VisiMix DI. ***Modeling of Suspending in Tanks with Different Impellers on the Shaft.***

LIQUID-SOLID MIXING IN REACTOR *SUSP D* WITH DISC TURBINE AND A310 IMPELLERS.

1. Entering the data for reactor in VisiMix DI and calculation of energy dissipation in the bulk of volume.

The data of the reactor **Susp_D** are entered in a project **Susp_D.vsd**. Type and main dimensions of the tank are presented in the Figure 1. Characteristics of mixing device and positions of impellers corresponds to Figures 2, 3 and 4. Properties of liquid media are shown in the Figure

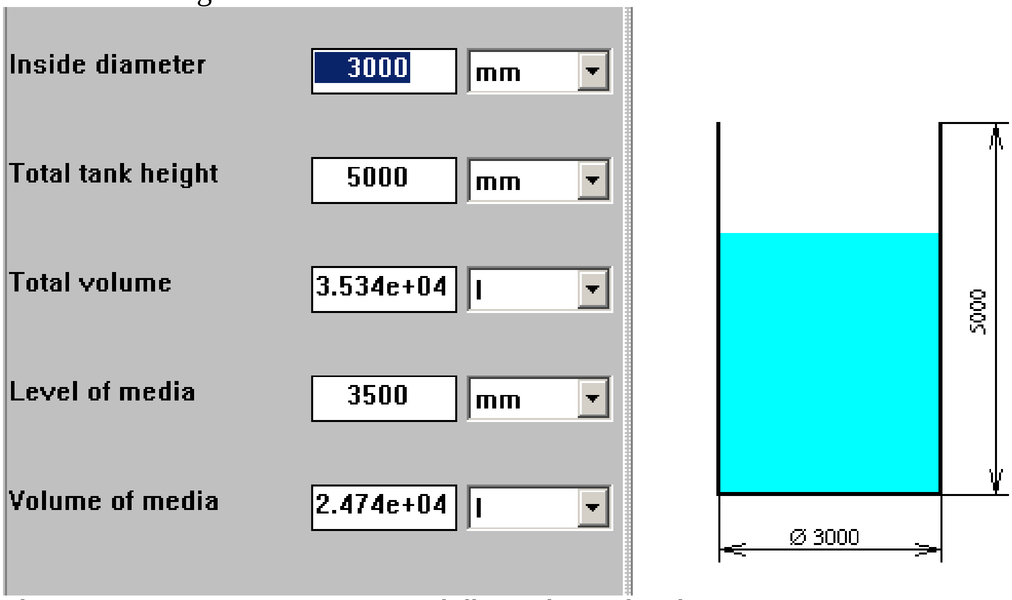


Figure 1. Reactor Susp_D. Type and dimensions of tank .

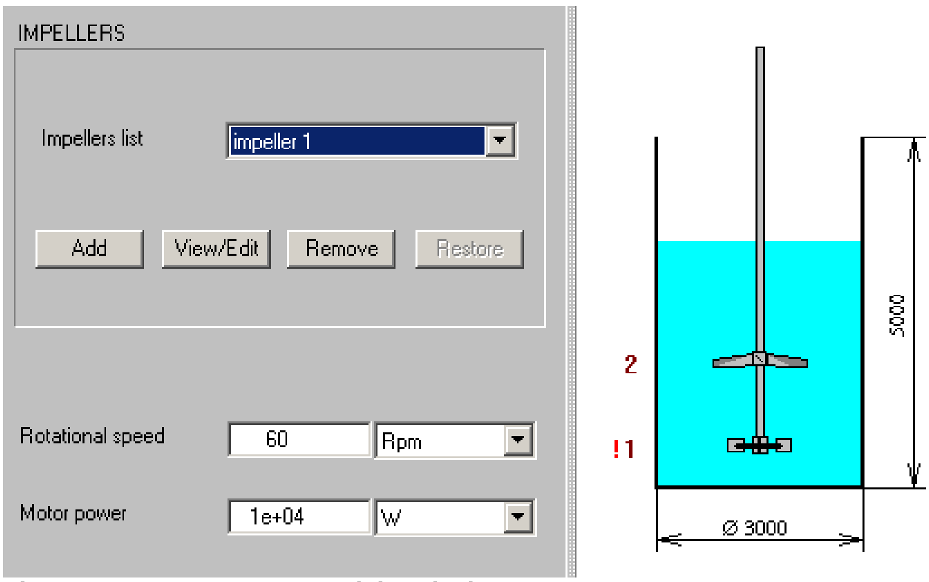
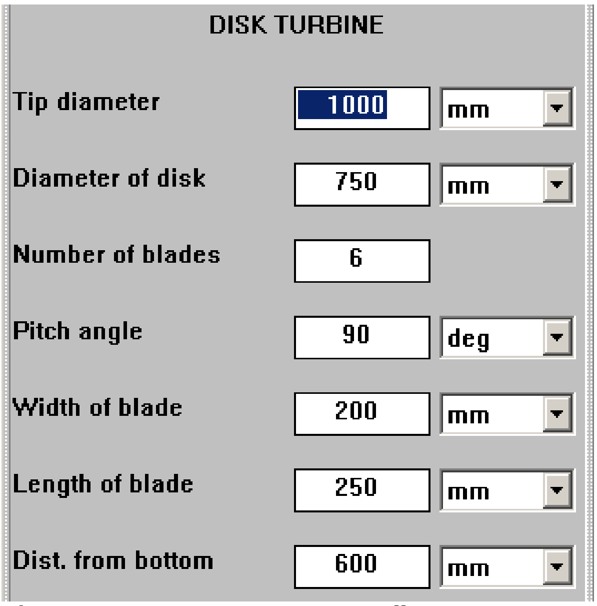


Figure 2. Reactor Susp_D. Mixing device.



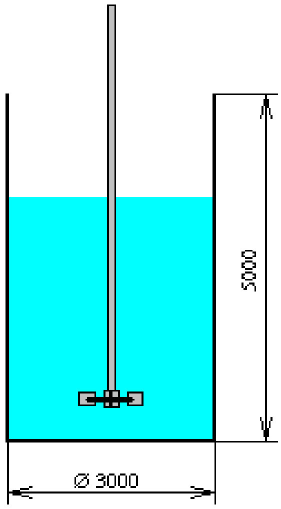


Figure 3. Reactor Susp_D. Impeller 1.

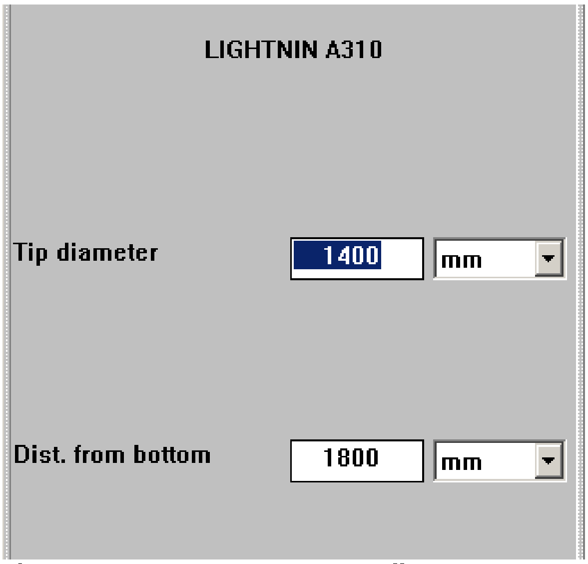


Figure 4. Reactor Susp_D. Impeller 2.

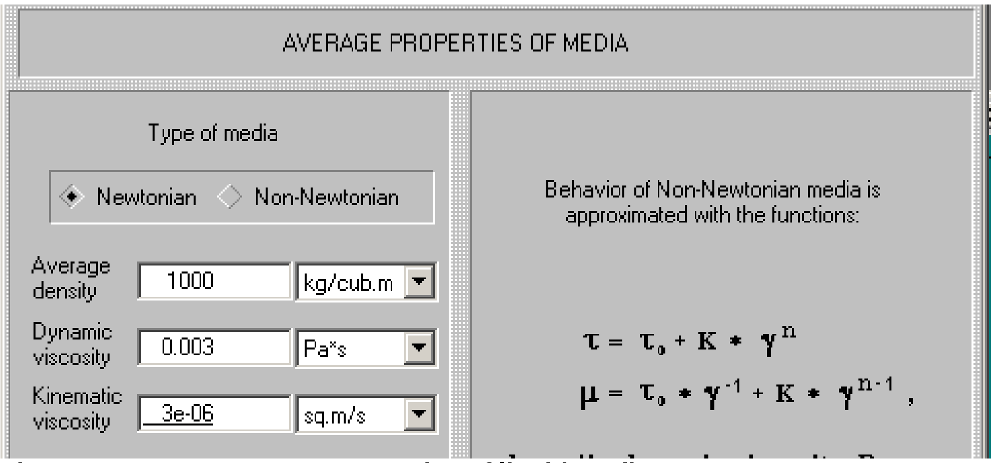


Figure 5. Reactor Susp_D. Properties of liquid media.

Calculation of ***Energy dissipation in the bulk of volume*** **– see Figures 6 and 7.**

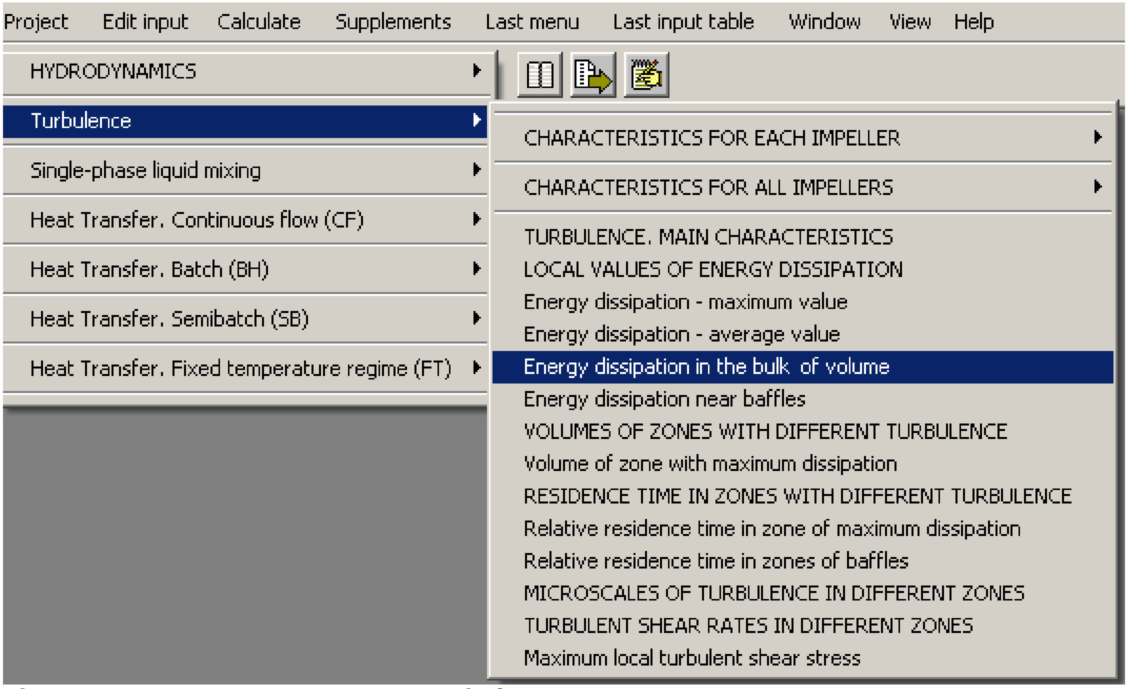


Figure 6. Reactor Susp_D. Menu Turbulence.

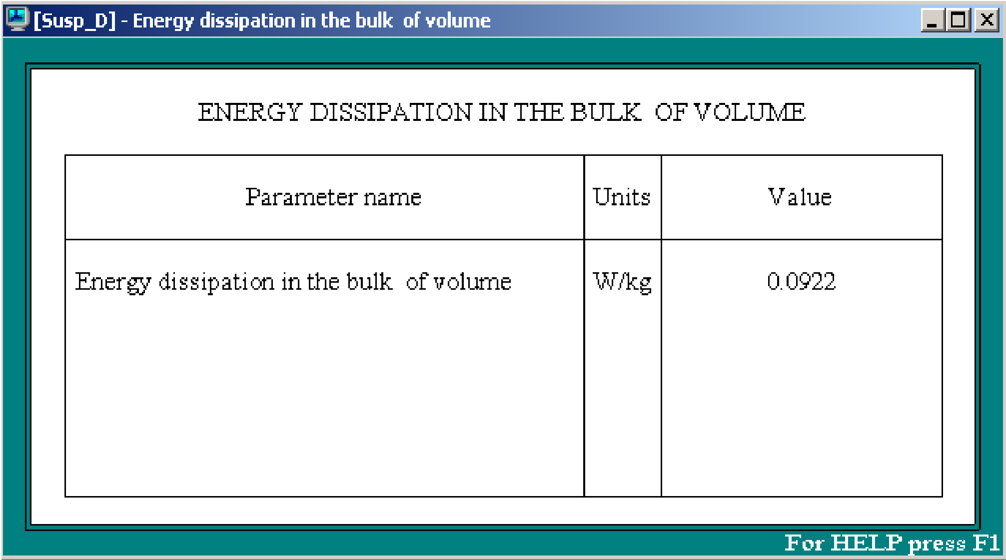


Figure 7. Reactor Susp_D. Energy dissipation in the bulk of volume.

2. Reproduction of the local energy dissipation in the tank using the program VisiMix Turbulent.

2.1 Open the project **Susp_T.vsm** in **VisiMix Turbulent**. Enter the tank corresponding to the data of Figure 1 and **Average properties of media** corresponding to Figure 5. Enter **2-stage Disk turbine** with dimensions corresponding to the data of Figure 3. Position of the upper turbine must correspond to position of the Impeller 2 – impeller A310 in Figure 4. Input table for the mixing device is shown in the Figure 8.

2.2 Select the **Rotational speed** of the turbines so as to provide the value of ***Energy dissipation in the bulk of volume*** in the limits 0.0922 ±0.01. As is shown in the Figure 9, this requirement is satisfied at 54 r.p.m.

Note. The calculated mixing power and overload of the drive (see Figure 10) in this case is not taken into account.

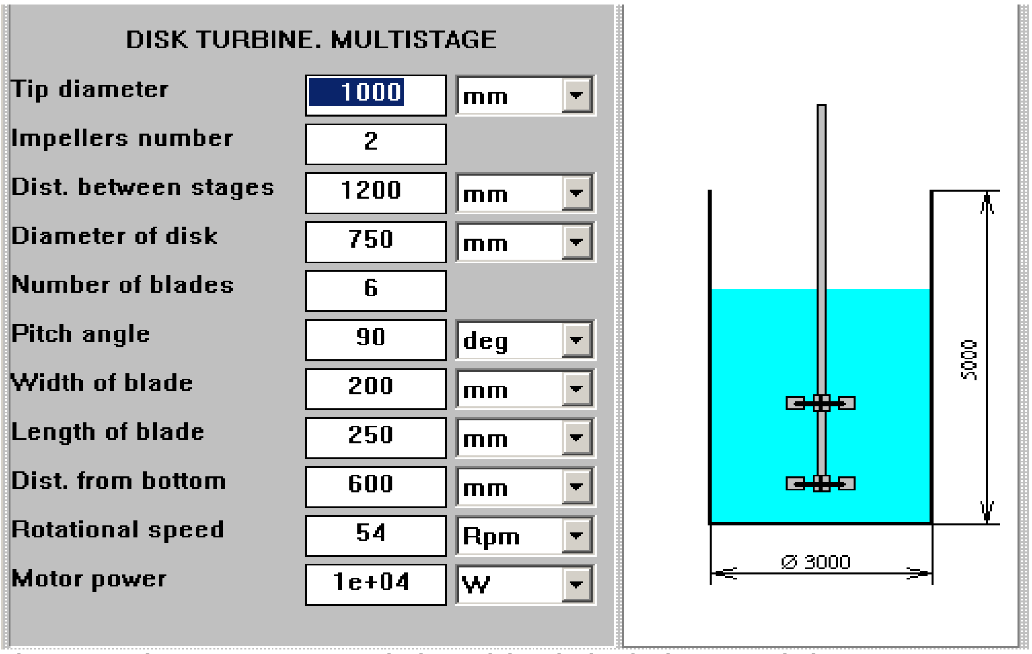


Figure 8. Project Susp_T.vsm. Equivalent mixing device for bottom turbulence.

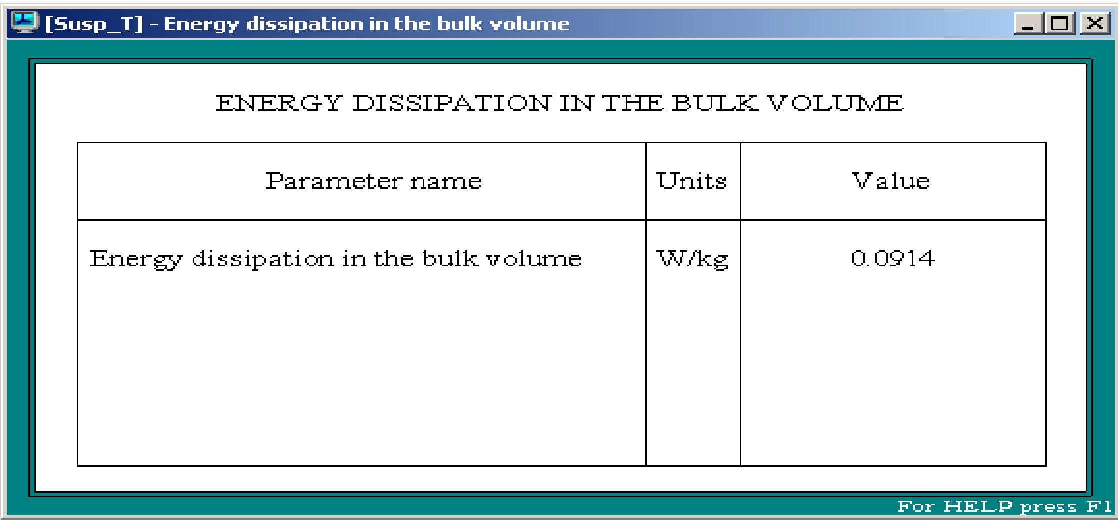


Figure 9. Project Susp_T.vsm. Energy dissipation corresponding to 54 r.p.m.

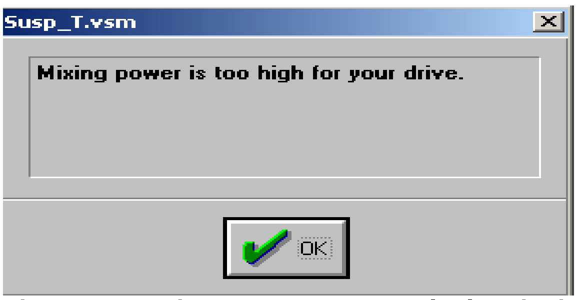


Figure 10. Project Susp_T.vsm. Calculated mixing power for the 'equivalent' project is not relevant.

2.3 Enter properties of solid and liquid phase (see Figure 11), click ***Calculate>Liquid-solid mixing>Complete/incomplete suspending*** and correct ***Average properties of media*** (Figure 12).

2.4 Check pick-up conditions (via ***Calculate>Liquid-solid mixing>Complete/incomplete suspending***). Accordingly to the results of calculations, the pick-up conditions are satisfied – see Figure 13.

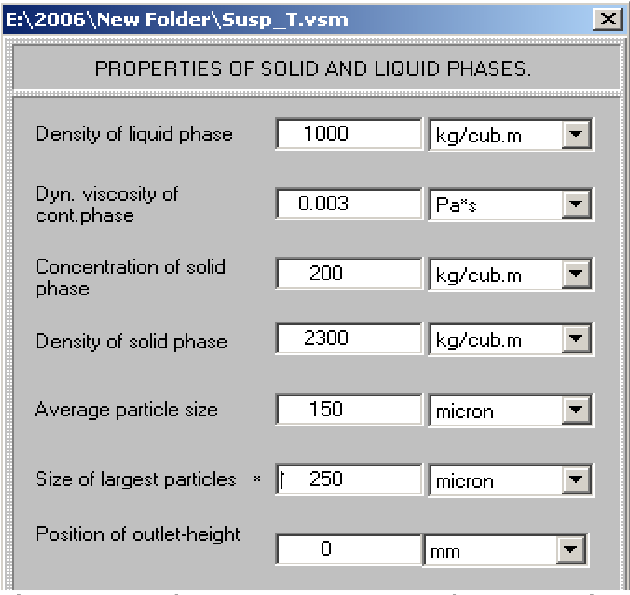


Figure 11. Project Susp T.vsm. Entering properties of solid and liquid phase

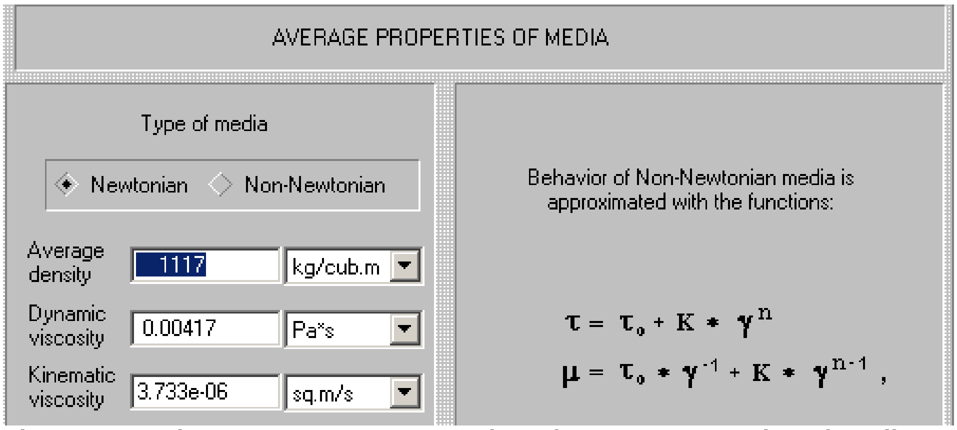
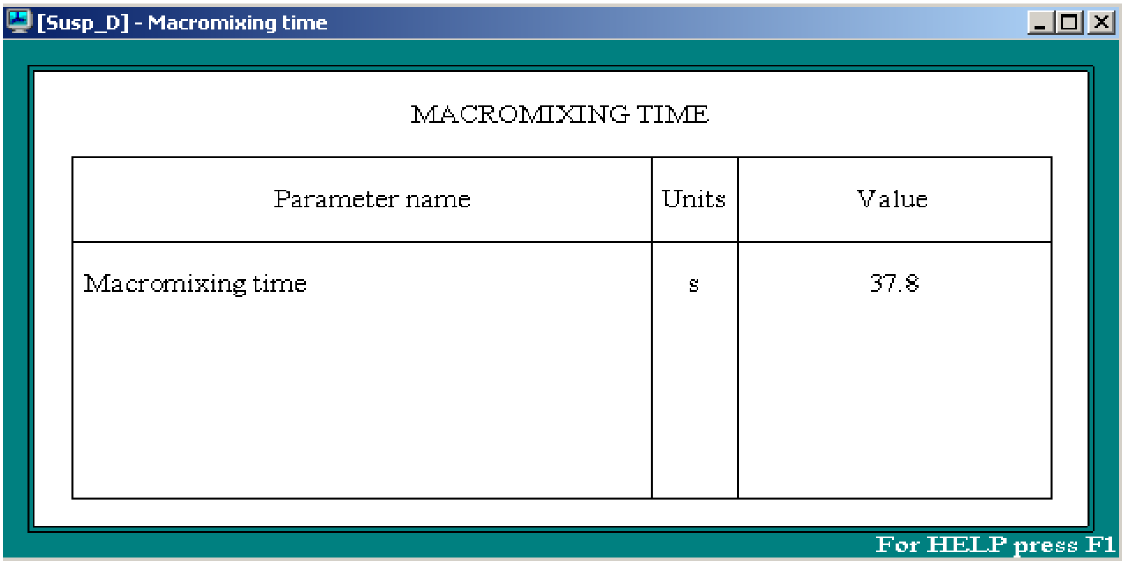


Figure 12. Project Susp_T.vsm. Correction of average properties of media.

Figure 13. Project Susp_T.vsm. Checking the pick-up conditions.

3. Reproduction of macroscale transport rate and modeling of suspension distribution.

3.1 Return to the program **VisiMix DI.** Calculate ***Macromixing time*** in the reactor **Susp_D.vsd –** see Figure 14.



Parameter name	Units	Value
Macromixing time	s	37.8

Figure 14. Project Susp_D.vsd. Macromixing time in reactor.

3.2. Return to the project **Susp_T.vsm** (program **VisiMix Turbulent**). Calculate ***Macromixing time***. Accordingly to the results (Figure 15), at 54 r.p.m. the calculated value is 120 sec.

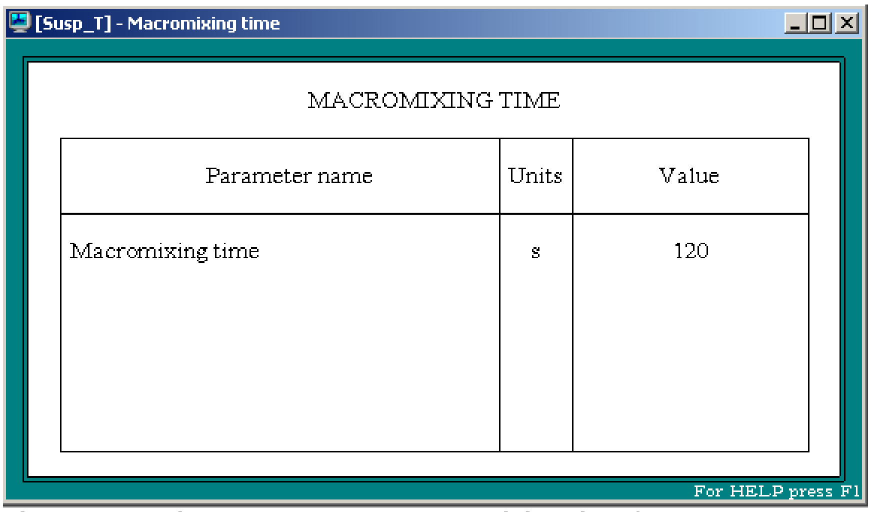


Figure 15. Project Susp_T.vsm. Macromixing time for 54 r.p.m.

3.3.For reproduction of the macroscale mixing rate of the tank Susp_D_vsd (see Figure 14), the ***Macromixing time*** for the project Susp_T.vsm must be within the limits 35.9 ÷ 39.7 sec. The corresponding rotation speed of turbines is about 54 r.p.m.* 120 / 37.8 = 171.4 r.p.m.

3.4 Change **Rotational speed** to 171 r.p.m. (Figure 16) and define ***Macromixing time*** (via ***Calculate>Single-phase liquid mixing***). Accordingly to the Figure 17, the calculated value is within the required limits.

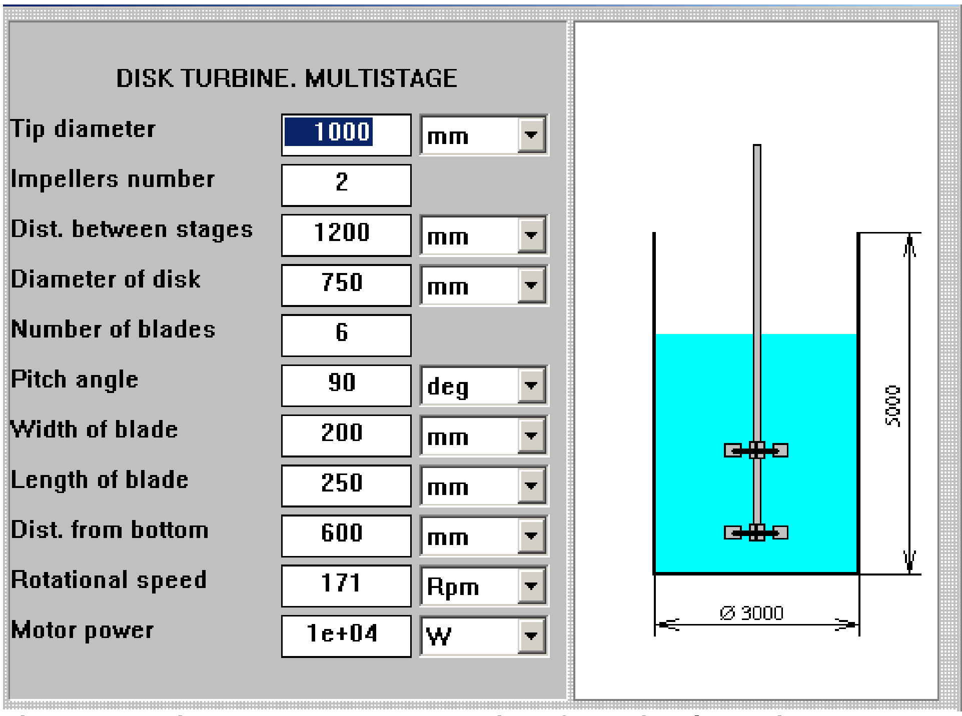
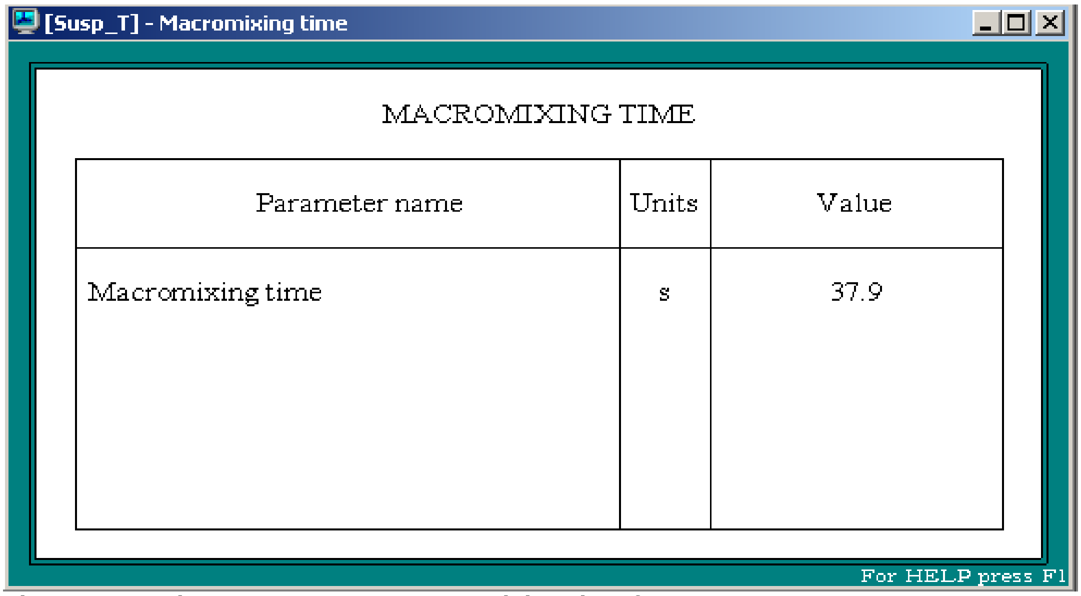


Figure 16. Project Susp_T.vsm. Correction of Rotational speed.


[Susp_T] - Macromixing time

MACROMIXING TIME

Parameter name	Units	Value
Macromixing time	s	37.9

For HELP press F1

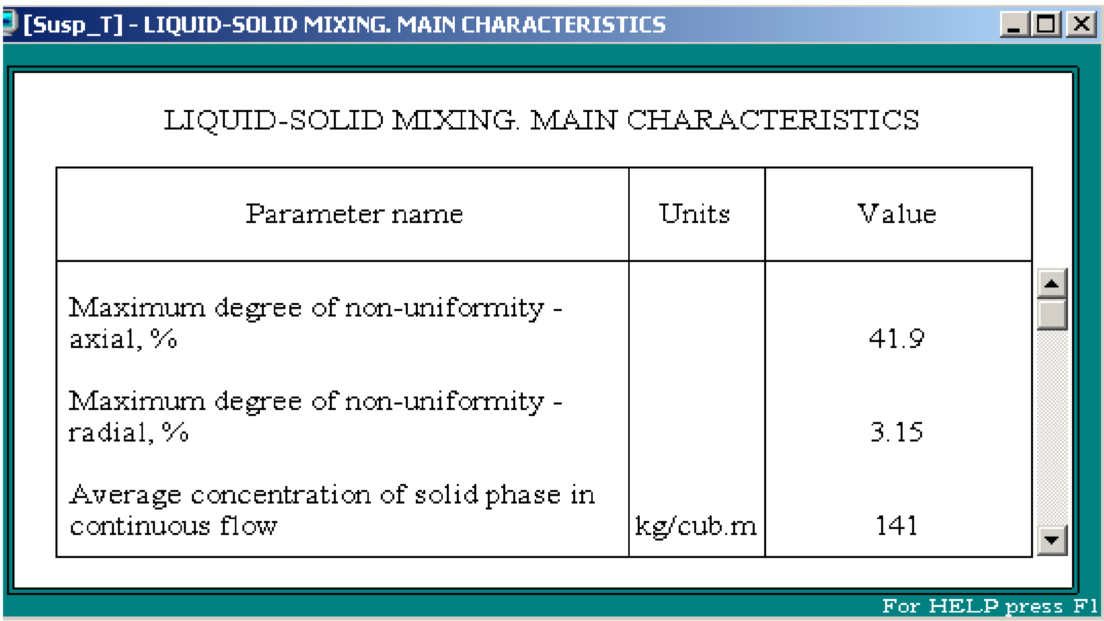
Figure 17. Project Susp_T.vsm. Macromixing time for 171 r.p.m.

Notes. 1. *The calculated mixing power and overload of the drive (see Figure 10) in this case is not relevant.*

2.*Difference of density and viscosity of suspension (see Figure 12) and of liquid phase (Figure 5) is not important for this example.*

3.5 Modeling of distribution of suspension.

Calculate parameters of suspension distribution via Calculate>Liquid/solid mixing. For example, select **Liquid/solid mixing. MAIN CHARACTERISTICS** – Figure 18.


[Susp_T] - LIQUID-SOLID MIXING. MAIN CHARACTERISTICS

LIQUID-SOLID MIXING. MAIN CHARACTERISTICS

Parameter name	Units	Value
Maximum degree of non-uniformity - axial, %		41.9
Maximum degree of non-uniformity - radial, %		3.15
Average concentration of solid phase in continuous flow	kg/cub.m	141

For HELP press F1

Figure 18. Calculated parameters of suspension distribution.