

# **Frequently Asked Question (FAQ) for the simulation program SimuCF**

**Program for process simulation of biological degradation processes  
in the field of waste management**



## Substrates

1. Why are the minimum degr. mat. dry solid content  and structure dry solid content  available the lowest only at 20 weight % when usually laboratory substrate would have even lower solid content?

SimuCF is a simulation software meant for solid substrate, therefore water content plays minor role here in the simulation. This input would require some manipulation if the microbiology activities involved in anaerobic degradation have a change in physical condition such as ventilation.

2. Is it necessary to manipulate the degradation efficiency of components  to  ? Are these important?

These input information  to  are indeed important in simulating anaerobic digestion using SimuCF. They can be manipulated to calibrate the programme virtually which must then also be the value determined from reality which already catered in the error possibilities in the laboratory. The degradabilities of carbohydrates, protein and fats are light, medium and heavy respectively.

3. Since bulk density  is not an important parameter when simulating for biogas potential, is it necessary to assign a value for it?

Yes. Although bulk density has no great influence over methane production from anaerobic digestion, a realistic bulk density value should be allocated. Otherwise, the output values for instance reactor size would give a value that is unrealistic. Therefore, bulk density should be given a value and not zero.

4. When the “database” option is selected, followed by a sample dataset  chosen and with “o.k.” button pressed, no data appear in any of the input fields essential to run a successful simulation. What could have happened?

For the time being, the database contains little data. If “database” is selected, values under “T” will be read into SimuCF after activating “input own material” by pressing “o.k.”.

5. Why is the degradability of carbohydrates/starch/amino acids/hemicellulose, proteins/cellulose and fats/waxes (  to  ) are set as default with the values of 70, 50 and 45 respectively?

Different degradability combinations could be simulated with SimuCF. depend on the quantity of waste substrate given and also the milieu state of the process in terms of pH value, temperature, water content, and etc.

6. What is the concept behind DM to wet (incl. structure)  ? When to use this function?

The values of  to  are wet material values. When entering the dry matter, the values under  and  are converted into moisture values.

7. What is meant for the max. material potential (charge) that is mentioned in Zone K? How different are the values from  to  with other output values from other zones?

The calculation of these values are based on other calculation methods from the literature. The values can be used for comparison or estimation. P (kg) m. and K (kg) m. are values read from the database "materials.txt".

## Surcharge Materials

8. There is information about anions from the biochemical analysis done in the laboratory, for instance chloride ion, nitrate ion, sulphate ion and etc. Is this information to be added under the field  to  respectively?

No. Section  to  are only filled when there is additional dosage of the stated materials into the process. Anions obtained from the biochemical analysis done in the laboratory are components already exist in the waste substrate. Therefore, they are totally different information.

9. What is the purpose to add calcium carbonate  when simulating?

The purpose of adding calcium carbonate is to increase and stabilise pH value of the simulated process.

## Operational setting

10. Is it necessary to fill up the type of heap form and also the dimension  to  for the simulation?

The type of heap form and its dimension are important for aerobic process (composting) but not for anaerobic digestion. These information  to  do not affect the outcome when SimuCF is simulated for anaerobic digestion process.

11. Why is greater length of treatment  affecting the final biomethane potential (BMP) outcome?

When  is simulated with "auto." setting , the treatment time will appear with at least 80% of the degradable material  being degraded. If 100% degradation is wished upon, one should extend the length of treatment time  day by day until  shows 100% degradation.

The gradient of the BMP graph corresponds most to reality when the minimum degradation time until the desired degree of degradation is reached (provided no error messages and signals appearing above zone K, in the middle of the SimuCF interface).

There are three material groups with different degradation gradient (light, medium and heavy) for ,  and  respectively. The influences from  to  are combined. The final output gradient of the graph is also material dependent.

12. What is the difference between air temp. env  and temp. material ? How to set the temperature of the process to be simulated?

is the temperature of air in the surrounding environment whereas  is the temperature of the material. To set the temperature of the process to be simulated with SimuCF,  must be entered. If  and  are entered, the temperature follows the process temperature with a temperature increase by . A constant process temperature can be set by entering ,  and . This can be higher than entered due to the released degradation energy.

13. What is settlement ? Is this relevant to simulate anaerobic digestion process?

This is the material change without biodegradation. This has an influence on the material height and pore volume. This is not relevant for the anaerobic biological processes, but for physical output values.

14. What is norm? How does it work?

“Norm” function can be seen at the field of  and . “Norm” is a short-form for normality that is defined as the equivalent concentration of a solution. When  is switched to “no”, the output results (e.g.  to ) would have result according to the temperature set at  (provided if  and  are switched on). If  is switch to “yes”, there are two temperatures that one can choose from at . The output results would then get normalised to the chosen temperature at 1013.25 mbar.

15. How does zone E  to  functions? What is the meaning of charge? How to manipulate when the system to simulate is batch, semi-continuous or continuous process?

In batch mode, the entire material is considered. In reality, the processes are often semi-continuous or quasi-continuous. In the simulation, the total amount is divided by the number of batches (individual additions of material) and added daily (quasi-continuous) or at the specified times (above zone S). The output is the fraction removed. With air input means that oxygen is added in the pore volume. As in all simulations, a process that works in reality has no inhibition messages (signals and messages above zone K) and with stable reproducibility.

## Inoculum

16. Is there a field to fill up the activity of microorganism as the activity of microorganism does actually contribute to the performance of the degradation?

No. SimuCF only allows the input of degradable or/and non-degradable materials and the lag phase . This is because the microorganism is already pre-existing in the waste substrate itself. In the simulation, the growth of the microorganisms start from zero.

With , the lag phase can be greatly shortened. This is used to simulate established processes in which the MO and milieu conditions are already well adjusted.

17. S/I ratio does play an important factor when running laboratory experiments for anaerobic digestion. Is this a factor to be concerned when simulating using Simulation CF?

Yes, the S/I ratio is important. In SimuCF, the substrate of the inoculum may have to be added. If only Microorganism suspension is added, only the total amount of water needs to be considered.  and  should be set to minimum lag phase.

18. What is lag-phase  ? When to use this function? Why are we using this function?

The function shows the degradation delay. Delays are caused by inhibitions of the Microorganism activities and by the milieu conditions. The initial phase (lag-phases) is automatically extended. With  the time until methane formation is shortened to a maximum.

## Performance

19. What are the key parameters to look out for when simulating anaerobic digestion using SimuCF?

The most important parameters in fermentation are substrate (C/N ratio), temperature, water content and pH value. In SimuCF, it is especially important that both CH<sub>4</sub> Creation (%)  and degraded in %  are reaching as high as 100%. This actually indicates the result whether the simulation is successful or not.

20. Why are there changes in the output values for bulk density  and structure density  after inclusion of input values for inorganic contents such as inorganics: -

- e.g. sand weight (wet) (kg)
- sand dry solid cont. (weight-%)
- add struct. weight (wet) (kg)
- struct. dry solid cont. (weight-%)  ?

New calculations for bulk density and structure density will be initiated if the input values for inorganic contents are added at  to  even after bulk density and structure density have already been defined earlier. If this outcome is not favourable, the input value for inorganic contents could be added to "structure weight (wet) (kg)"  directly.

21. Is it possible to obtain the same biomethane potential (BMP) outcome when having the same biochemical compositional ratio but different absolute mass of waste substrate input?

If the ratio is the same but the quantities are different, delays can occur due to inhomogeneities. These are taken into account in SimuCF. The absolute amount of methane is different, the relative methane production, i.e. with reference to quantity, should be relatively similar, as the nutrient content of the input waste substrate is the same.

## Others

22. How to use zone M  to  ? When to use this zone?

This input allows a percentage input. The reference is . The dry content values entered are converted to the wet material weight. If values are in zone K, the calculated values are added from the entries in zone M. The programme should run when additions are made. The programme must first read in the values.

23. What are the purposes of  and ? When to use these functions? How to use these functions?

Enables the output of the input values as a text file.

24. What valuable information can we obtain from Zone S?

This area is to be explained in a more differentiated way. They are output values in the respective units mentioned. Oxygen consumption and gas formation potential under anaerobic conditions can also be read after different times. Balances, initial values and maximum concentrations as well. At the top of zone S, the graphs of the laboratory experiments of the examples (above zone L) are shown.

25. Should the treatment duration  match in comparisons?

It depends on the comparative value of interest. Do you want the slope or the yield? For the slope,  should be taken with the time found with "auto" .