bioengineering

MDPI

Supplementary elements

Text S1. Medium preparation

Text S2. Compensation curve gas flow meter

Table S1. Minimal medium composition

Table S2. Trace elements SL10 (DSMZ medium 320)

Table S3. Trace elements SL10 (DSMZ medium 320)

Table S4. Wind and PV regime

Table S5. PV regime

Figure S1. Compensation curve gas flow meter

Figure S2. Gas loading rate and product gas composition during the initial phase before day 32

Figure S3. N-total and P-total during the initial phase consisting of start-up phase and stable phase and the flexible phase consisting of PV+Wind and PV regime

Figure S4. Stability parameters during the initial phase before day 32

Figure S5. Bacterial community structure analysis based on 16S rRNA gene V3-V4 region amplicon sequencing on genus level, Archaea excluded.

Figure S6. Shannon and Simpson indexes of the bacterial community structure.

Figure S7. Shannon and Simpson indexes of the archaeal community structure.

Text S1. Medium preparation

Minimal medium for the cultivation of a mixed culture was prepared according to Table 1. Diammoniumphosphate and Urea were prepared freshly. The pH was controlled after media preparation and was 8.0 ±0.1.

The trace element stock solution Trace elements SL10 (DSMZ medium 320) was prepared first by dissolving $FeCl_2$ in HCl and diluting it with water before other salts were added and dissolved according to Table S2. The Selenite-tungstate stock solution (DSMZ medium 385) was prepared according to Table S3. Both stock solutions were stored in sterile serum bottles after sterile filtration with 0.2 µm PES filter (VWR International GmbH, Darmstadt, Germany) at 7°C.

A sodium sulfide stock solution (c= 50 g/L) was prepared by dissolving sodium sulfide nonahydrate in water and adjusting the pH to 7.0 with NaOH and HCL. The sodium sulfide stock solution was aliquoted in 50 ml tubes and stored at -20°C.

Table S1. Minimal medium composition

Component	Concentration	Unit
Urea	1.7560	g/L
Diammoniumphosphate	0.8527	g/L
Sodium sulfate stock solution	7.50	ml/L
Trace element stock solution SL-10 (DSMZ medium 320)	1.00	ml/L
Selenite-tungstate stock solution (DSMZ medium 385)	1.00	ml/L

Table S2. Trace elements SL10 (DSMZ medium 320)

component	Concentration	unit
HCl (25%)	10	ml
FeCl2 x 4 H2O	1500	mg/L
ZnCl2	70	mg/L
MnCl2 x 4 H2O	100	mg/L
H3BO3	6	mg/L
CoCl2 x 6 H2O	190	mg/L
CuCl2 x 2 H2O	2	mg/L
NiCl2 x 6 H2O	24	mg/L
Na2MoO4 x 2 H2O	36	mg/L

Table S3. Trace elements SL10 (DSMZ medium 320)

Component	Concentration	unit
NaOH	500	mg/L
Na2SeO3 x 5 H2O	3	mg/L
Na2WO4 x 2 H2O	4	mg/L

Table S4. Wind and PV regime

start_time	end_time	setpoint
00:00:00	00:14:59	0
00:15:00	00:29:59	0
00:30:00	00:44:59	0
00:45:00	00:59:59	0
01:00:00	01:14:59	0
01:15:00	01:29:59	0
01:30:00	01:44:59	0

01:45:00	01:59:59	0
02:00:00	02:14:59	0
02:15:00	02:29:59	0
02:30:00	02:44:59	0
02:45:00	02:59:59	0
03:00:00	03:14:59	0
03:15:00	03:29:59	0
03:30:00	03:44:59	0
03:45:00	03:59:59	0
04:00:00	04:14:59	0
04:15:00	04:29:59	0
04:30:00	04:44:59	0
04:45:00	04:59:59	0
05:00:00	05:14:59	0
05:15:00	05:29:59	0
05:30:00	05:44:59	0
05:45:00	05:59:59	0
06:00:00	06:14:59	0
06:15:00	06:29:59	0
06:30:00	06:44:59	0
06:45:00	06:59:59	0
07:00:00	07:14:59	48
07:15:00	07:29:59	77
07:30:00	07:44:59	126
07:45:00	07:59:59	185
08:00:00	08:14:59	248
08:15:00	08:29:59	314
08:30:00	08:44:59	383
08:45:00	08:59:59	455
09:00:00	09:14:59	524
09:15:00	09:29:59	593
09:30:00	09:44:59	654
09:45:00	09:59:59	707
10:00:00	10:14:59	753
10:15:00	10:29:59	793
10:30:00	10:44:59	825
10:45:00	10:59:59	853
11:00:00	11:14:59	877
11:15:00	11:29:59	895
11:30:00	11:44:59	913
11:45:00	11:59:59	921
12:00:00	12:14:59	935
12:15:00	12:29:59	949
12:30:00	12:44:59	957
12:45:00	12:59:59	959

13:00:00	13:14:59	960
13:15:00	13:29:59	955
13:30:00	13:44:59	944
13:45:00	13:59:59	932
14:00:00	14:14:59	914
14:15:00	14:29:59	898
14:30:00	14:44:59	884
14:45:00	14:59:59	860
15:00:00	15:14:59	829
15:15:00	15:29:59	793
15:30:00	15:44:59	761
15:45:00	15:59:59	715
16:00:00	16:14:59	670
16:15:00	16:29:59	617
16:30:00	16:44:59	561
16:45:00	16:59:59	503
17:00:00	17:14:59	444
17:15:00	17:29:59	384
17:30:00	17:44:59	322
17:45:00	17:59:59	261
18:00:00	18:14:59	201
18:15:00	18:29:59	146
18:30:00	18:44:59	99
18:45:00	18:59:59	61
19:00:00	19:14:59	48
19:15:00	19:29:59	0
19:30:00	19:44:59	0
19:45:00	19:59:59	0
20:00:00	20:14:59	0
20:15:00	20:29:59	0
20:30:00	20:44:59	0
20:45:00	20:59:59	0
21:00:00	21:14:59	0
21:15:00	21:29:59	0
21:30:00	21:44:59	0
21:45:00	21:59:59	0
22:00:00	22:14:59	0
22:15:00	22:29:59	0
22:30:00	22:44:59	0
22:45:00	22:59:59	0
23:00:00	23:14:59	0
23:15:00	23:29:59	0
23:30:00	23:44:59	0
23:45:00	23:59:59	0

Table S5. PV regime

start_time	end_time	setpoint
00:00:00	00:14:59	0
00:15:00	00:29:59	0
00:30:00	00:44:59	0
00:45:00	00:59:59	0
01:00:00	01:14:59	0
01:15:00	01:29:59	0
01:30:00	01:44:59	0
01:45:00	01:59:59	0
02:00:00	02:14:59	0
02:15:00	02:29:59	0
02:30:00	02:44:59	0
02:45:00	02:59:59	0
03:00:00	03:14:59	0
03:15:00	03:29:59	0
03:30:00	03:44:59	0
03:45:00	03:59:59	0
04:00:00	04:14:59	0
04:15:00	04:29:59	0
04:30:00	04:44:59	0
04:45:00	04:59:59	0
05:00:00	05:14:59	0
05:15:00	05:29:59	0
05:30:00	05:44:59	0
05:45:00	05:59:59	0
06:00:00	06:14:59	0
06:15:00	06:29:59	0
06:30:00	06:44:59	0
06:45:00	06:59:59	0
07:00:00	07:14:59	0
07:15:00	07:29:59	0
07:30:00	07:44:59	0
07:45:00	07:59:59	0
08:00:00	08:14:59	0
08:15:00	08:29:59	0
08:30:00	08:44:59	0
08:45:00	08:59:59	0
09:00:00	09:14:59	0
09:15:00	09:29:59	0
09:30:00	09:44:59	0
09:45:00	09:59:59	0
10:00:00	10:14:59	0
10:15:00	10:29:59	0
10:30:00	10:44:59	0

10:45:00	10:59:59	0
11:00:00	11:14:59	0
11:15:00	11:29:59	0
11:30:00	11:44:59	0
11:45:00	11:59:59	0
12:00:00	12:14:59	77
12:15:00	12:29:59	126
12:30:00	12:44:59	185
12:45:00	12:59:59	248
13:00:00	13:14:59	314
13:15:00	13:29:59	383
13:30:00	13:44:59	455
13:45:00	13:59:59	524
14:00:00	14:14:59	593
14:15:00	14:29:59	654
14:30:00	14:44:59	707
14:45:00	14:59:59	753
15:00:00	15:14:59	793
15:15:00	15:29:59	825
15:30:00	15:44:59	853
15:45:00	15:59:59	877
16:00:00	16:14:59	895
16:15:00	16:29:59	913
16:30:00	16:44:59	921
16:45:00	16:59:59	935
17:00:00	17:14:59	949
17:15:00	17:29:59	957
17:30:00	17:44:59	959
17:45:00	17:59:59	960
18:00:00	18:14:59	955
18:15:00	18:29:59	944
18:30:00	18:44:59	932
18:45:00	18:59:59	914
19:00:00	19:14:59	898
19:15:00	19:29:59	884
19:30:00	19:44:59	860
19:45:00	19:59:59	829
20:00:00	20:14:59	793
20:15:00	20:29:59	761
20:30:00	20:44:59	715
20:45:00	20:59:59	670
21:00:00	21:14:59	617
21:15:00	21:29:59	561
21:30:00	21:44:59	503
21:45:00	21:59:59	444

22:00:00	22:14:59	384
22:15:00	22:29:59	322
22:30:00	22:44:59	261
22:45:00	22:59:59	201
23:00:00	23:14:59	146
23:15:00	23:29:59	99
23:30:00	23:44:59	61
23:45:00	23:59:59	0

Text 2. Compensation curve gas flow meter

Correction factors were created in 10% increments from 0% to 100% Methane and plotted against the methane concentration. It was assumed that carbon dioxide and hydrogen react stoichiometrically to produce methane, so that the remaining gas contains hydrogen and carbon dioxide in a 4:1 ratio. The equation of the linear regression was then used to correct the gas volume flow based on the methane concentration.

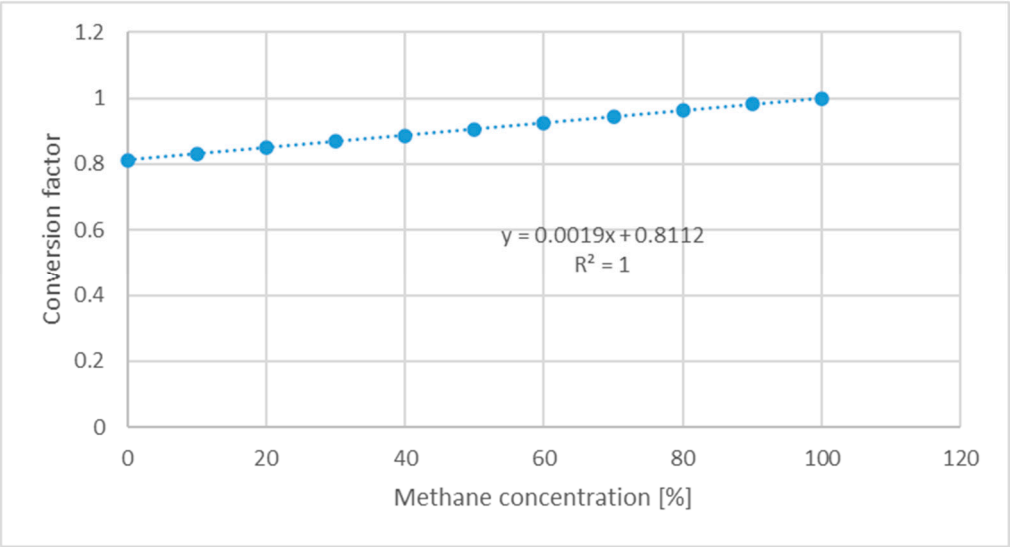


Figure S1. Compensation curve gas flow meter

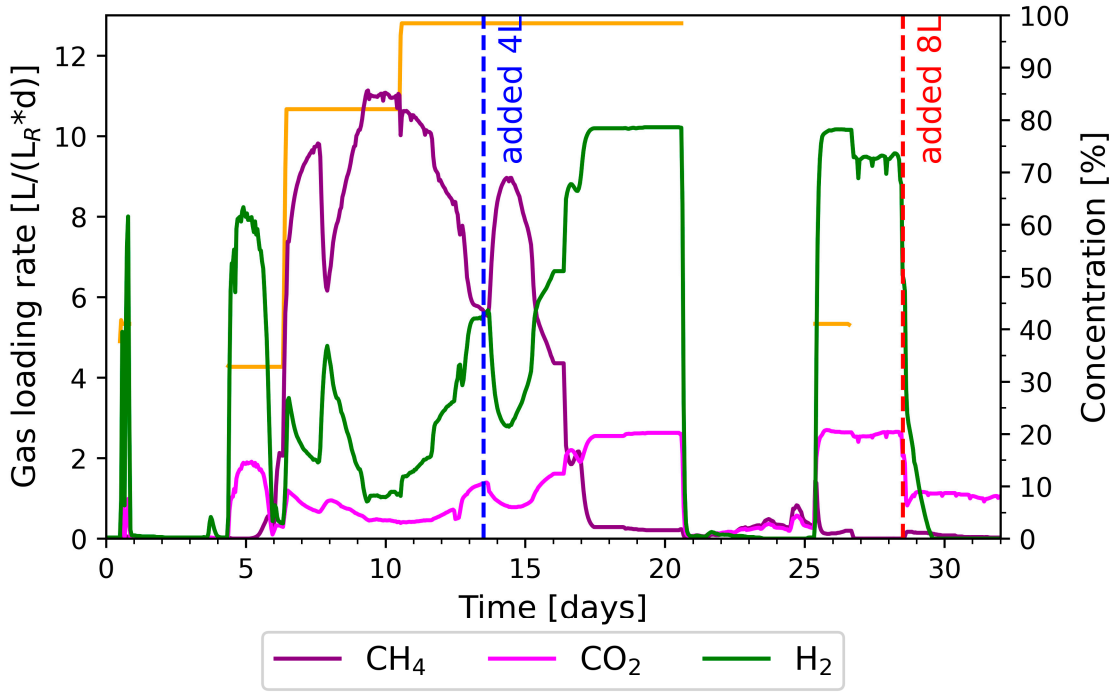


Figure S2. Gas loading rate (orange) and product gas concentration of methane (purple), carbon dioxide (magenta), hydrogen (green) during the initial phase before day 32.

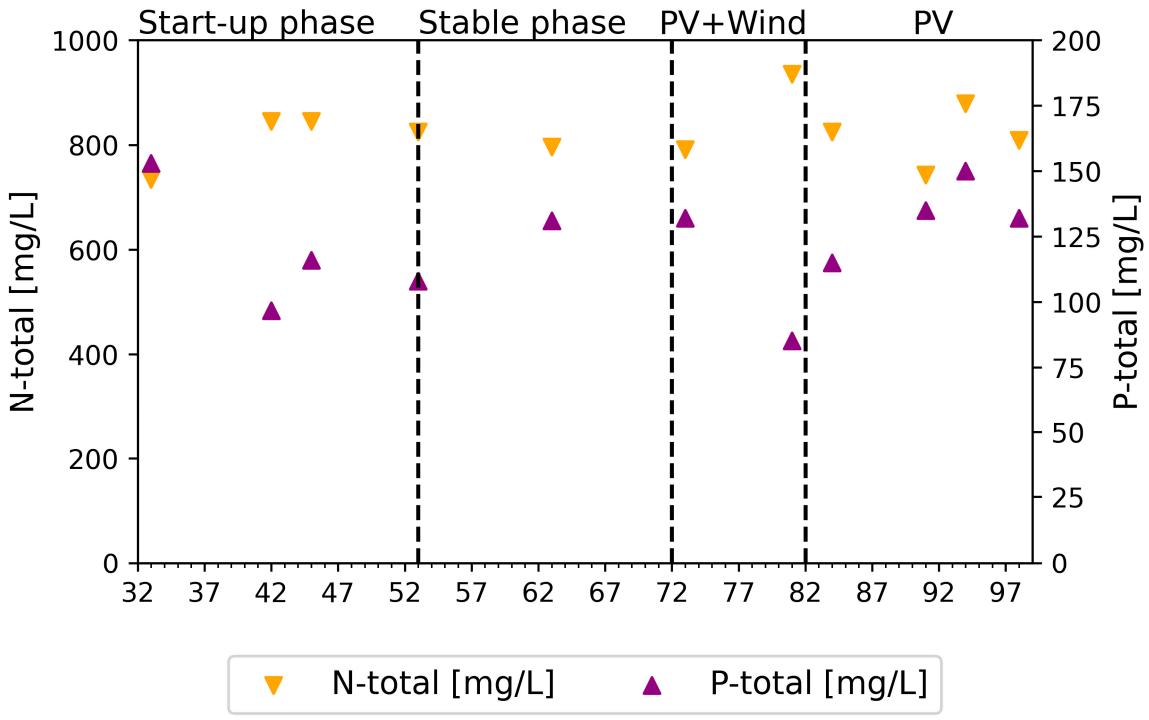


Figure S3. N-total (orange) and P-total (purple) during the initial phase consisting of start-up phase and stable phase (Max. LR) and the flexible phase consisting of PV+Wind and PV regime

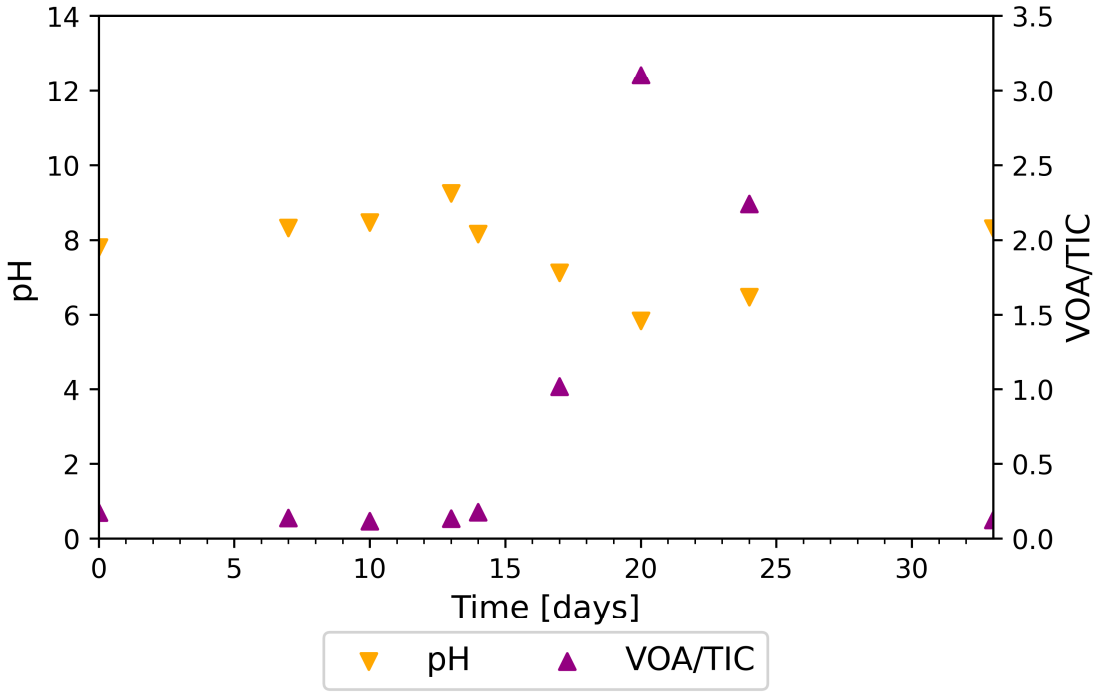


Figure S4 Stability parameters during the initial phase before day 32 pH (orange triangles, tips pointing downwards) volatile organic acid to total inorganic carbonate ratio VOA/TIC (purple triangles, tips pointing upwards)

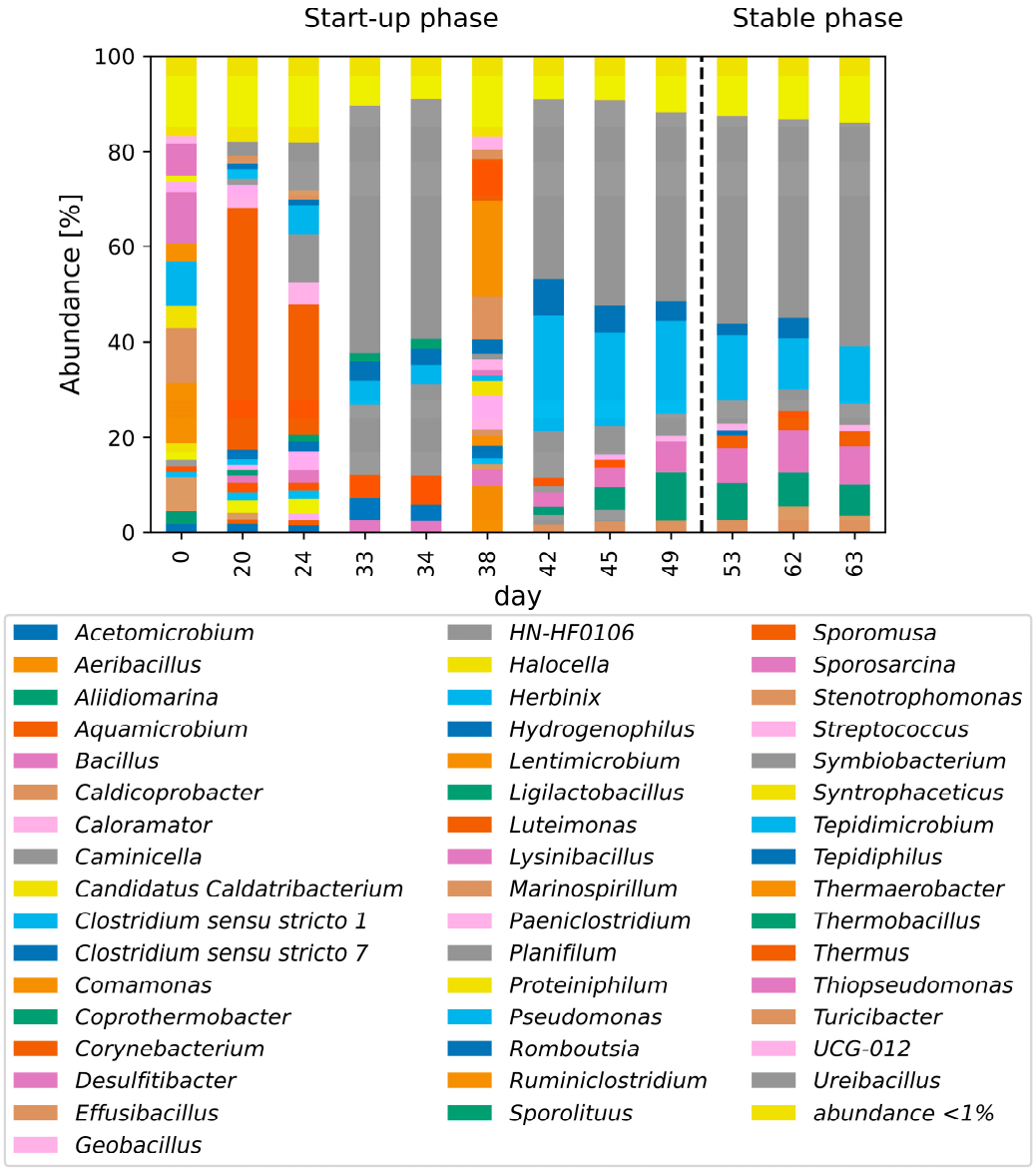


Figure S5. Bacterial community structure analysis based on 16S rRNA gene V3-V4 region amplicon sequencing on genus level, Archaea excluded. Taxa with abundance higher than 1%. The sample on day 0 represents the inoculum. On day 13 and 28 additional inoculum was added.

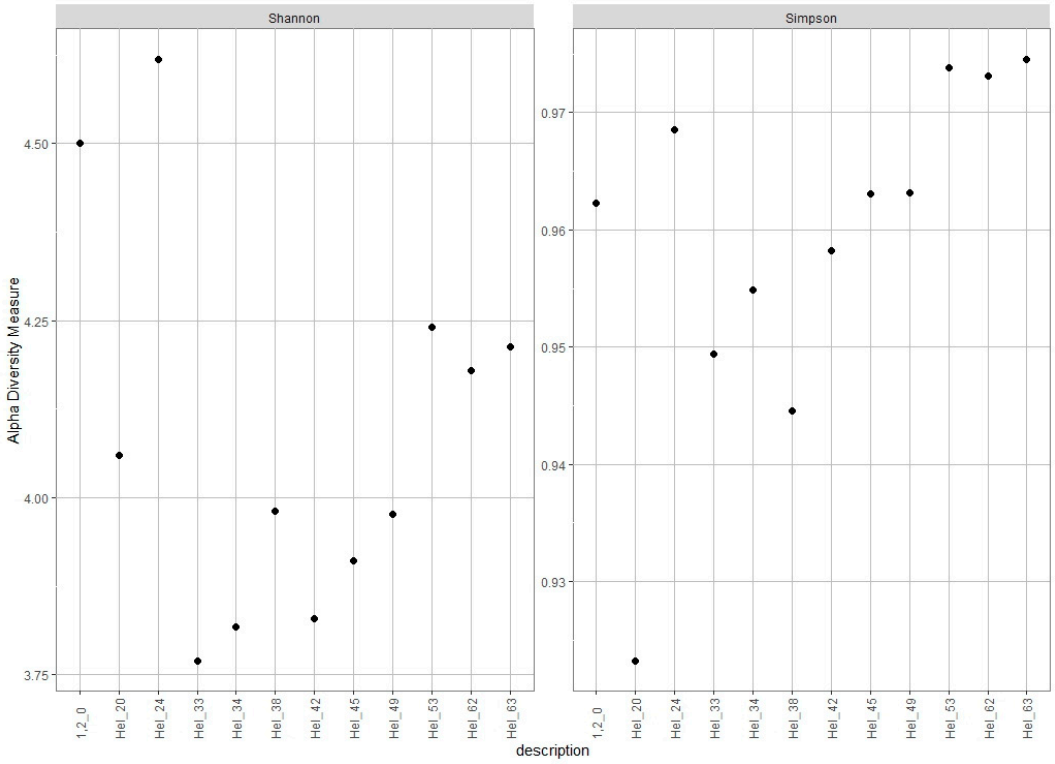


Figure S6. Shannon and Simpson indexes of the bacterial community structure. The number behind the suffix Hel_ and 1,2_ represents the day of operation. The sample on day 0 represents the inoculum.

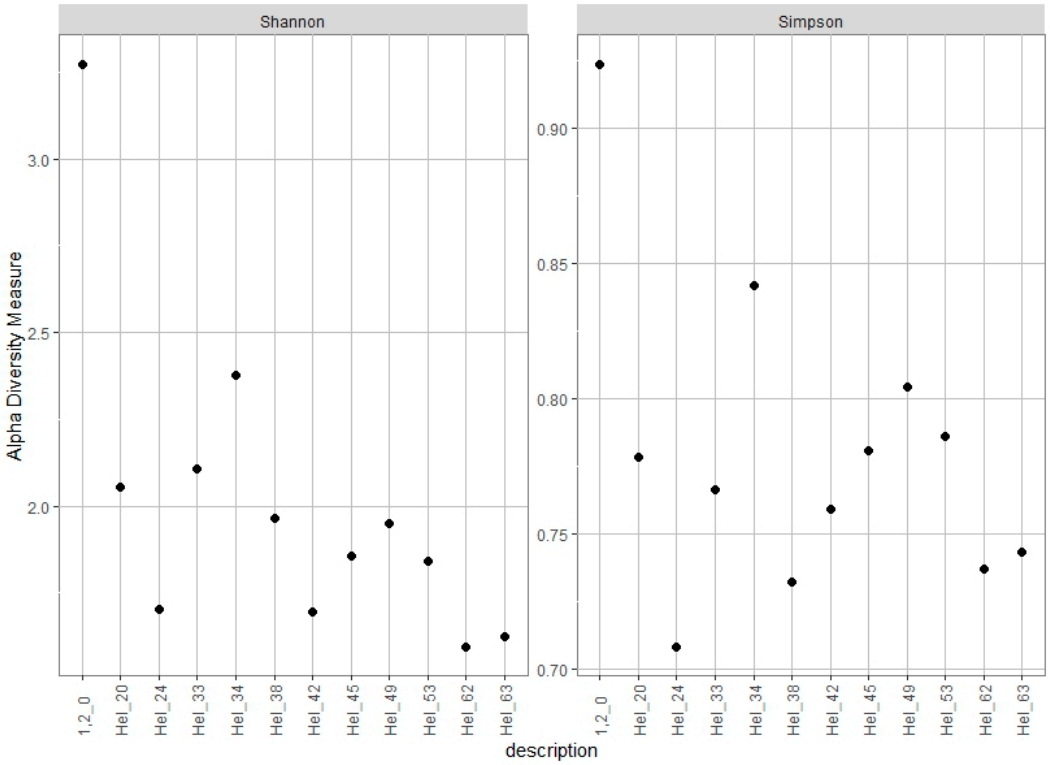


Figure S7. Shannon and Simpson indexes of the archaeal community structure. The number behind the suffix Hel_ and 1,2_ represents the day of operation. The sample on day 0 represents the inoculum.