Article:

Mu, M, Karthik, P, Chen, J et al. (2 more authors) (2021) Effect of amylose and amylopectin content on the colloidal behaviour of emulsions stabilised by OSA-Modified starch. Food Hydrocolloids, 111. 106363. ISSN 0268-005X

https://doi.org/10.1016/j.foodhyd.2020.106363

Fig 1. FT-IR spectra of native and OSA modified starch samples.

Table 1. Table providing amylose content (AC) and Degree of substitution (DS) of native waxy maze (W) and native normal corn starch (N), their hydrophobically modified samples (OS-W and OS-N), and the adsorbed OS-starch fraction recovered from the interface (OS-W_R and OS-N_R) post emulsification. A significant level of statistical difference ($p < 0.05$) is detected for any two samples with different lowercase superscript letters that follow the values of DS or AC in each column.

Fig 2. Mean droplet size $D_{4,3}$ for emulsions measured under different pH conditions, following various periods of storage (day 0 to day 21); A) emulsion W, B) emulsion N.

Fig 3. Variation of ζ-potential of emulsion droplets with pH, measured after varying periods of storage (day 0 and day 14); A) emulsion W, B) emulsion N.

Fig 4. The evolution of the average droplet size, $D_{4,3}$, in W emulsion (black solid lines) and N emulsion samples (red dashed lines) with the storage period. Samples are considered with A) no additional electrolyte, B) addition of 0.02M NaCl, C) addition of 0.1M NaCl, D) addition of 0.2M NaCl. Standard deviations are represented as error bars.

Table 2. Measured ζ-potentials of emulsions W or N without any added electrolyte and with 0.2M added NaCl.

Fig 5. Power law fits to apparent viscosity results, η, plotted on a log-log graph against shear rate, obtained in the range 5 to 200 s^{-1}. Emulsion W (solid line) and N (dotted line), were stored for 21 days at NaCl concentrations of 0.2M prior to the measurements. The resulting flow consistency index, K, and the flow behaviour index, n, are indicated on the graph for each case. The low value of n-1 indicates a near Newtonian behaviour for W sample.

Fig 6. Droplet size distribution of emulsion N with the addition of 0.2M NaCl at day 0, and after 7 days of storage, before and after the addition of 2% SDS.

Fig 7. Microscopic images of emulsions W and N with either no additional electrolyte, or 0.2M NaCl, after various periods of storage.

Fig 8. Changes in $D_{4,3}$ of W and N emulsion samples treated with enzyme, and their corresponding control samples with no enzyme, plotted as a function of time post introduction of the enzyme. Results are obtained during *in vitro* oral digestion with A) amylase solution, and emulsions stored at 25 °C (for W emulsions this is shown in the inset), B) artificial saliva, and emulsions stored at 4 °C, C) artificial saliva, and emulsions stored at 25 °C, and D) artificial saliva, and emulsions stored at 50 °C.

Fig 9. Microscopic images for emulsions W and N stored at 25 °C during *in vitro* oral digestion, obtained at various times following the introduction of artificial saliva.

Fig 10. Changes in $D_{4,3}$ occurring with time during the *in vivo* oral digestion of emulsions W (black solid lines) and N (red dashed lines). Results are only shown for three of the ten panellists, to provide some examples.

Fig 11. Examples of microscopic images for emulsions W and N during *in vivo* oral digestion, from samples obtained for one representative panellist.

Fig 12. Backscattering (IR) profiles of emulsions W and N, mixed 1:1 v/v with freshly collected human saliva. The percentage BS is reported as a function of time following the mixing (0 - 20 min) throughout the height of the emulsion sample (0 - 40 mm).

Fig 1.

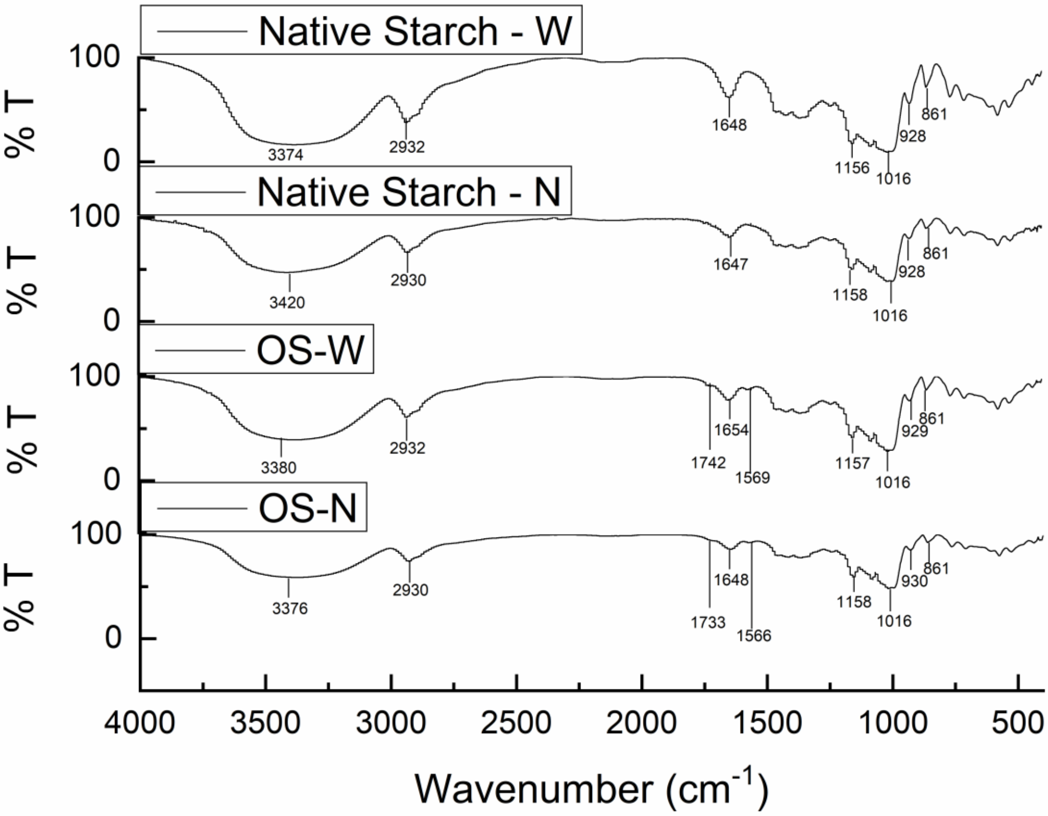
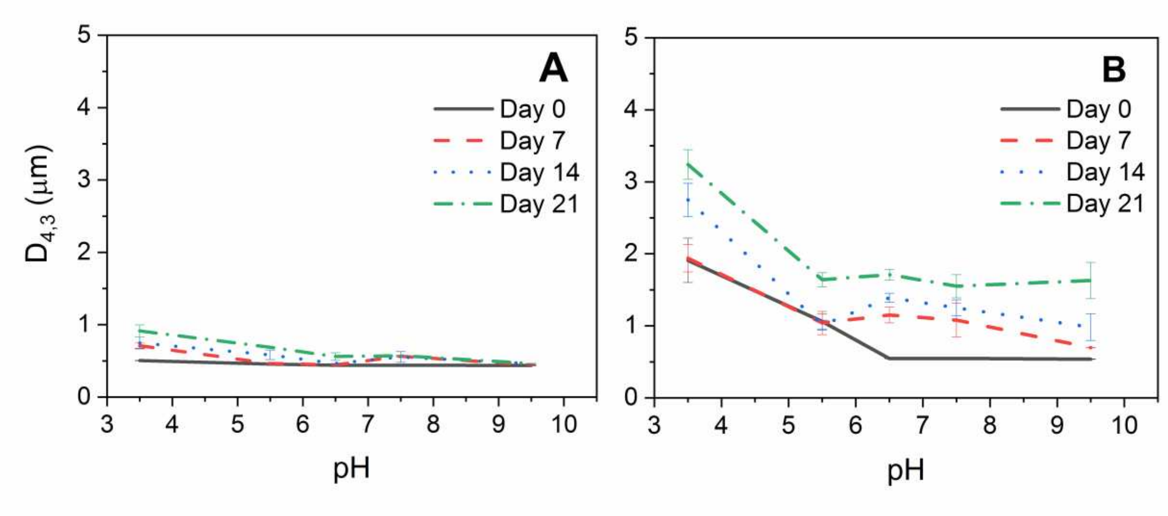

Native Starch - W
Native Starch - N
OS-W
OS-N
100
0
% T
3374
2932
1648
1156
1016
928
861
3420
2930
1647
1158
1016
928
861
3380
2932
1742
1654
1569
1157
1016
929
861
3376
2930
1733
1648
1566
1158
1016
930
861
4000
3500
3000
2500
2000
1500
1000
500
Wavenumber (cm^{-1})

Table 1.

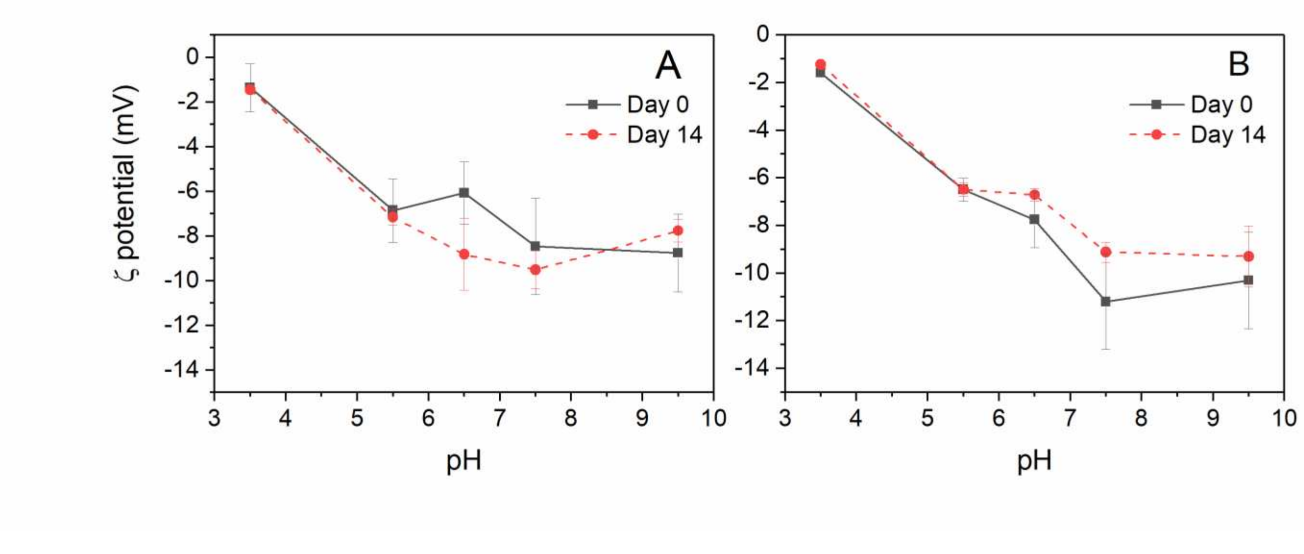
	AC (%)	DS
Native W	5.48 ± 0.99[a]	/
OS-W	3.93 ± 0.31[b]	0.0160 ± 0.0021[a]
OS-W_R	7.99 ± 0.64[c]	0.0194 ± 0.0001[b]
Native N	28.37 ± 0.10[d]	/
OS-N	21.86 ± 1.79[e]	0.0229 ± 0.0012[c]
OS-N_R	23.59 ± 1.23[e]	0.0291 ± 0.0029[d]

Fig 2.



A
B
Day 0
Day 7
Day 14
Day 21
D$_{4,3}$ (μm)
pH
0
1
2
3
4
5
3
4
5
6
7
8
9
10

Fig 3.



A
B
Day 0
Day 14
ζ potential (mV)
pH
0
-2
-4
-6
-8
-10
-12
-14
3
4
5
6
7
8
9
10

Fig 4.

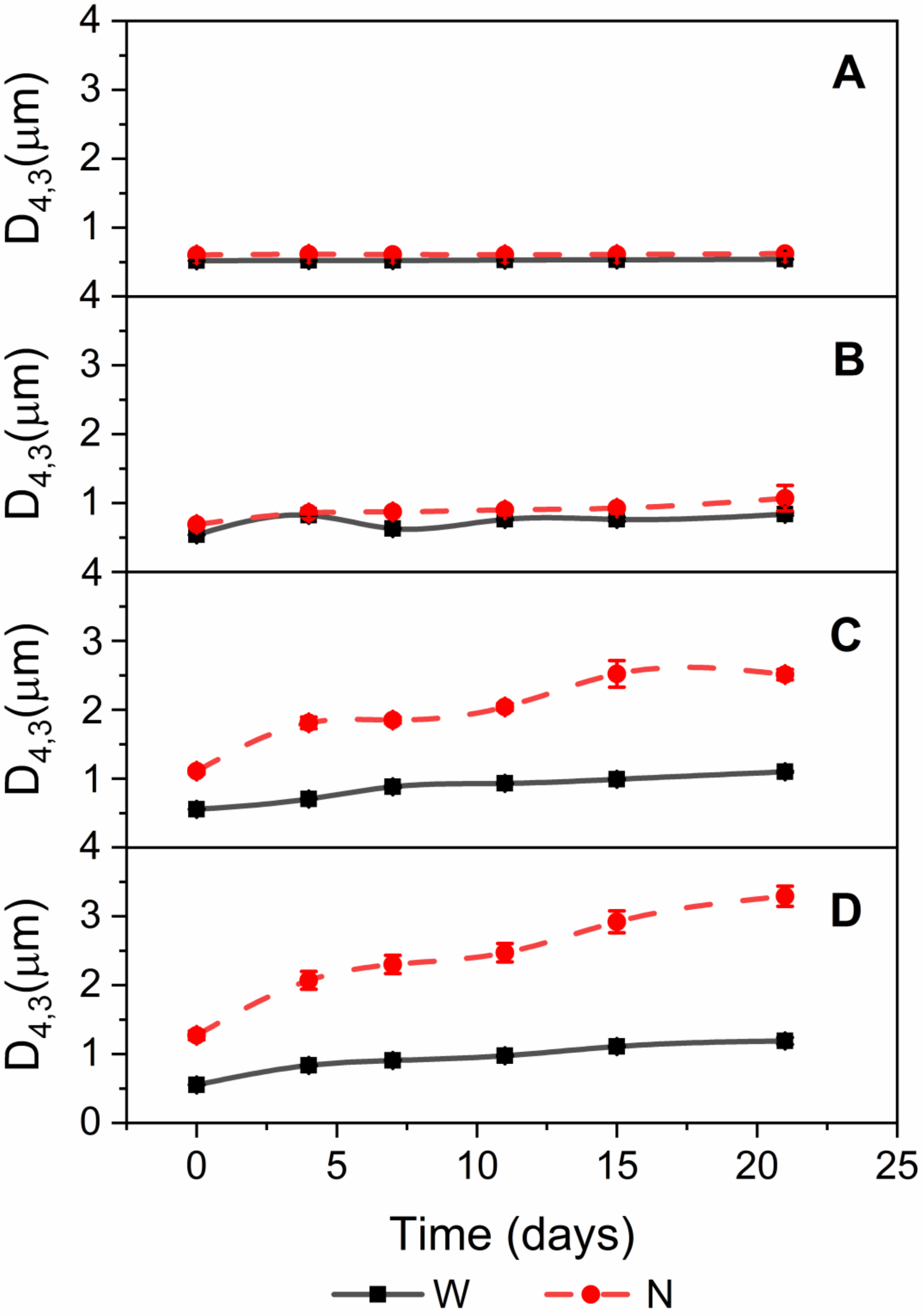


Table 2.

	W with no additional electrolyte (mV)	W with 0.2M additional NaCl (mV)	N with no additional electrolyte (mV)	N with 0.2M additional NaCl (mV)
ζ-potential	-17.11 ± 1.02	-2.85 ± 0.38	-15.13 ± 0.63	-2.3 ± 0.18

Fig 5.

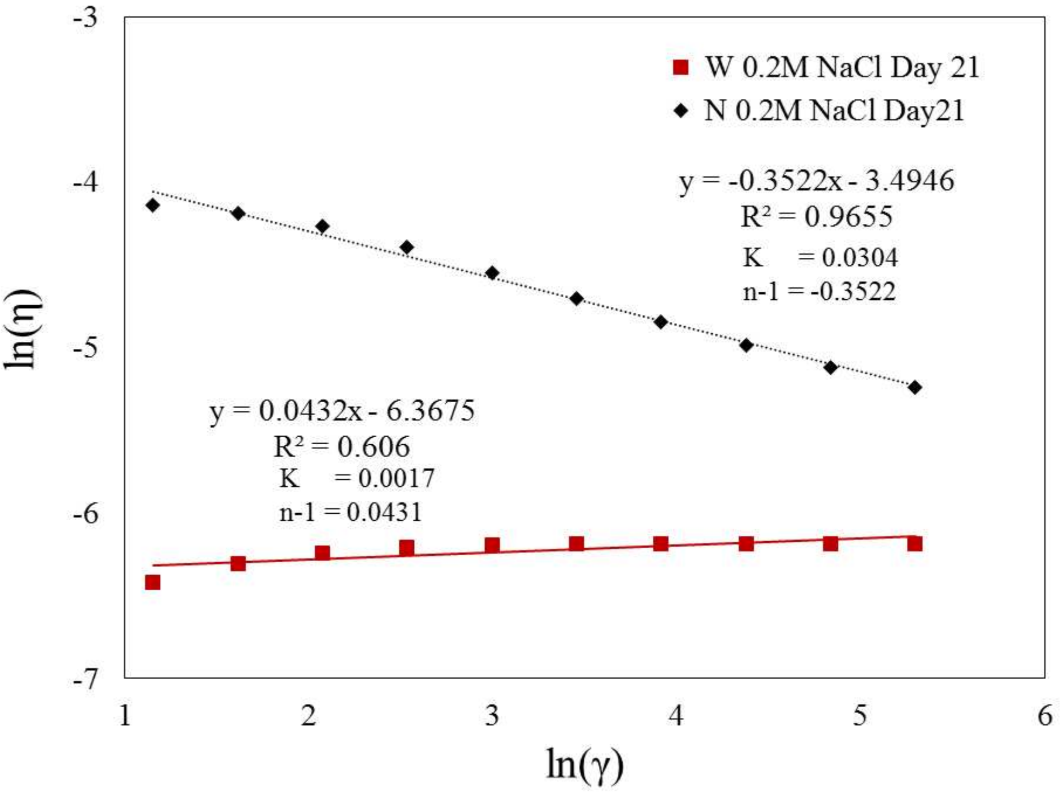
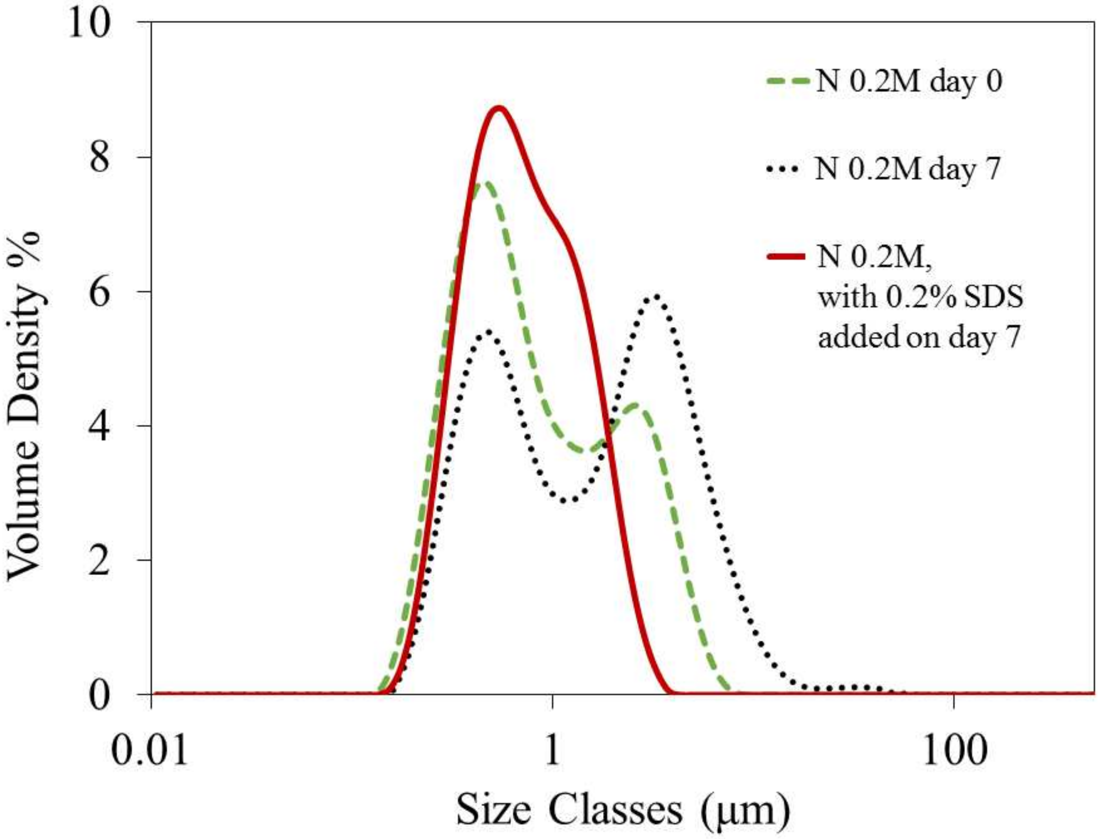


Fig 6.



N 0.2M day 0
N 0.2M day 7
N 0.2M, with 0.2% SDS added on day 7
Volume Density %
10
8
6
4
2
0
0.01
1
100
Size Classes (µm)

Fig 7.

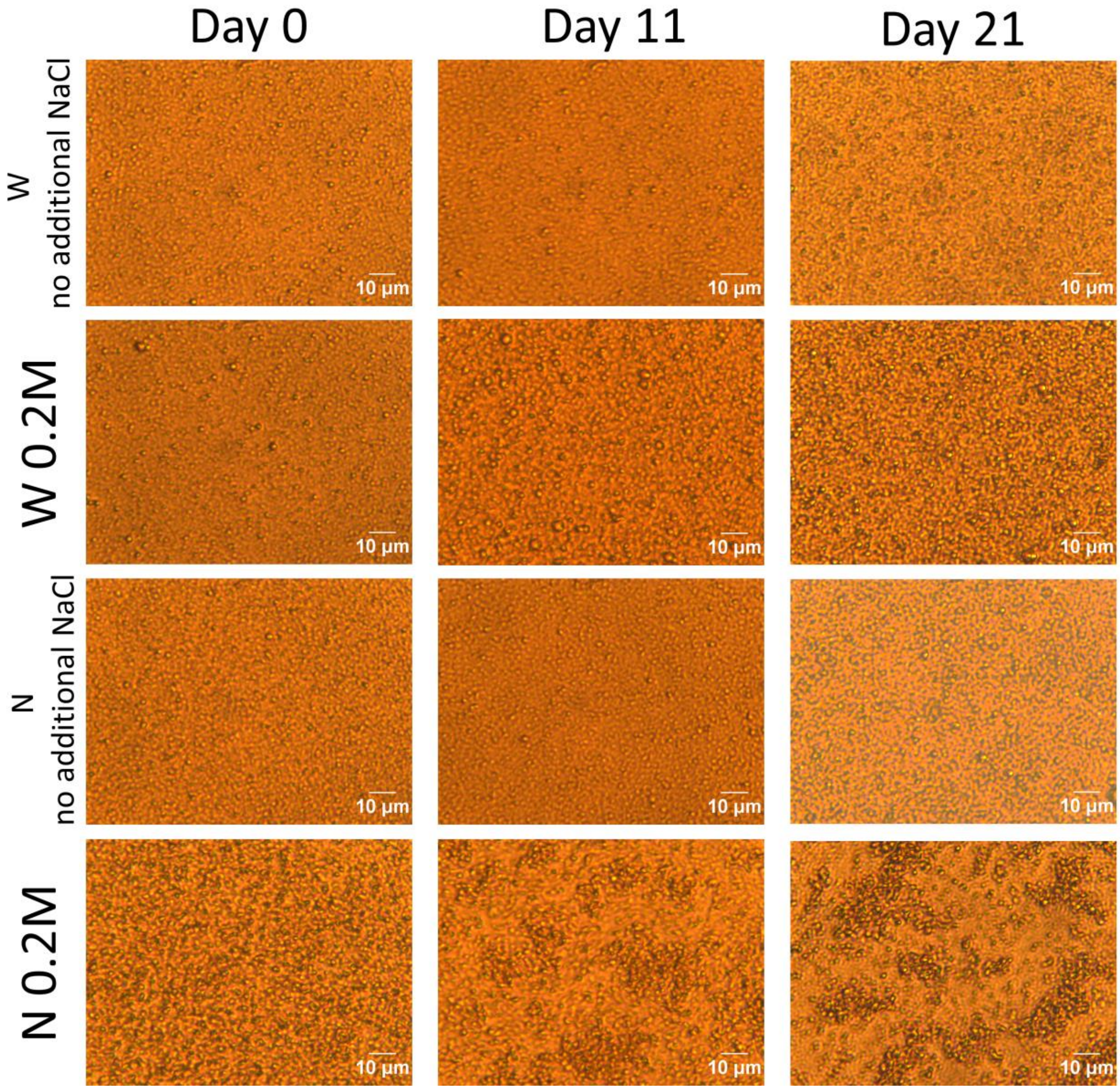

Day 0
Day 11
Day 21
W
no additional NaCl
W 0.2M
N
no additional NaCl
N 0.2M
10 µm

Fig 8.

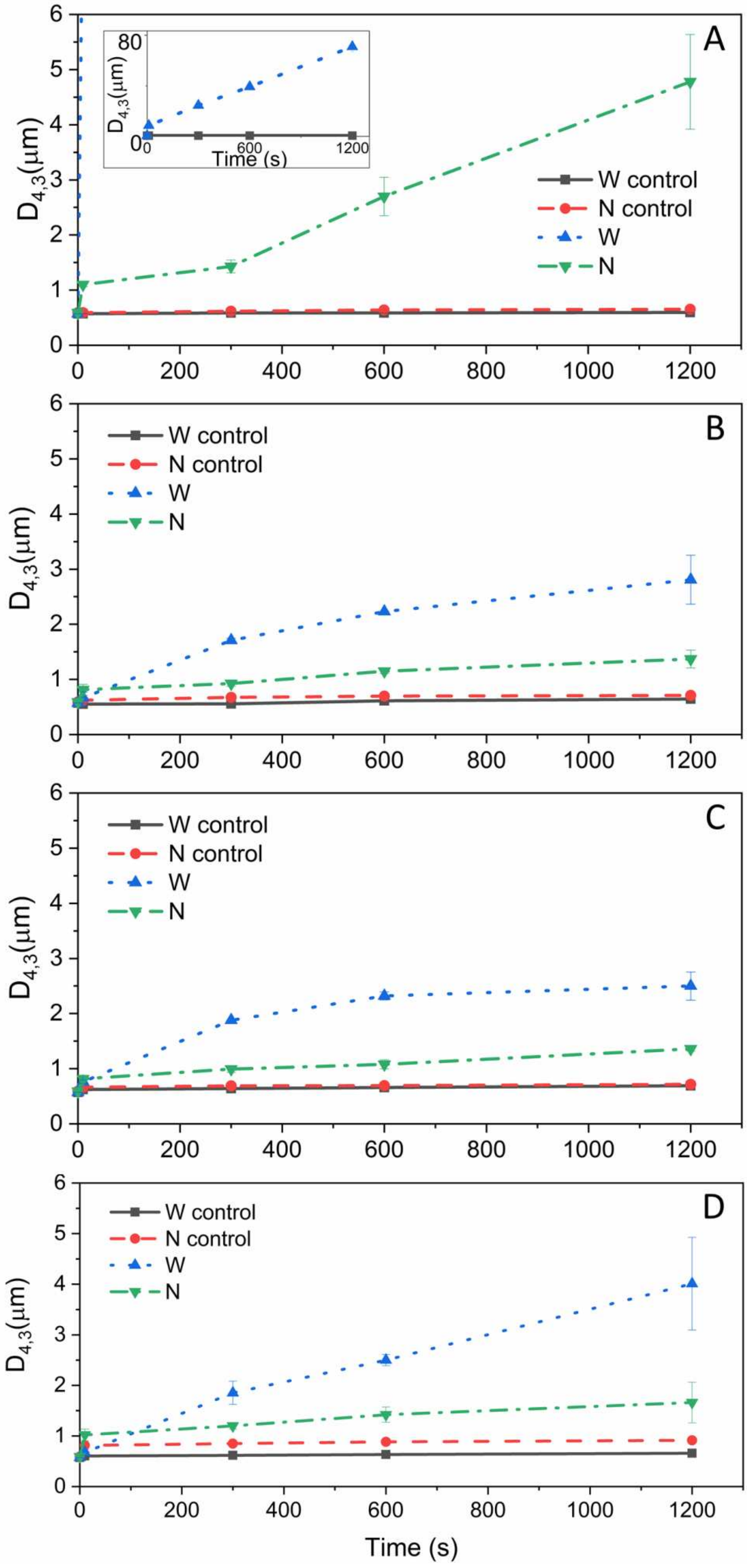

A
B
C
D
D$_{4,3}$(μm)
Time (s)
W control
N control
W
N
0
1
2
3
4
5
6
0
200
400
600
800
1000
1200
80
0
600
1200

Fig 9.

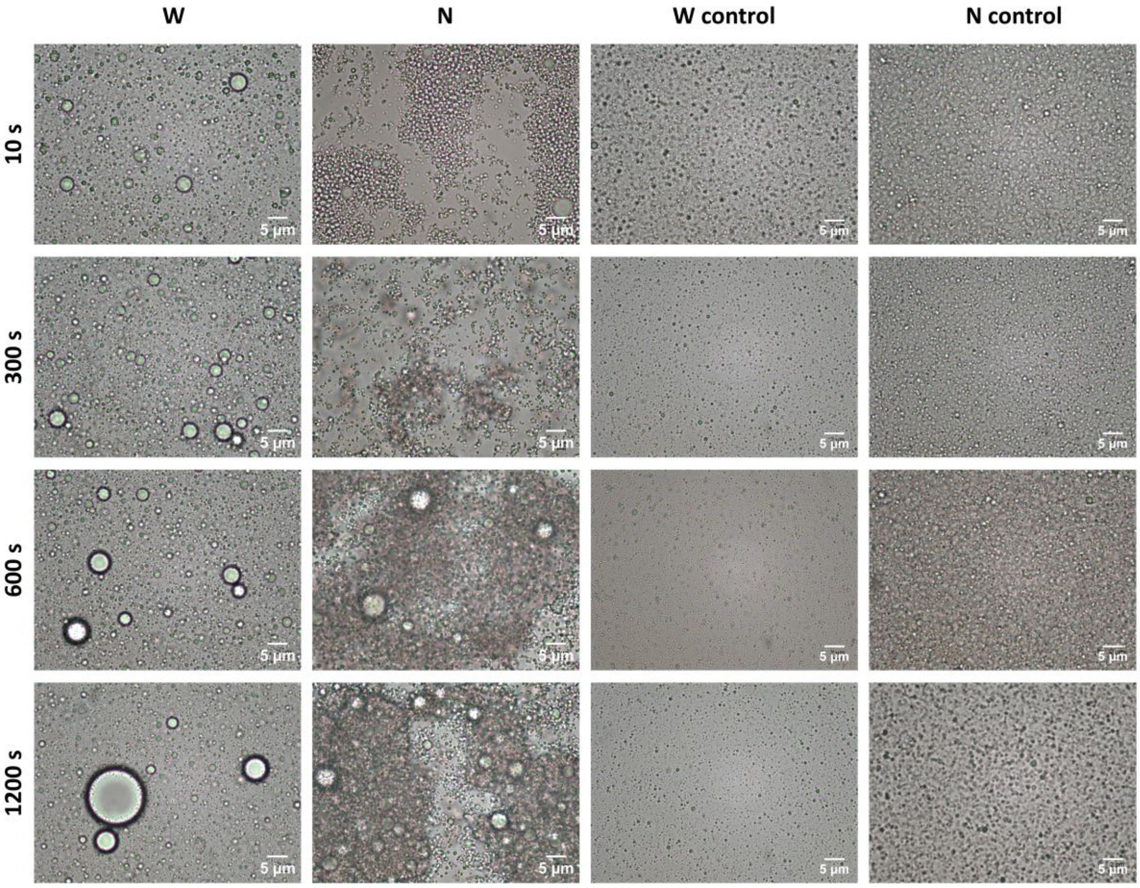


Fig 10.

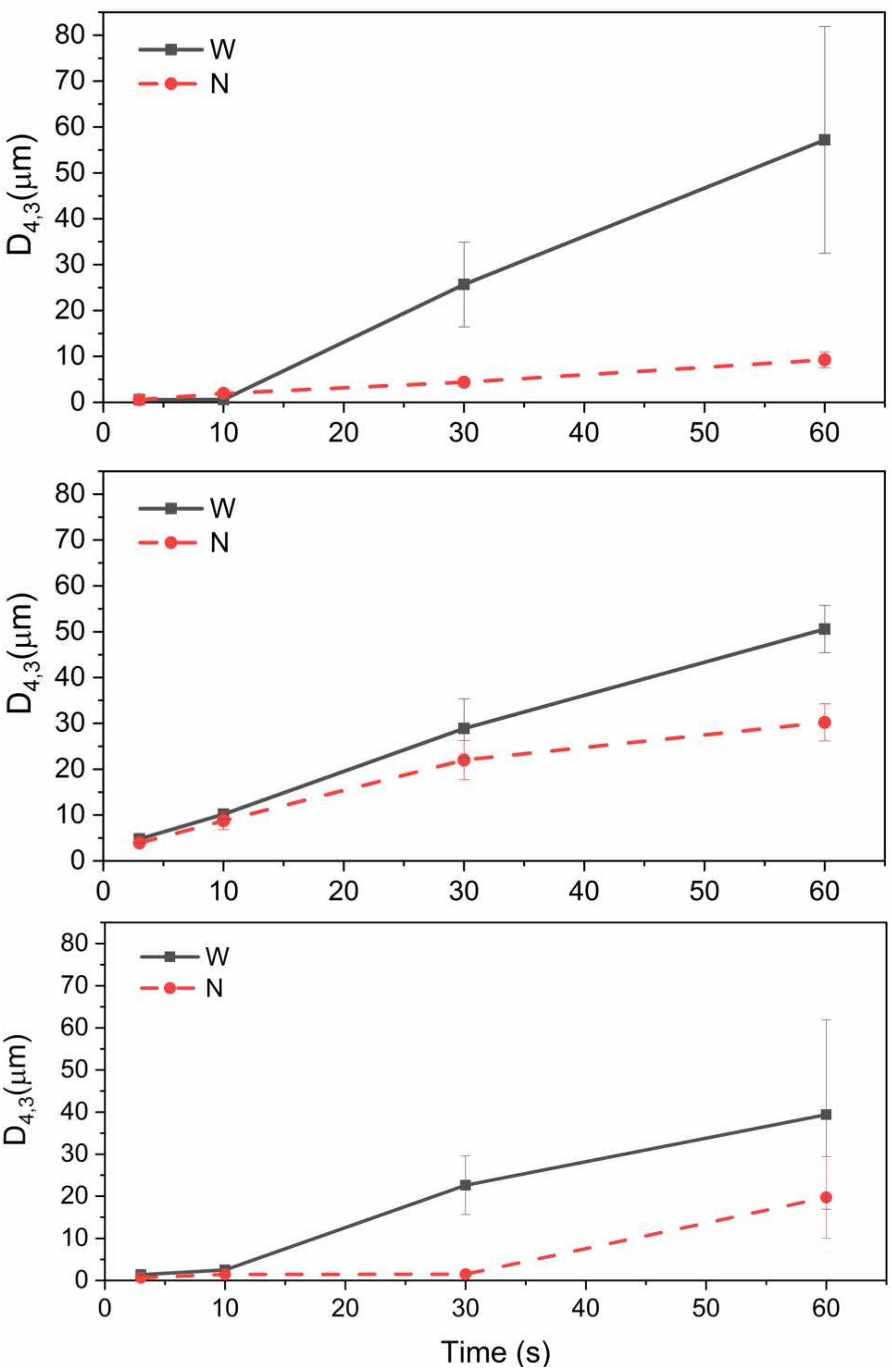


Fig 11.

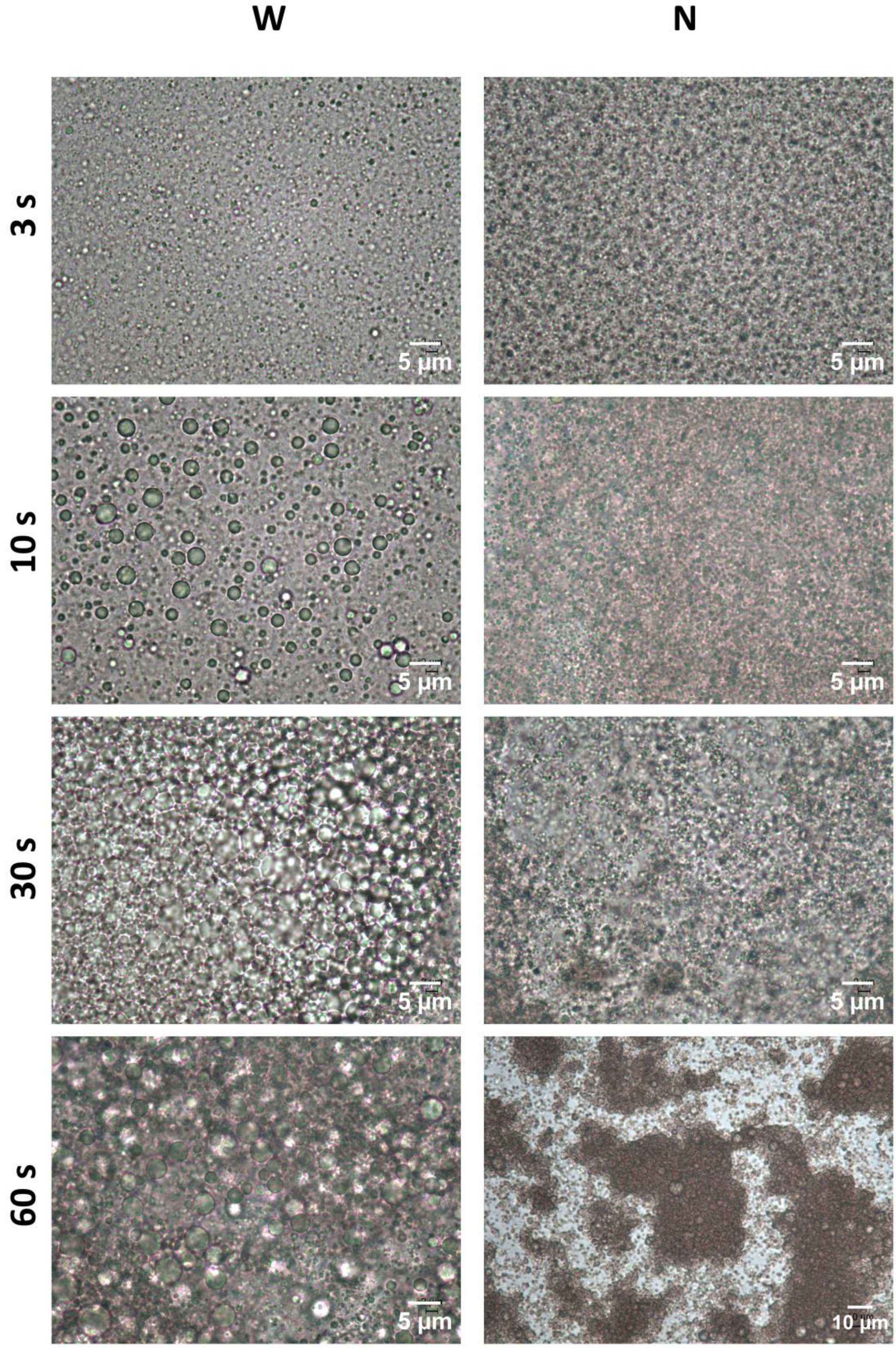
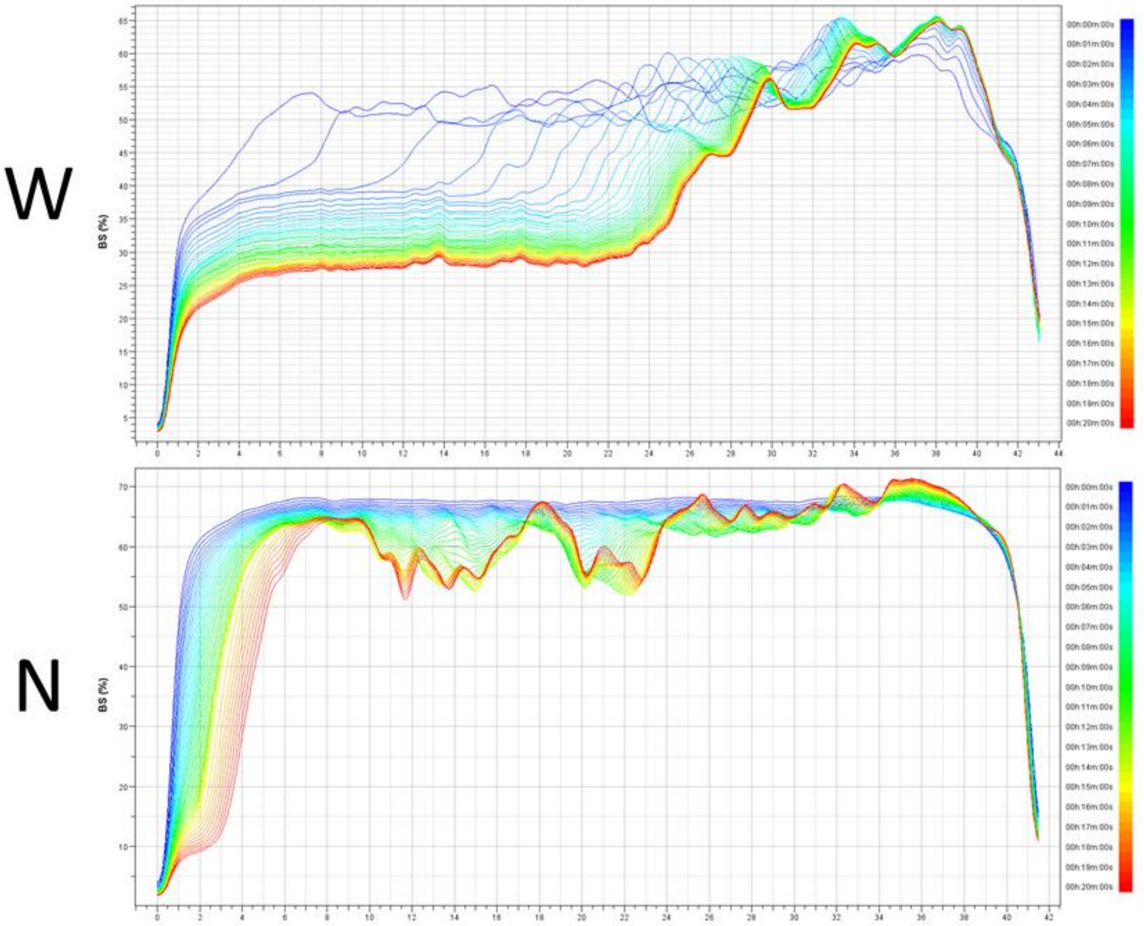


Fig 12.


W
N
BS (%)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
5
10
15
20
25
30
35
40
45
50
55
60
65
70
00h:00m:00s
00h:01m:00s
00h:02m:00s
00h:03m:00s
00h:04m:00s
00h:05m:00s
00h:06m:00s
00h:07m:00s
00h:08m:00s
00h:09m:00s
00h:10m:00s
00h:11m:00s
00h:12m:00s
00h:13m:00s
00h:14m:00s
00h:15m:00s
00h:16m:00s
00h:17m:00s
00h:18m:00s
00h:19m:00s
00h:20m:00s