Supplementary Information

Two-Stage Environmental Response of Sporosarcina pasteurii: Stepwise Alkaline–Low-NaCl Exposure and Subsequent Temperature Challenge

Supplementary multi-indicator coordination and weighting-sensitivity analysis

The supplementary analysis included only the 21 Phase II treatments, comprising three pH-NaCl backgrounds and seven temperature treatments. The Phase I values measured at 30 °C were excluded because they were obtained during the preceding sequential-exposure stage and were not part of the Phase II temperature-response experiment. Composite scores and rankings were calculated using urease activity, OD_{600}, and apparent dry precipitate mass (ADPM). The objective-subjective mixing coefficient α was varied from 0 to 1 at intervals of 0.1.

Table S1. Combined indicator weights under different values of the objective-subjective mixing coefficient α for the 21 Phase II treatments.

α	Urease activity	OD_{600}	ADPM
0.0	0.5045	0.2912	0.2043
0.1	0.4741	0.2921	0.2339
0.2	0.4436	0.2929	0.2635
0.3	0.4132	0.2938	0.2930
0.4	0.3827	0.2947	0.3226
0.5	0.3523	0.2956	0.3522
0.6	0.3218	0.2965	0.3817
0.7	0.2914	0.2974	0.4113
0.8	0.2609	0.2982	0.4409
0.9	0.2305	0.2991	0.4704
1.0	0.2000	0.3000	0.5000

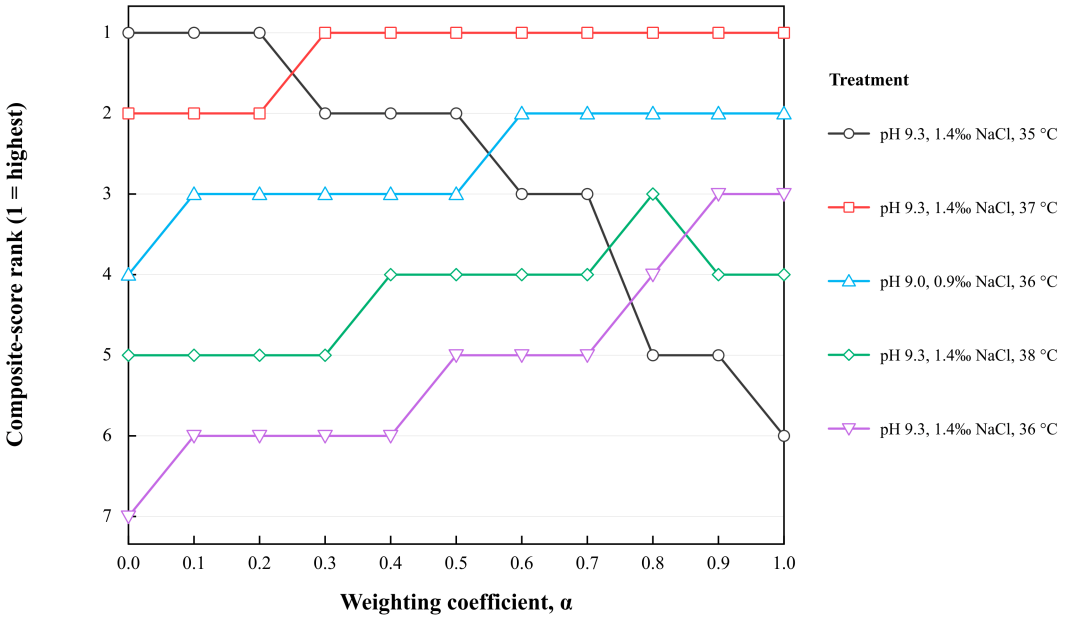
Note: α represents the objective–subjective mixing coefficient. ADPM denotes apparent dry precipitate mass. All calculations were performed using unrounded weights.

Table S2. Top three Phase II treatments and their composite scores under different values of the objective-subjective mixing coefficient α.

α	Rank 1 treatment	Rank 1 score	Rank 2 treatment	Rank 2 score	Rank 3 treatment	Rank 3 score
0.0	pH 9.3, 1.4‰ NaCl, 35 °C	0.845	pH 9.3, 1.4‰ NaCl, 37 °C	0.820	pH 9.0, 0.9‰ NaCl, 35 °C	0.777
0.1	pH 9.3, 1.4‰ NaCl, 35 °C	0.832	pH 9.3, 1.4‰ NaCl, 37 °C	0.818	pH 9.0, 0.9‰ NaCl, 36 °C	0.768
0.2	pH 9.3, 1.4‰ NaCl, 35 °C	0.820	pH 9.3, 1.4‰ NaCl, 37 °C	0.817	pH 9.0, 0.9‰ NaCl, 36 °C	0.771
0.3	pH 9.3, 1.4‰ NaCl, 37 °C	0.815	pH 9.3, 1.4‰ NaCl, 35 °C	0.807	pH 9.0, 0.9‰ NaCl, 36 °C	0.775
0.4	pH 9.3, 1.4‰ NaCl, 37 °C	0.814	pH 9.3, 1.4‰ NaCl, 35 °C	0.795	pH 9.0, 0.9‰ NaCl, 36 °C	0.778
0.5	pH 9.3, 1.4‰ NaCl, 37 °C	0.813	pH 9.3, 1.4‰ NaCl, 35 °C	0.783	pH 9.0, 0.9‰ NaCl, 36 °C	0.782
0.6	pH 9.3, 1.4‰ NaCl, 37 °C	0.811	pH 9.0, 0.9‰ NaCl, 36 °C	0.785	pH 9.3, 1.4‰ NaCl, 35 °C	0.770
0.7	pH 9.3, 1.4‰ NaCl, 37 °C	0.810	pH 9.0, 0.9‰ NaCl, 36 °C	0.789	pH 9.3, 1.4‰ NaCl, 35 °C	0.758
0.8	pH 9.3, 1.4‰ NaCl, 37 °C	0.808	pH 9.0, 0.9‰ NaCl, 36 °C	0.792	pH 9.3, 1.4‰ NaCl, 38 °C	0.757
0.9	pH 9.3, 1.4‰ NaCl, 37 °C	0.807	pH 9.0, 0.9‰ NaCl, 36 °C	0.795	pH 9.3, 1.4‰ NaCl, 36 °C	0.771
1.0	pH 9.3, 1.4‰ NaCl, 37 °C	0.805	pH 9.0, 0.9‰ NaCl, 36 °C	0.799	pH 9.3, 1.4‰ NaCl, 36 °C	0.785

Note: Composite scores were calculated from normalized urease activity, OD_{600}, and ADPM values for all 21 Phase II treatments. Treatment rankings were determined among all 21 treatments rather than only among the three treatments displayed in each row.

Figure S1 Sensitivity of representative Phase II treatment rankings to the objective-subjective mixing coefficient α.



Note: Rankings were calculated among all 21 Phase II treatments at each α value using urease activity, OD_{600}, and apparent dry precipitate mass (ADPM). Lower rank values indicate better multi-indicator coordination. The treatment at pH 9.3, 1.4‰ NaCl, and 35 °C ranked first at α = 0.0–0.2, whereas the corresponding 37 °C treatment ranked first at α = 0.3–1.0.

Table S3. Spearman rank correlations between the complete treatment ranking at each α value and the ranking obtained at α = 0.5.

α	Spearman ρ
0.0	0.9338
0.1	0.9545
0.2	0.9571
0.3	0.9831
0.4	0.9935
0.5	1.0000

α	Spearman ρ
0.6	0.9961
0.7	0.9831
0.8	0.9649
0.9	0.9597
1.0	0.9208

Note: Spearman's ρ was calculated using the complete rankings of all 21 Phase II treatments. Values closer to 1 indicate greater similarity to the ranking obtained at α = 0.5.

Table S4. Šídák-adjusted simple-effects pairwise comparisons for urease activity in Phase II.

A. Pairwise temperature comparisons within each pH–NaCl background

NaCl (‰)	Temperature comparison (°C)	Mean 1 (mM urea min⁻¹)	Mean 2 (mM urea min⁻¹)	Mean difference (1−2)	t	Šídák-adjusted P	Significance
0.9	35 vs 36	1.3554	1.1554	0.2000	3.1225	0.0659	ns
0.9	35 vs 37	1.3554	0.9110	0.4444	6.9390	<0.0001	****
0.9	35 vs 38	1.3554	0.6888	0.6666	10.4085	<0.0001	****
0.9	35 vs 39	1.3554	0.9110	0.4444	6.9390	<0.0001	****
0.9	35 vs 40	1.3554	0.6888	0.6666	10.4085	<0.0001	****
0.9	35 vs 41	1.3554	0.6666	0.6888	10.7554	<0.0001	****
0.9	36 vs 37	1.1554	0.9110	0.2444	3.8164	0.0092	**
0.9	36 vs 38	1.1554	0.6888	0.4666	7.2859	<0.0001	****
0.9	36 vs 39	1.1554	0.9110	0.2444	3.8164	0.0092	**
0.9	36 vs 40	1.1554	0.6888	0.4666	7.2859	<0.0001	****
0.9	36 vs 41	1.1554	0.6666	0.4888	7.6329	<0.0001	****
0.9	37 vs 38	0.9110	0.6888	0.2222	3.4695	0.0253	*
0.9	37 vs 39	0.9110	0.9110	0.0000	0.0000	1.0000	ns
0.9	37 vs 40	0.9110	0.6888	0.2222	3.4695	0.0253	*
0.9	37 vs 41	0.9110	0.6666	0.2444	3.8164	0.0092	**
0.9	38 vs 39	0.6888	0.9110	-0.2222	3.4695	0.0253	*
0.9	38 vs 40	0.6888	0.6888	0.0000	0.0000	1.0000	ns
0.9	38 vs 41	0.6888	0.6666	0.0222	0.3469	1.0000	ns
0.9	39 vs 40	0.9110	0.6888	0.2222	3.4695	0.0253	*
0.9	39 vs 41	0.9110	0.6666	0.2444	3.8164	0.0092	**
0.9	40 vs 41	0.6888	0.6666	0.0222	0.3469	1.0000	ns
1.4	35 vs 36	1.3776	0.9110	0.4666	7.2859	<0.0001	****
1.4	35 vs 37	1.3776	1.1554	0.2222	3.4695	0.0253	*
1.4	35 vs 38	1.3776	0.8888	0.4888	7.6329	<0.0001	****
1.4	35 vs 39	1.3776	0.9110	0.4666	7.2859	<0.0001	****
1.4	35 vs 40	1.3776	0.8888	0.4888	7.6329	<0.0001	****
1.4	35 vs 41	1.3776	0.6666	0.7110	11.1024	<0.0001	****
1.4	36 vs 37	0.9110	1.1554	-0.2444	3.8164	0.0092	**
1.4	36 vs 38	0.9110	0.8888	0.0222	0.3469	1.0000	ns
1.4	36 vs 39	0.9110	0.9110	0.0000	0.0000	1.0000	ns
1.4	36 vs 40	0.9110	0.8888	0.0222	0.3469	1.0000	ns
1.4	36 vs 41	0.9110	0.6666	0.2444	3.8164	0.0092	**
1.4	37 vs 38	1.1554	0.8888	0.2666	4.1634	0.0032	**
1.4	37 vs 39	1.1554	0.9110	0.2444	3.8164	0.0092	**
1.4	37 vs 40	1.1554	0.8888	0.2666	4.1634	0.0032	**

NaCl (‰)	Temperature comparison (°C)	Mean 1 (mM urea min⁻¹)	Mean 2 (mM urea min⁻¹)	Mean difference (1−2)	t	Šídák-adjusted P	Significance
1.4	37 vs 41	1.1554	0.6666	0.4888	7.6329	<0.0001	****
1.4	38 vs 39	0.8888	0.9110	-0.0222	0.3469	1.0000	ns
1.4	38 vs 40	0.8888	0.8888	0.0000	0.0000	1.0000	ns
1.4	38 vs 41	0.8888	0.6666	0.2222	3.4695	0.0253	*
1.4	39 vs 40	0.9110	0.8888	0.0222	0.3469	1.0000	ns
1.4	39 vs 41	0.9110	0.6666	0.2444	3.8164	0.0092	**
1.4	40 vs 41	0.8888	0.6666	0.2222	3.4695	0.0253	*
1.9	35 vs 36	0.9110	0.8221	0.0889	1.3878	0.9813	ns
1.9	35 vs 37	0.9110	0.8444	0.0667	1.0408	0.9995	ns
1.9	35 vs 38	0.9110	0.4666	0.4444	6.9390	<0.0001	****
1.9	35 vs 39	0.9110	0.6888	0.2222	3.4695	0.0253	*
1.9	35 vs 40	0.9110	0.4444	0.4666	7.2859	<0.0001	****
1.9	35 vs 41	0.9110	0.4444	0.4666	7.2859	<0.0001	****
1.9	36 vs 37	0.8221	0.8444	-0.0222	0.3469	1.0000	ns
1.9	36 vs 38	0.8221	0.4666	0.3555	5.5512	<0.0001	****
1.9	36 vs 39	0.8221	0.6888	0.1333	2.0817	0.6070	ns
1.9	36 vs 40	0.8221	0.4444	0.3777	5.8981	<0.0001	****
1.9	36 vs 41	0.8221	0.4444	0.3777	5.8981	<0.0001	****
1.9	37 vs 38	0.8444	0.4666	0.3777	5.8981	<0.0001	****
1.9	37 vs 39	0.8444	0.6888	0.1555	2.4286	0.3389	ns
1.9	37 vs 40	0.8444	0.4444	0.4000	6.2451	<0.0001	****
1.9	37 vs 41	0.8444	0.4444	0.4000	6.2451	<0.0001	****
1.9	38 vs 39	0.4666	0.6888	-0.2222	3.4695	0.0253	*
1.9	38 vs 40	0.4666	0.4444	0.0222	0.3469	1.0000	ns
1.9	38 vs 41	0.4666	0.4444	0.0222	0.3469	1.0000	ns
1.9	39 vs 40	0.6888	0.4444	0.2444	3.8164	0.0092	**
1.9	39 vs 41	0.6888	0.4444	0.2444	3.8164	0.0092	**
1.9	40 vs 41	0.4444	0.4444	0.0000	0.0000	1.0000	ns

B. Pairwise pH–NaCl background comparisons within each temperature.

Temperature (°C)	Background 1	Background 2	Mean 1 (mM urea min⁻¹)	Mean 2 (mM urea min⁻¹)	Mean difference (1−2)	t	Šídák-adjusted P	Summary
35	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.3554	1.3776	-0.0222	0.3469	0.9804	ns
35	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.3554	0.9110	0.4444	6.9390	<0.0001	****
35	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.3776	0.9110	0.4666	7.2859	<0.0001	****
36	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.1554	0.9110	0.2444	3.8164	0.0013	**
36	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.1554	0.8221	0.3333	5.2042	<0.0001	****
36	pH 9.3, 1.4‰	pH 9.6, 1.9‰	0.9110	0.8221	0.0889	1.3878	0.4334	ns
37	pH 9.0, 0.9‰	pH 9.3, 1.4‰	0.9110	1.1554	-0.2444	3.8164	0.0013	**
37	pH 9.0, 0.9‰	pH 9.6, 1.9‰	0.9110	0.8444	0.0667	1.0408	0.6627	ns
37	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.1554	0.8444	0.3111	4.8573	0.0001	****
38	pH 9.0, 0.9‰	pH 9.3, 1.4‰	0.6888	0.8888	-0.2000	3.1225	0.0097	**
38	pH 9.0, 0.9‰	pH 9.6, 1.9‰	0.6888	0.4666	0.2222	3.4695	0.0037	**

Temperature (°C)	Background 1	Background 2	Mean 1 (mM urea min⁻¹)	Mean 2 (mM urea min⁻¹)	Mean difference (1−2)	t	Šídák-adjusted P	Summary
38	pH 9.3, 1.4‰	pH 9.6, 1.9‰	0.8888	0.4666	0.4222	6.5920	<0.0001	****
39	pH 9.0, 0.9‰	pH 9.3, 1.4‰	0.9110	0.9110	0.0000	0.0000	1.0000	ns
39	pH 9.0, 0.9‰	pH 9.6, 1.9‰	0.9110	0.6888	0.2222	3.4695	0.0037	**
39	pH 9.3, 1.4‰	pH 9.6, 1.9‰	0.9110	0.6888	0.2222	3.4695	0.0037	**
40	pH 9.0, 0.9‰	pH 9.3, 1.4‰	0.6888	0.8888	-0.2000	3.1225	0.0097	**
40	pH 9.0, 0.9‰	pH 9.6, 1.9‰	0.6888	0.4444	0.2444	3.8164	0.0013	**
40	pH 9.3, 1.4‰	pH 9.6, 1.9‰	0.8888	0.4444	0.4444	6.9390	<0.0001	****
41	pH 9.0, 0.9‰	pH 9.3, 1.4‰	0.6666	0.6666	0.0000	0.0000	1.0000	ns
41	pH 9.0, 0.9‰	pH 9.6, 1.9‰	0.6666	0.4444	0.2222	3.4695	0.0037	**
41	pH 9.3, 1.4‰	pH 9.6, 1.9‰	0.6666	0.4444	0.2222	3.4695	0.0037	**

Note: Significance: ns ≥ 0.05; * < 0.05; ** < 0.01; *** < 0.001; **** < 0.0001. Urease means shown here use the revised ×2.02 scale; this uniform rescaling does not change t statistics or adjusted P values. Two-way ANOVA pooled residual MSE = 0.00150780; pairwise SE of the difference = 0.03170493 on the original response scale. Adjusted P values are based on df = 42.

Table S5. Šídák-adjusted simple-effects pairwise comparisons for OD_{600} in Phase II

A. Pairwise temperature comparisons within each pH–NaCl background

pH	NaCl (‰)	Temperature comparison (°C)	Mean 1 (OD_{600})	Mean 2 (OD_{600})	Mean difference (1−2)	t	Šídák-adjusted P	Summary
9	0.9	35 vs 36	1.5050	1.4800	0.0250	1.0827	0.9991	ns
9	0.9	35 vs 37	1.5050	1.3580	0.1470	6.3661	< 0.0001	****
9	0.9	35 vs 38	1.5050	1.5310	-0.0260	1.1260	0.9985	ns
9	0.9	35 vs 39	1.5050	1.5490	-0.0440	1.9055	0.7483	ns
9	0.9	35 vs 40	1.5050	1.4640	0.0410	1.7756	0.8381	ns
9	0.9	35 vs 41	1.5050	1.0850	0.4200	18.1890	< 0.0001	****
9	0.9	36 vs 37	1.4800	1.3580	0.1220	5.2835	0.0001	****
9	0.9	36 vs 38	1.4800	1.5310	-0.0510	2.2087	0.5026	ns
9	0.9	36 vs 39	1.4800	1.5490	-0.0690	2.9882	0.0937	ns
9	0.9	36 vs 40	1.4800	1.4640	0.0160	0.6929	1.0000	ns
9	0.9	36 vs 41	1.4800	1.0850	0.3950	17.1063	< 0.0001	****
9	0.9	37 vs 38	1.3580	1.5310	-0.1730	7.4921	< 0.0001	****
9	0.9	37 vs 39	1.3580	1.5490	-0.1910	8.2717	< 0.0001	****
9	0.9	37 vs 40	1.3580	1.4640	-0.1060	4.5906	0.0008	***
9	0.9	37 vs 41	1.3580	1.0850	0.2730	11.8228	< 0.0001	****
9	0.9	38 vs 39	1.5310	1.5490	-0.0180	0.7795	1.0000	ns
9	0.9	38 vs 40	1.5310	1.4640	0.0670	2.9016	0.1166	ns
9	0.9	38 vs 41	1.5310	1.0850	0.4460	19.3150	< 0.0001	****
9	0.9	39 vs 40	1.5490	1.4640	0.0850	3.6811	0.0137	*
9	0.9	39 vs 41	1.5490	1.0850	0.4640	20.0945	< 0.0001	****
9	0.9	40 vs 41	1.4640	1.0850	0.3790	16.4134	< 0.0001	****
9.3	1.4	35 vs 36	1.5207	1.4600	0.0607	2.6273	0.2233	ns
9.3	1.4	35 vs 37	1.5207	1.6620	-0.1413	6.1207	< 0.0001	****
9.3	1.4	35 vs 38	1.5207	1.5570	-0.0363	1.5735	0.9366	ns

pH	NaCl (‰)	Temperature comparison (°C)	Mean 1 (OD_{600})	Mean 2 (OD_{600})	Mean difference (1−2)	t	Šídák-adjusted P	Summary
9.3	1.4	35 vs 39	1.5207	1.3620	0.1587	6.8714	< 0.0001	****
9.3	1.4	35 vs 40	1.5207	1.2000	0.3207	13.8872	< 0.0001	****
9.3	1.4	35 vs 41	1.5207	1.3680	0.1527	6.6116	< 0.0001	****
9.3	1.4	36 vs 37	1.4600	1.6620	-0.2020	8.7480	< 0.0001	****
9.3	1.4	36 vs 38	1.4600	1.5570	-0.0970	4.2008	0.0028	**
9.3	1.4	36 vs 39	1.4600	1.3620	0.0980	4.2441	0.0025	**
9.3	1.4	36 vs 40	1.4600	1.2000	0.2600	11.2599	< 0.0001	****
9.3	1.4	36 vs 41	1.4600	1.3680	0.0920	3.9843	0.0055	**
9.3	1.4	37 vs 38	1.6620	1.5570	0.1050	4.5472	0.0010	***
9.3	1.4	37 vs 39	1.6620	1.3620	0.3000	12.9921	< 0.0001	****
9.3	1.4	37 vs 40	1.6620	1.2000	0.4620	20.0079	< 0.0001	****
9.3	1.4	37 vs 41	1.6620	1.3680	0.2940	12.7323	< 0.0001	****
9.3	1.4	38 vs 39	1.5570	1.3620	0.1950	8.4449	< 0.0001	****
9.3	1.4	38 vs 40	1.5570	1.2000	0.3570	15.4606	< 0.0001	****
9.3	1.4	38 vs 41	1.5570	1.3680	0.1890	8.1850	< 0.0001	****
9.3	1.4	39 vs 40	1.3620	1.2000	0.1620	7.0158	< 0.0001	****
9.3	1.4	39 vs 41	1.3620	1.3680	-0.0060	0.2598	1.0000	ns
9.3	1.4	40 vs 41	1.2000	1.3680	-0.1680	7.2756	< 0.0001	****
9.6	1.9	35 vs 36	1.2880	1.2660	0.0220	0.9528	0.9999	ns
9.6	1.9	35 vs 37	1.2880	1.5470	-0.2590	11.2165	< 0.0001	****
9.6	1.9	35 vs 38	1.2880	1.5570	-0.2690	11.6496	< 0.0001	****
9.6	1.9	35 vs 39	1.2880	1.1560	0.1320	5.7165	< 0.0001	****
9.6	1.9	35 vs 40	1.2880	1.3240	-0.0360	1.5591	0.9416	ns
9.6	1.9	35 vs 41	1.2880	1.2770	0.0110	0.4764	1.0000	ns
9.6	1.9	36 vs 37	1.2660	1.5470	-0.2810	12.1693	< 0.0001	****
9.6	1.9	36 vs 38	1.2660	1.5570	-0.2910	12.6024	< 0.0001	****
9.6	1.9	36 vs 39	1.2660	1.1560	0.1100	4.7638	0.0005	***
9.6	1.9	36 vs 40	1.2660	1.3240	-0.0580	2.5118	0.2864	ns
9.6	1.9	36 vs 41	1.2660	1.2770	-0.0110	0.4764	1.0000	ns
9.6	1.9	37 vs 38	1.5470	1.5570	-0.0100	0.4331	1.0000	ns
9.6	1.9	37 vs 39	1.5470	1.1560	0.3910	16.9331	< 0.0001	****
9.6	1.9	37 vs 40	1.5470	1.3240	0.2230	9.6575	< 0.0001	****
9.6	1.9	37 vs 41	1.5470	1.2770	0.2700	11.6929	< 0.0001	****
9.6	1.9	38 vs 39	1.5570	1.1560	0.4010	17.3662	< 0.0001	****
9.6	1.9	38 vs 40	1.5570	1.3240	0.2330	10.0906	< 0.0001	****
9.6	1.9	38 vs 41	1.5570	1.2770	0.2800	12.1260	< 0.0001	****
9.6	1.9	39 vs 40	1.1560	1.3240	-0.1680	7.2756	< 0.0001	****
9.6	1.9	39 vs 41	1.1560	1.2770	-0.1210	5.2402	0.0001	***
9.6	1.9	40 vs 41	1.3240	1.2770	0.0470	2.0354	0.6452	ns

B. Pairwise pH–NaCl background comparisons within each temperature

Temperature (°C)	Background 1	Background 2	Mean 1 (OD_{600})	Mean 2 (OD_{600})	Mean difference (1−2)	t	Šídák-adjusted P	Summary

Temperature (°C)	Background 1	Background 2	Mean 1 (OD_{600})	Mean 2 (OD_{600})	Mean difference (1−2)	t	Šídák-adjusted P	Summary
35	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.5050	1.5207	-0.0157	0.6785	0.8759	ns
35	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.5050	1.2880	0.2170	9.3976	< 0.0001	****
35	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.5207	1.2880	0.2327	10.0761	< 0.0001	****
36	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.4800	1.4600	0.0200	0.8661	0.7745	ns
36	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.4800	1.2660	0.2140	9.2677	< 0.0001	****
36	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.4600	1.2660	0.1940	8.4016	< 0.0001	****
37	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.3580	1.6620	-0.3040	13.1654	< 0.0001	****
37	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.3580	1.5470	-0.1890	8.1850	< 0.0001	****
37	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.6620	1.5470	0.1150	4.9803	< 0.0001	****
38	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.5310	1.5570	-0.0260	1.1260	0.6055	ns
38	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.5310	1.5570	-0.0260	1.1260	0.6055	ns
38	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.5570	1.5570	0.0000	0.0000	1.0000	ns
39	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.5490	1.3620	0.1870	8.0984	< 0.0001	****
39	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.5490	1.1560	0.3930	17.0197	< 0.0001	****
39	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.3620	1.1560	0.2060	8.9213	< 0.0001	****
40	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.4640	1.2000	0.2640	11.4331	< 0.0001	****
40	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.4640	1.3240	0.1400	6.0630	< 0.0001	****
40	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.2000	1.3240	-0.1240	5.3701	< 0.0001	****
41	pH 9.0, 0.9‰	pH 9.3, 1.4‰	1.0850	1.3680	-0.2830	12.2559	< 0.0001	****
41	pH 9.0, 0.9‰	pH 9.6, 1.9‰	1.0850	1.2770	-0.1920	8.3150	< 0.0001	****
41	pH 9.3, 1.4‰	pH 9.6, 1.9‰	1.3680	1.2770	0.0910	3.9409	< 0.0001	***

Note: Significance: ns ≥ 0.05; * < 0.05; ** < 0.01; *** < 0.001; **** < 0.0001.Two-way ANOVA pooled residual MSE = 0.00079978; pairwise SE of the difference = 0.02309089 on the original response scale. Adjusted P values are based on df = 42.