Task 1: Simple screening

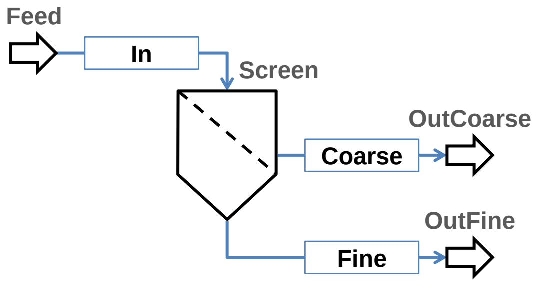

Figure 1. Flowsheet of simple screening.

1. Create a flowsheet in Dyssol with the structure shown in Figure 1. Use the values specified below as process parameters.
2. Perform simulation for time interval of 10 s and compare obtained results with Figure 2.
3. Determine how the changes in separation sharpness affect the parameters of output streams.

Note: if some parameters are not specified, use default values.

Units:

Feed	
Model	InletFlow
Screen	
Model	Screen Molerus & Hoffmann
Cut size	0.001 m
Separation sharpness	5
OutCoarse	
Model	OutletFlow
OutFine	
Model	OutletFlow

Components: Sand

Phases: Solid phase

PSD mesh:

Entry	Numeric
Type	Equidistant
Classes	10
Limits	0 – 2 [mm]

Parameters of input streams and holdups:

Feed	
Time points	0 s
Mass flow	0.1 kg/s
Phase fractions	100% Solid
Compounds fractions in the solid phase	100% Sand
Compound of PSD q3 distribution	Sand
PSD q3	see table below

From [mm]	To [mm]	q3 [1/mm]
0	0.2	0
0.2	0.4	0.03
0.4	0.6	0.06
0.6	0.8	0.11
0.8	1.0	0.41
1.0	1.2	1.47
1.2	1.4	1.62
1.4	1.6	0.81
1.6	1.8	0.49
1.8	2	0

Simulation time: 10 s

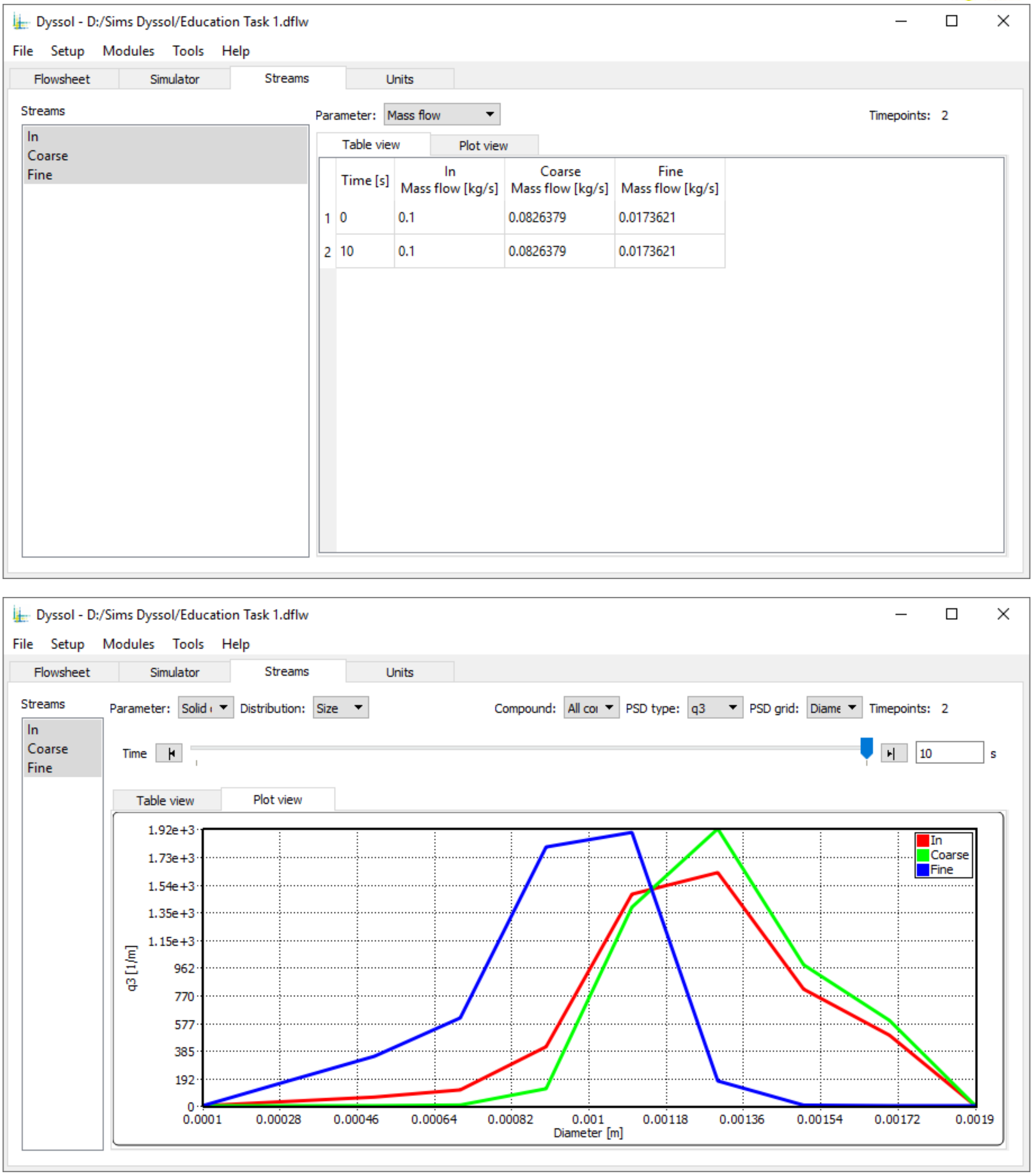

Figure 2. Simulation results of simple screening.

Task 2: Screening process with recycle stream

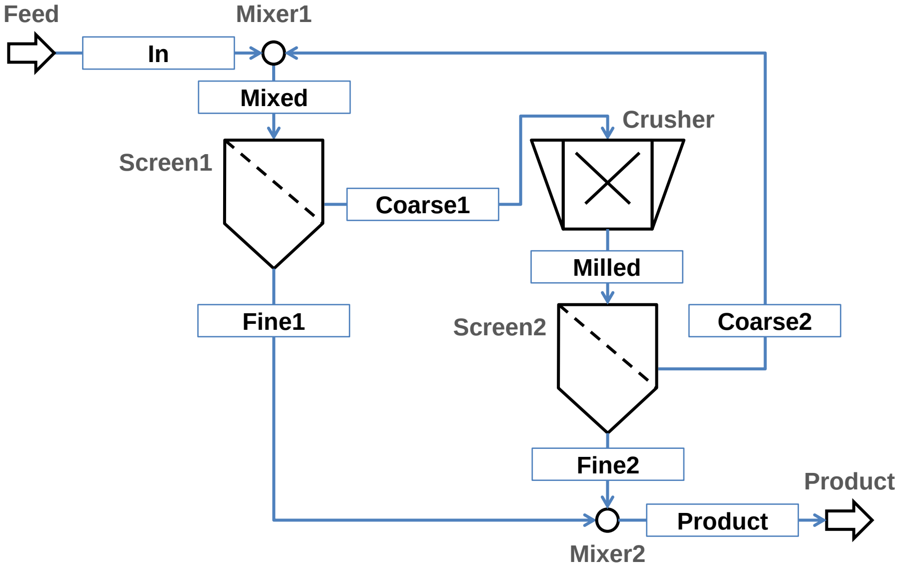

Figure 3. Flowsheet of screening process with recycle stream.

1. Create a flowsheet in Dyssol with the structure shown in Figure 3. Use the values specified below as process parameters.
2. Simulate the flowsheet for time interval of 50 s and check the mass-balance of the scheme.
3. Compare parameters of the product with the inlet parameters (particle size distribution, Sauter mean diameter).
4. Investigate how the change in separation sharpness affects the flow rate of the recycle stream (Coarse2) and the particle size distribution of the product (Product).

Note: if some parameters are not specified, use default values.

Units:

Feed					
Model	InletFlow				
Screen1					
Model	Screen Plitt				
Cut size	0.002 m				
Separation sharpness: Time [s]	0	10	20	30	40
Separation sharpness: Values	15	10	6	4	3
Screen2					
Model	Screen Plitt				
Cut size	0.002 m				
Separation sharpness: Time [s]	0	5	10	15	20

Separation sharpness: Values	15 11 8 5 3
Crusher	
Model	Crusher Bond's law
Power input	1 kW
Bond work index	15 kWh/t
Standard deviation	0.0002 m
Mixer1	
Model	Mixer
Mixer2	
Model	Mixer
Product	
Model	OutletFlow

Components: Urea

Phases: Solid phase

PSD mesh:

Entry	Numeric
Type	Equidistant
Classes	200
Limits	0 – 4 [mm]

Parameters of input streams and holdups:

Feed	
Time points	0 s
Mass flow	0.5 kg/s
Phase fractions	100% Solid
Compounds fractions in the solid phase	100% Urea
Compound of PSD q3 distribution	Urea
PSD q3 Distribution type	Normal
PSD q3 D50	0.002 m
PSD q3 Standard deviation	0.0002 m

Options:

Relative tolerance	1e-06
Absolute tolerance	1e-08

Simulation time: 50 s

Task 3: Granulation process

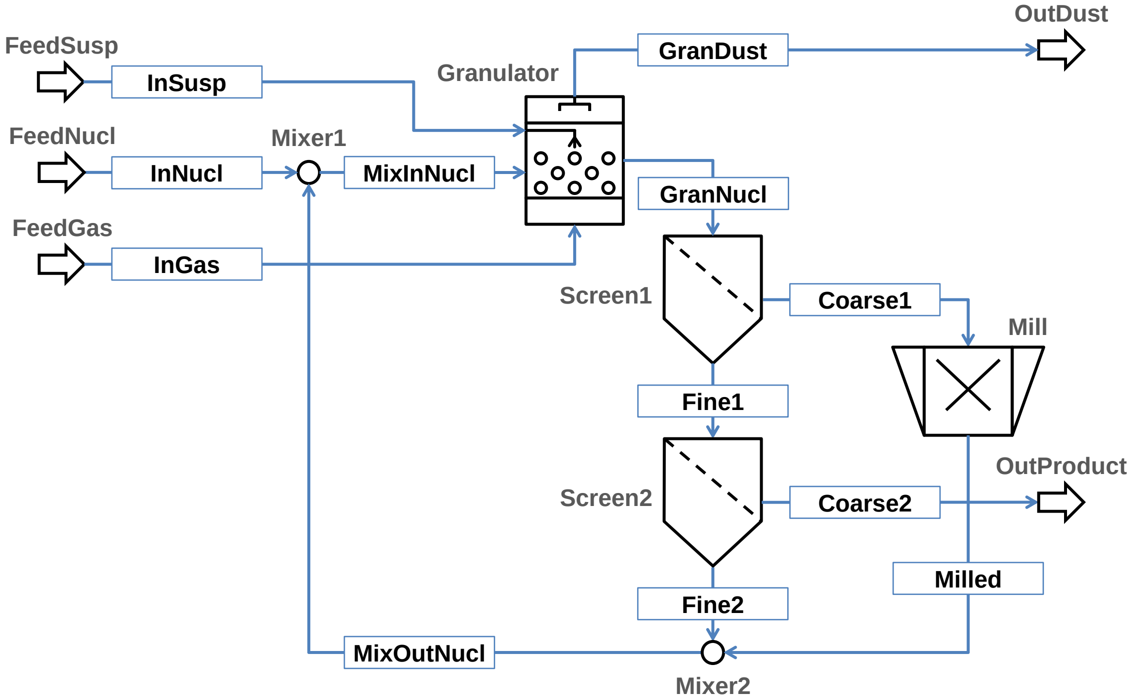

Figure 4. Flowsheet of granulation process.

1. Create a flowsheet in Dyssol with the structure shown in Figure 4. Use the values specified below as process parameters.
2. Simulate the flowsheet for time interval of 10 h and check the mass-balance of the scheme.
3. Compare parameters of the product with the inlet parameters (mass flow, particle size distribution, Sauter mean diameter).
4. Analyze the response of the system (rise time, period of oscillations, decay ratio, overshoot ratio) for two case studies:
   - Case 1: stepwise change of nuclei mass flow from 0.005 kg/s to 0.0025 kg/s.
   - Case 2: stepwise change of milling diameter from 0.9 mm to 0.8 mm.

   Repeat the analysis for both case studies with an increased hold-up mass in the granulator (200 kg instead 100 kg). Compare the obtained results.
5. Investigate how the increase of the mill’s efficiency (step by step reduction of the “Expected value” parameter from 0.9 mm to 0.6 mm) influences the stability of the process.

Note: if some parameters are not specified, use default values.

Units:

FeedSusp	
Model	InletFlow
FeedNucl	
Model	InletFlow
FeedGas	
Model	InletFlow
Granulator	
Model	Granulator
Overspray	0
Relative tolerance	1e-05
Absolute tolerance	1e-06
Screen1	
Model	Screen Probability model
Mean value	0.0014 m
Standard deviation	5.5e-05 m
Screen2	
Model	Screen Probability model
Mean value	0.001 m
Standard deviation	6.5e-05 m
Mill	
Model	Crusher Const output
Mean value	0.0009 m
Standard deviation	0.0001 m
Mixer1	
Model	Mixer
Mixer2	
Model	Mixer
OutDust	
Model	OutletFlow
OutProduct	
Model	OutletFlow

Components: Urea, H_2O, Air

Phases: Gas phase, Liquid phase, Solid phase

PSD mesh:

Entry	Numeric
Type	Equidistant
Classes	100
Limits	0 – 4 [mm]

Parameters of input streams and holdups:

FeedSusp	
Time points	0 s
Mass flow	0.035 kg/s
Phase fractions	80% Solid, 20% Liquid
Compounds fractions in the gas phase	100% Air
Compounds fractions in the liquid phase	100% H_2O
Compounds fractions in the solid phase	100% Urea
Compound of PSD q3 distribution	Urea
PSD q3 Distribution type	LogNormal
PSD q3 D50	0 m
PSD q3 Geometric mean	-1 (empty distribution)
FeedNucl	
Time points	0 s
Mass flow	0.005 kg/s
Phase fractions	100% Solid
Compounds fractions in the gas phase	100% Air
Compounds fractions in the liquid phase	100% H_2O
Compounds fractions in the solid phase	100% Urea
Compound of PSD q3 distribution	Urea
PSD q3 Distribution type	Normal
PSD q3 D50	0.001 m
PSD q3 Standard deviation	0.00015 mm
FeedGas	
Time points	0 s
Mass flow	2 kg/s
Phase fractions	100% Gas
Compounds fractions in the gas phase	100% Air
Compounds fractions in the liquid phase	100% H_2O
Compounds fractions in the solid phase	100% Urea
Compound of PSD q3 distribution	Urea
PSD q3 Distribution type	LogNormal
PSD q3 D50	0 m
PSD q3 Geometric mean	-1 (empty distribution)
Granulator Holdup	
Time points	0 s
Mass	100 kg
Phase fractions	100% Solid
Compounds fractions in the gas phase	100% Air
Compounds fractions in the liquid phase	100% H_2O
Compounds fractions in the solid phase	100% Urea
Compound of PSD q3 distribution	Urea
PSD q3 Distribution type	Normal
PSD q3 D50	0.001 mm
PSD q3 Standard deviation	0.0001 mm

Options:

Relative tolerance	1e-04
Absolute tolerance	1e-08
Convergence method	Wegstein
Data extrapolation	Linear

Simulation time: 36000 s