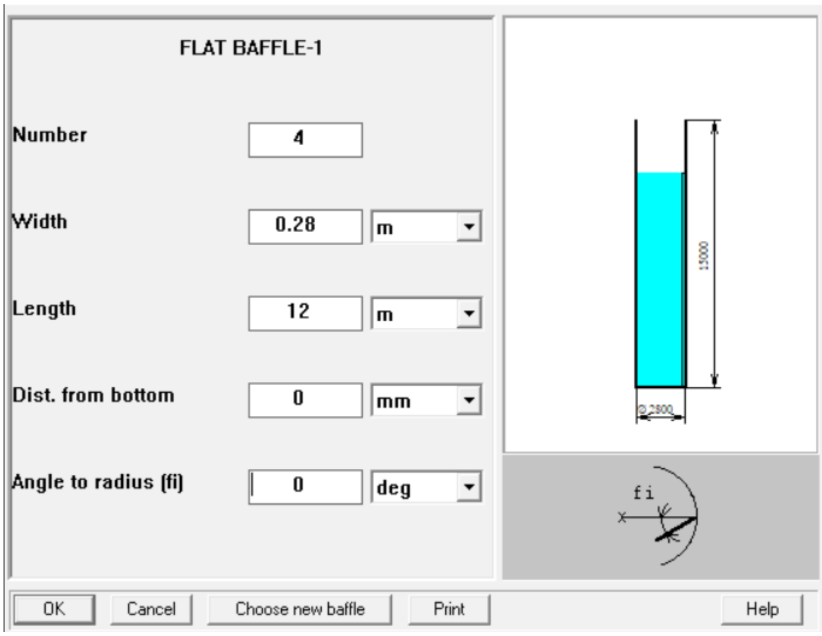


Figure 6. Baffle Geometry Input Window

Press OK. Impeller selection window is displayed as shown in Fig. 7. Select a pitch paddle multistage impeller.

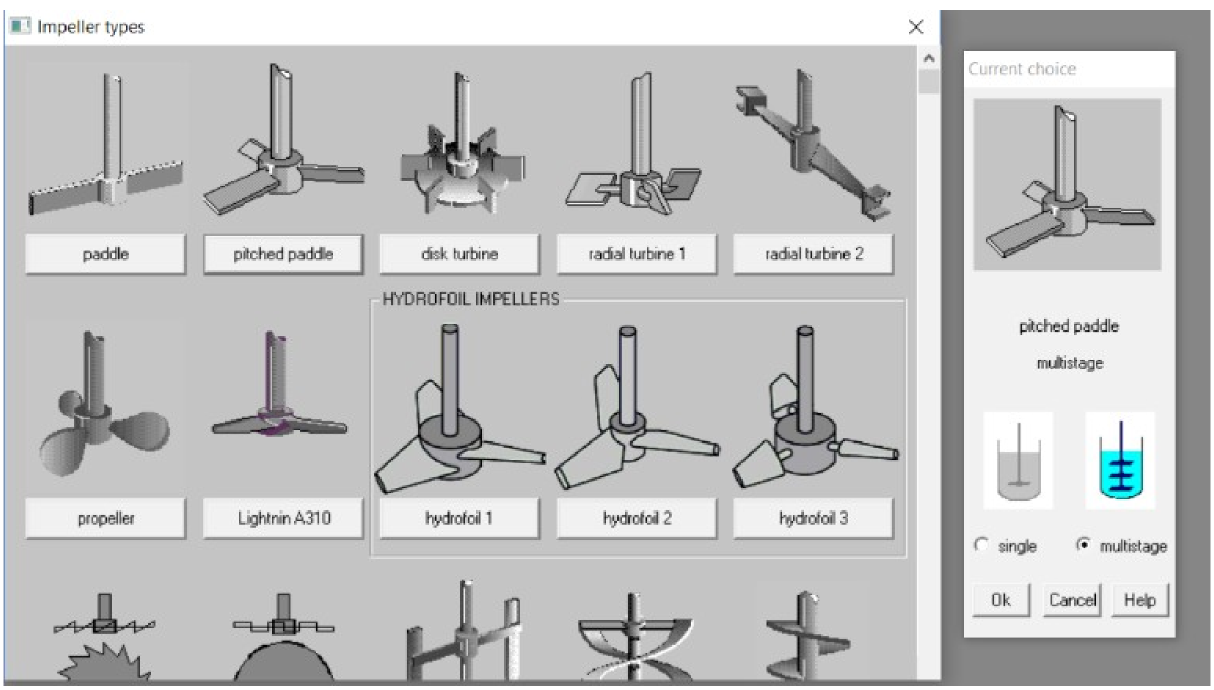


Figure 7. Impeller Type Selection Window

Press OK. The impeller geometry input window is displayed, see Fig. 8.

Enter impeller characteristics shown in Fig. 2.

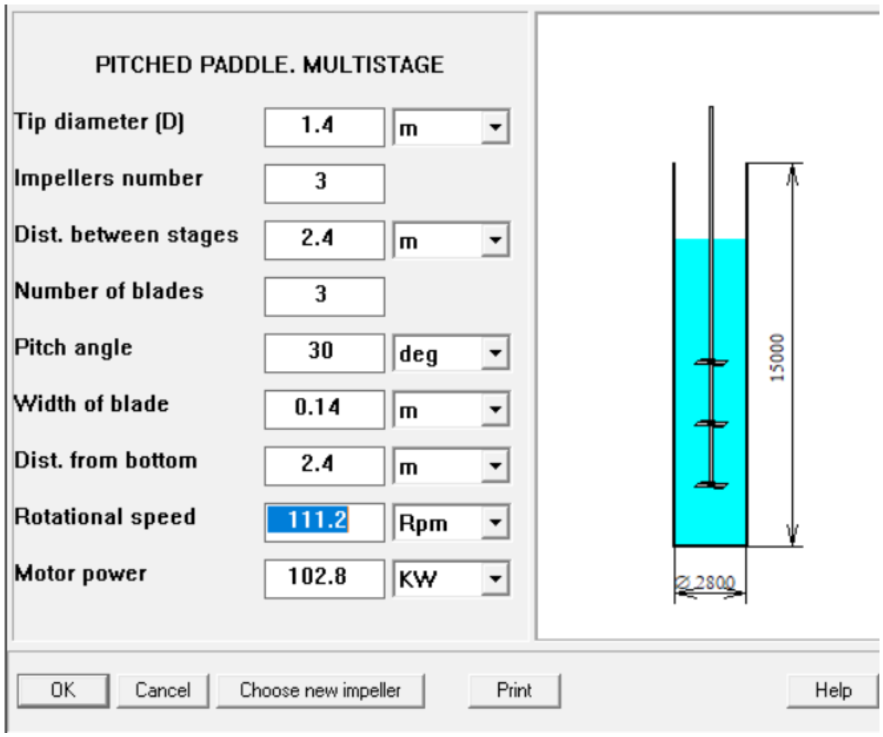


Figure 8. Impeller Geometry Input Window

Press OK. The window for jacket characteristics is displayed, see Fig. 9. Enter characteristics of your reactor jacket.

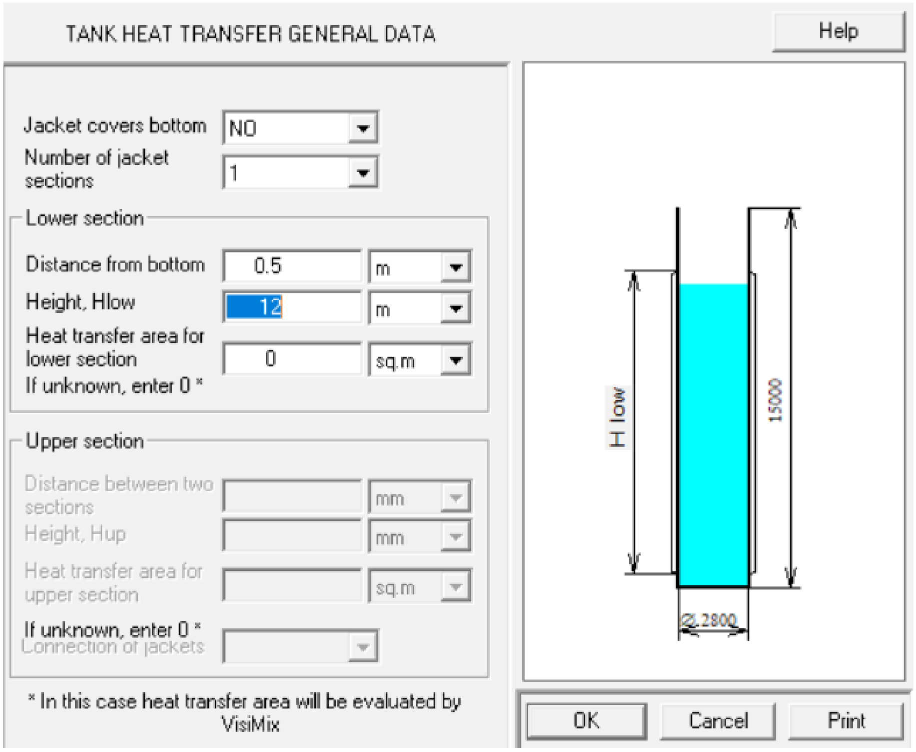


Figure 9. Jacket General Characteristics

Press OK. The input windows for characteristics of liquid inside the bubble column are displayed consecutively, see Figs. 10 and 11. Enter characteristics of your liquid.

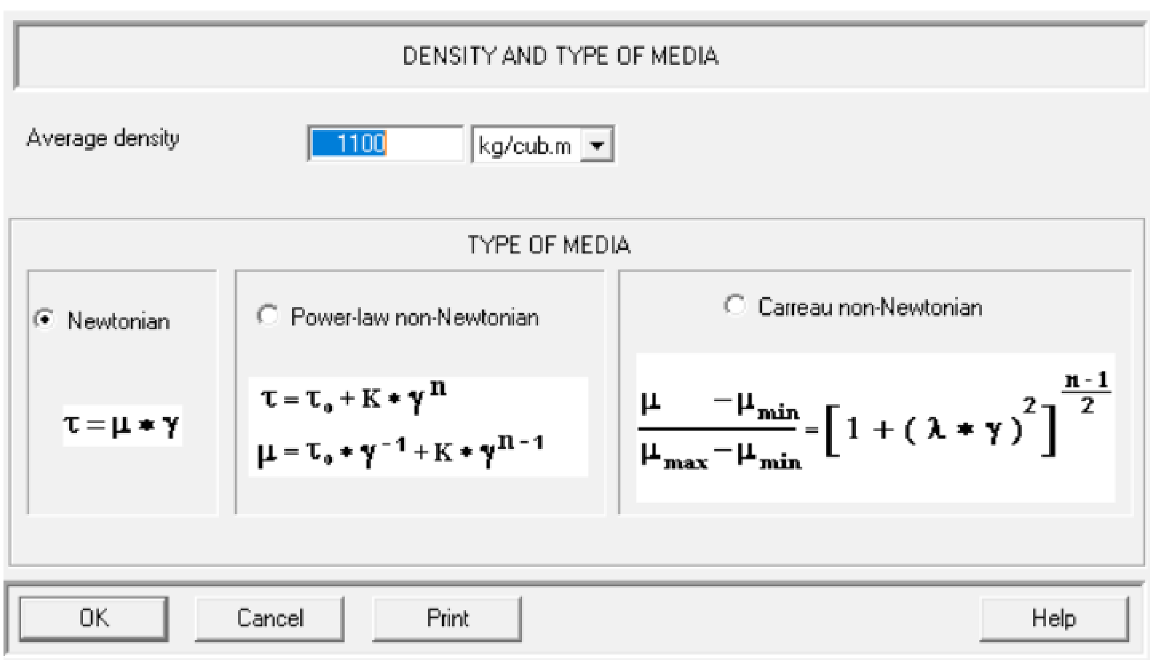


Figure 10. Liquid Density and Rheological Characteristics

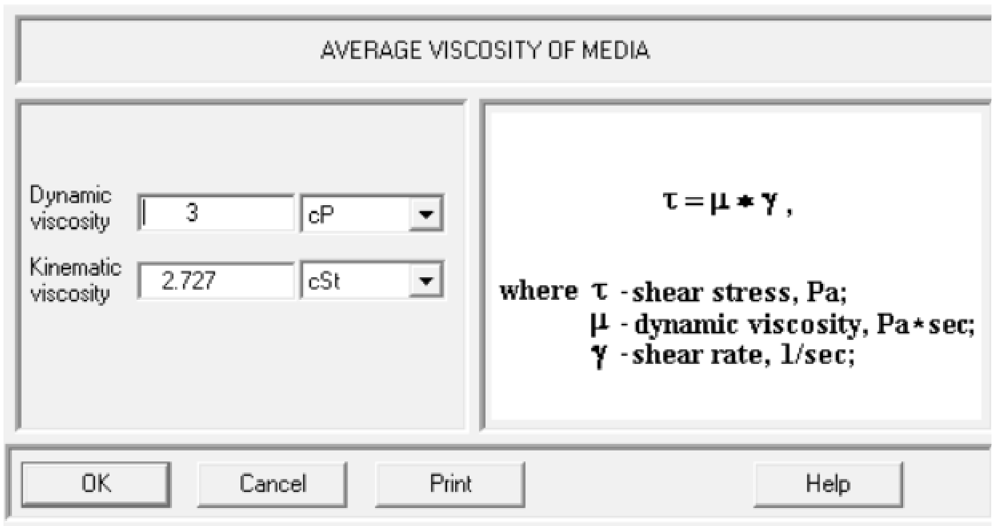


Figure 11. Liquid Viscosity

Press OK.   A sketch of the equivalent mixing tank is displayed, see Fig. 12.

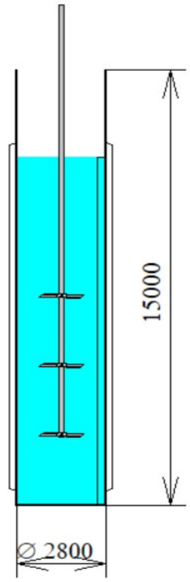


Figure 12. Tank Sketch

From “**Calculate**” menu at VisiMix Turbulent main window, select a characteristic of heat transfer you want to calculate for your bubble column, see Fig. 13.

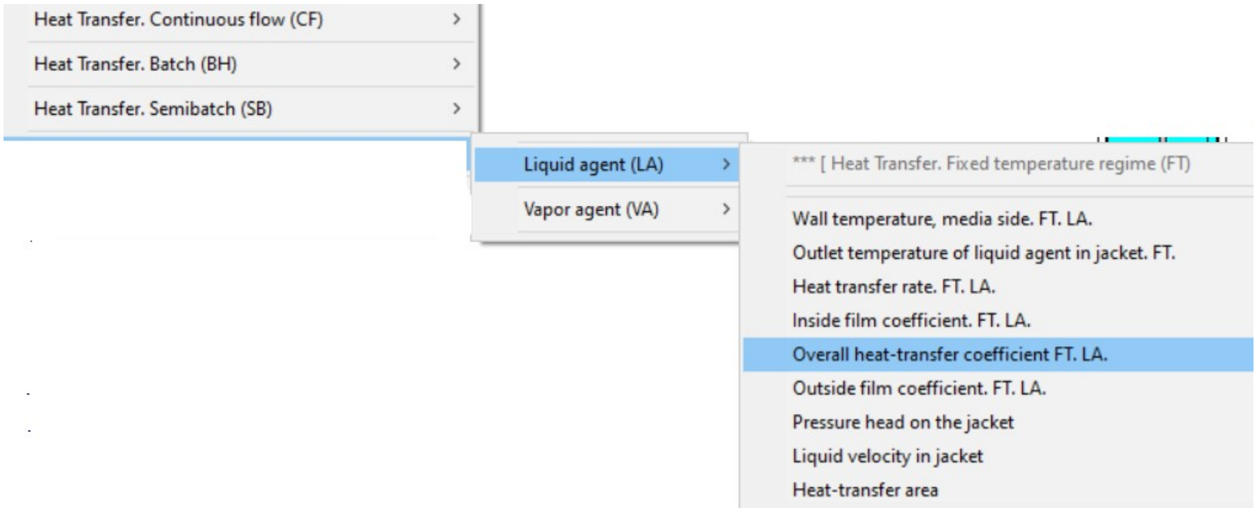


Figure 13. VisiMix Heat Transfer Section Menu

We consider overall heat-transfer coefficient calculation for liquid agent below as an example.

After selection, the tank shell characteristic input window (Fig. 14) is displayed.

Enter characteristics of your column wall.

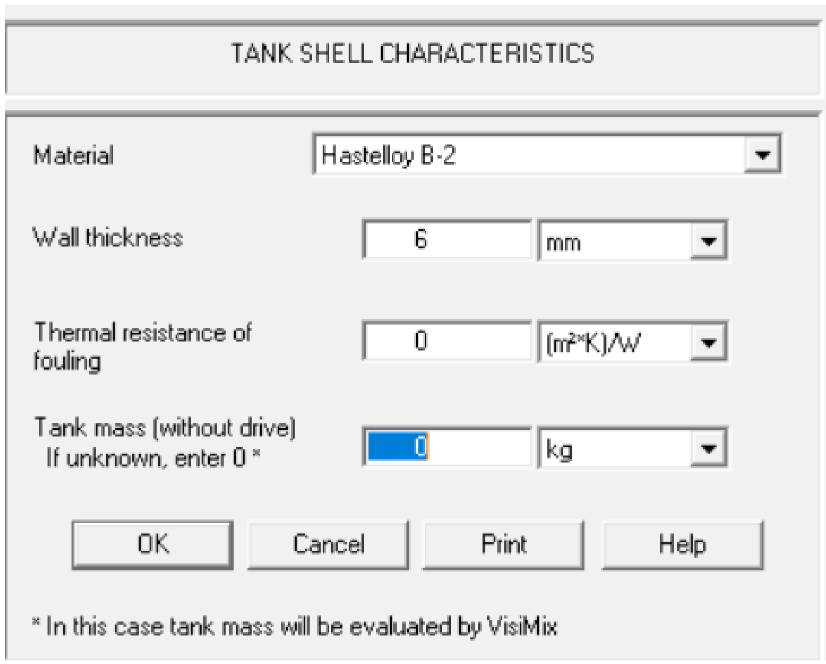


Figure 14. Tank Wall Characteristics

Press OK. The input window for specific characteristics of jacket is displayed as shown in Fig. 15.

Enter characteristics of your Jacket.

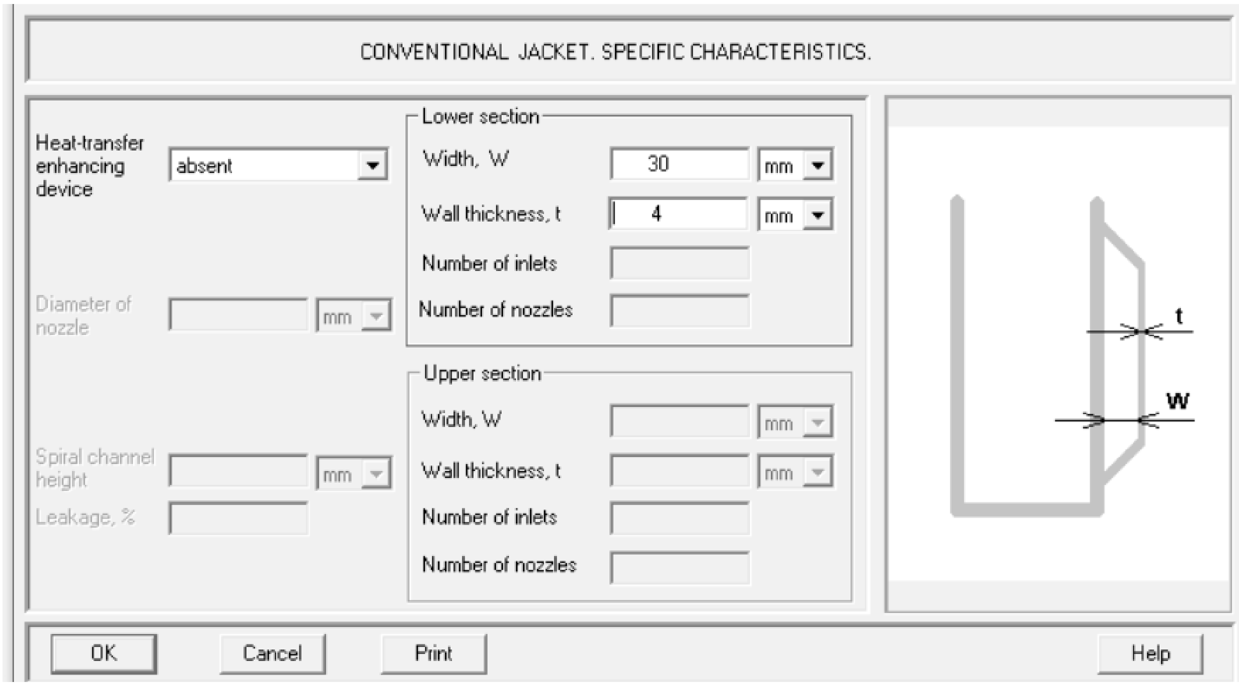


Figure 15. Jacket Characteristics

Press OK. The window for entering your process temperature limits is displayed as shown in Fig. 16. Enter characteristics of your process.

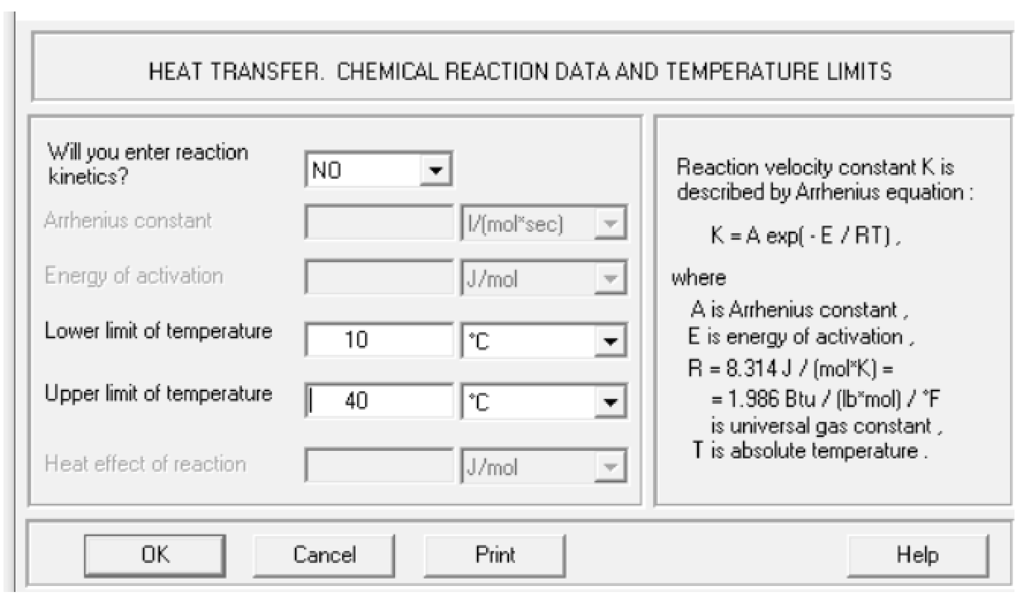


Figure 16. Process Characteristics

Press OK. The input window for entering characteristics of heating or cooling liquid supplied to the jacket is displayed as shown in Fig. 17.

Enter characteristics and flow rate of your heating or cooling liquid.

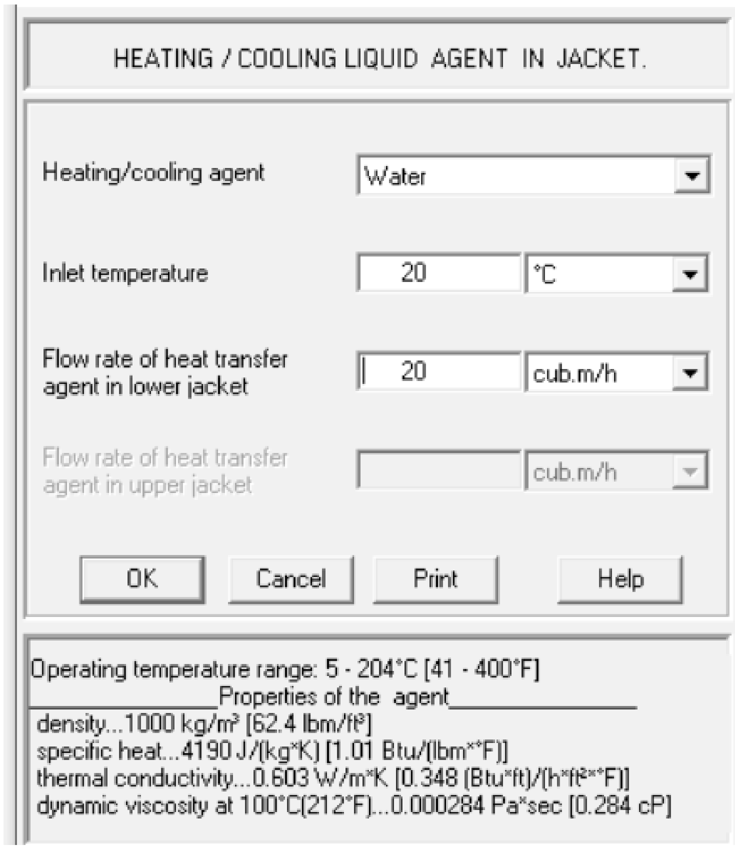


Figure 17. Heating or Cooling Liquid Characteristics

Press OK. As the fixed temperature mode was selected for simulation as shown in Fig. 13, the input window for entering the process temperature is displayed as shown in Fig. 18.

Enter your process temperature.

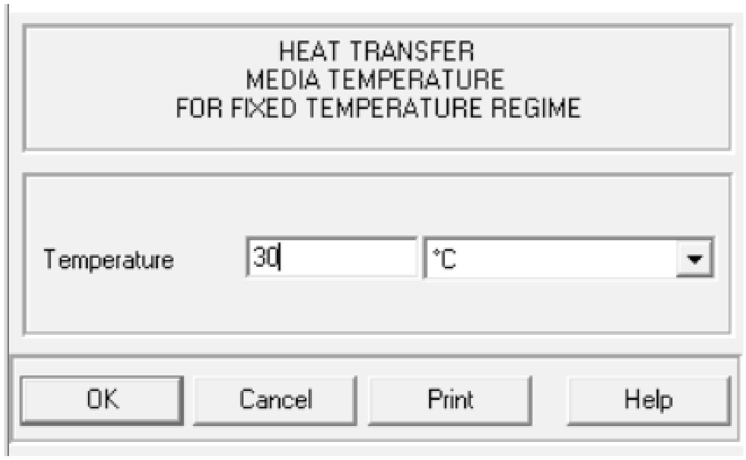


Figure 18. Process Temperature

Press OK. Finally, the input window for thermal characteristics of the liquid in your column is displayed as shown in Fig. 19.

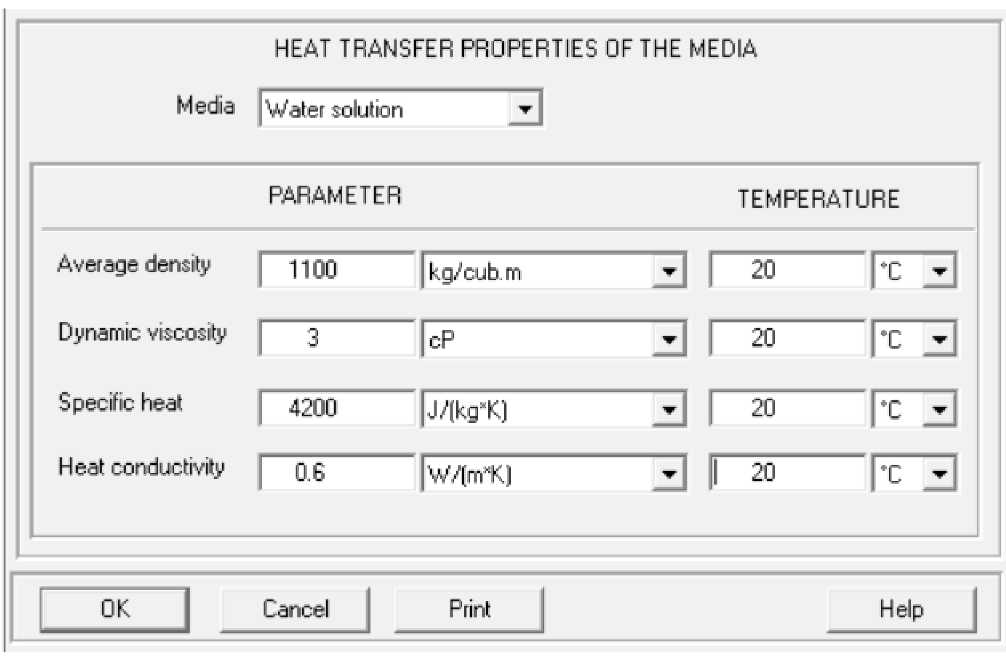
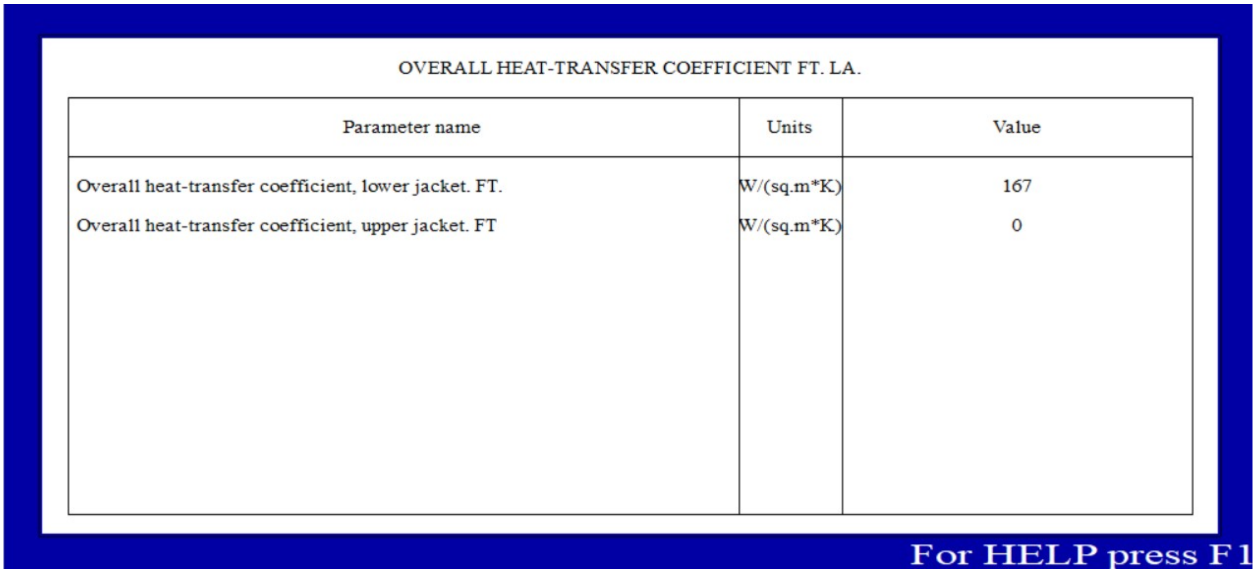


Fig. 19. Thermal Properties of the Mixing Liquid

Press OK.

Now all necessary input data are entered, and the heat transfer characteristic selected in Fig. 13 are calculated as shown in Fig. 20.



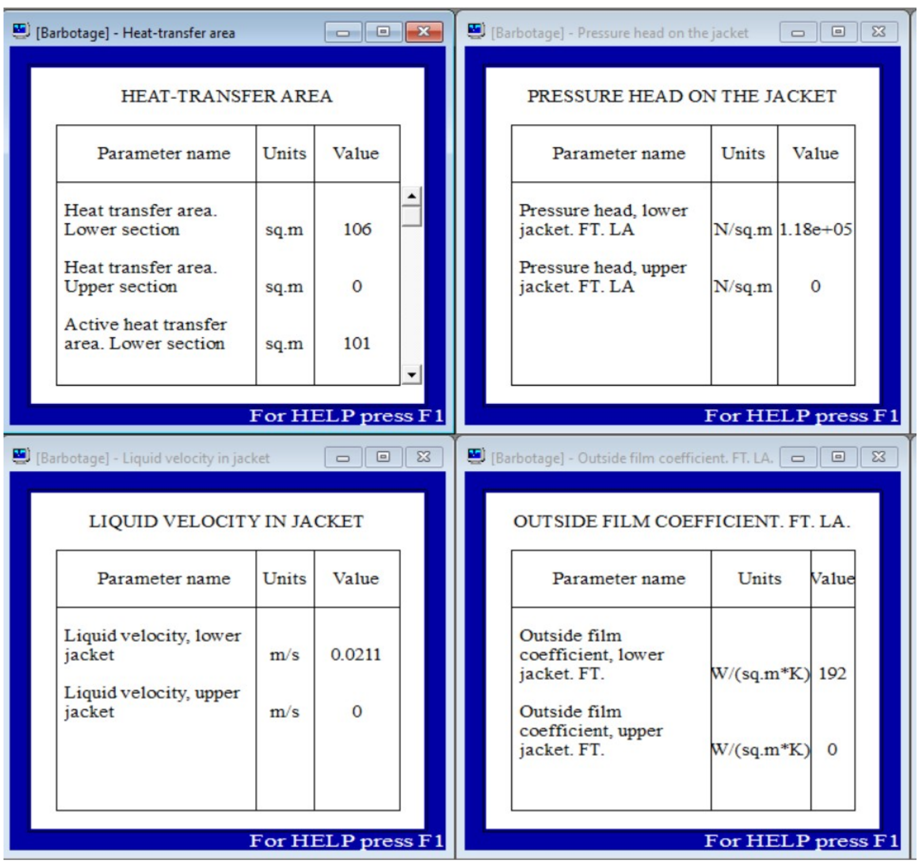
OVERALL HEAT-TRANSFER COEFFICIENT FT. LA.

Parameter name	Units	Value
Overall heat-transfer coefficient, lower jacket. FT.	W/(sq.m*K)	167
Overall heat-transfer coefficient, upper jacket. FT	W/(sq.m*K)	0

For HELP press F1

Figure 20. Output Window – Heat Transfer Characteristic Selected

You can select more parameters from the VisiMix calculation menu and obtain their values as shown in Fig. 21.



[Barbotage] - Heat-transfer area

HEAT-TRANSFER AREA

Parameter name	Units	Value
Heat transfer area. Lower section	sq.m	106
Heat transfer area. Upper section	sq.m	0
Active heat transfer area. Lower section	sq.m	101

For HELP press F1

[Barbotage] - Pressure head on the jacket

PRESSURE HEAD ON THE JACKET

Parameter name	Units	Value
Pressure head, lower jacket. FT. LA	N/sq.m	1.18e+05
Pressure head, upper jacket. FT. LA	N/sq.m	0

For HELP press F1

[Barbotage] - Liquid velocity in jacket

LIQUID VELOCITY IN JACKET

Parameter name	Units	Value
Liquid velocity, lower jacket	m/s	0.0211
Liquid velocity, upper jacket	m/s	0

For HELP press F1

[Barbotage] - Outside film coefficient. FT. LA.

OUTSIDE FILM COEFFICIENT. FT. LA.

Parameter name	Units	Value
Outside film coefficient, lower jacket. FT.	W/(sq.m*K)	192
Outside film coefficient, upper jacket. FT.	W/(sq.m*K)	0

For HELP press F1

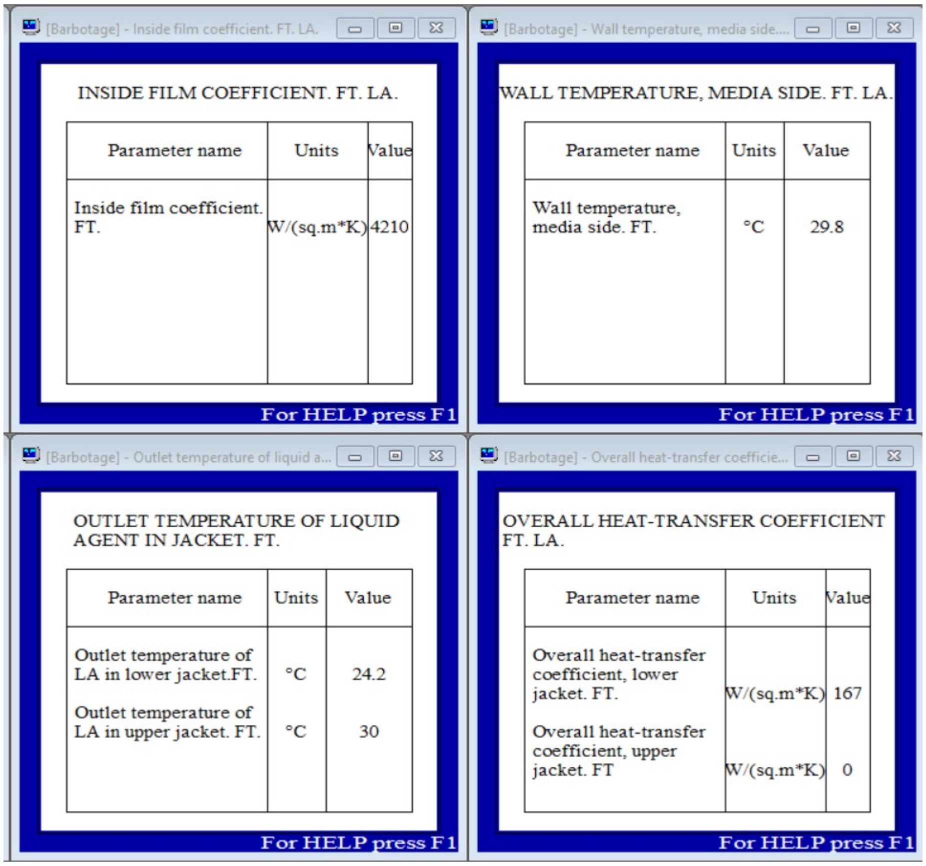


Figure 21. Output Window Examples

Note. Using the Gas Liquid section of VisiMix, one can obtain a value of mass transfer rate also.