SUPPLEMENTARY DATA
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TABLE S1. Screening results—Interaction BWa156 *vs.* BZr6

Factors		1	2	3	4	5	6	7	8	9	10	11	12
Cl_3Fe	mg mL^{-1}	20	0	0	20	0	20	0	0	20	0	20	20
Agitation		YES	YES	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES
Nitrogen (YAN)	mg mL^{-1}	200	200	300	300	300	200	300	200	300	200	300	200
Reducing sugars	°Brix	23	25	25	25	23	23	23	25	25	23	23	25
Ethanol	% v/v	0	5	0	5	5	5	5	0	0	0	0	5
B/S ratio		1	0.02	0.02	0.02	1	0.02	1	1	1	0.02	0.02	1
Temperature	°C	20	25	20	20	25	25	20	25	25	20	25	20
pH		4	4	4	3.5	3.5	4	4	3.5	4	3.5	3.5	3.5
Glycerol	g/L	5	5	0	5	0	0	5	5	0	0	5	0
SO_2 molecular	mg mL^{-1}	0.6	0	0.6	0.6	0.6	0.6	0	0.6	0	0	0	0
Dummy		-1	-1	1	-1	-1	1	1	1	-1	-1	1	1
Spoilage (BZr6)	cell mL^{-1}	0	$6.08*10^6$	0	0	0	0	$4.1*10^6$	0	$9.56*10^6$	$4.18*10^6$	$6.2*10^6$	$1.81*10^7$
Biocontroller (BWa156)	cell mL^{-1}	0	$6*10^4$	0	0	0	0	$3.5*10^6$	0	$1.6*10^5$	$2*10^4$	0	0

Table S2. Screening—Interaction BWa156 *vs.* BZr6—Spoilage (BZr6). Statistical analysis

	Sum of squares	middle squares	f value	p value Prob>f	
Model	140.687288	23.4478813	4506.10294	< 0.0001	Significant
A-$FeCl_3$	0.08545741	0.08545741	16.4228019	0.0098	
B-Agitation	0.03198744	0.03198744	6.14719518	0.0559	
D-red. sugars	0.08261623	0.08261623	15.8767963	0.0105	
F-B/S ratio	0.03558293	0.03558293	6.83815999	0.0474	
J-Glycerol	0.03743442	0.03743442	7.19396934	0.0437	
K-SO_2 molecular	140.414209	140.414209	26984.1387	< 0.0001	
Residue	0.02601792	0.00520358			

R^2: 0.99
Model:
Agitation (NO)
Log10 (Spoilage + 1.00) = + 5.94270 + 8.43887E-003 * $FeCl_3$ + 3.01724 * 10^{-3} * Red. sugars + 0.11113 * B/S ratio - 0.013963 * Glycerol - 8.55175 * SO_2 molecular
Agitation (YES)
Log10 (Spoilage + 1.00) = + 6.04596 + 8.43887 * 10^{-3} * $FeCl_3$ + 3.01724 * 10^{-3} * Red. sugars + 0.11113 * B/S ratio - 0.013963 * Glycerol - 8.55175 * SO_2 molecular

TABLE S3. Screening—Interaction BWa156 *vs.* BZr6—Biocontroller (BWa156). Statistical analysis

	Sum of squares	middle squares	f value	p value Prob>f	
Model	68.2362232	17.0590558	17.425092	0.0010	Significant
A-$FeCl_3$	9.04656707	9.04656707	9.2406793	0.0189	
B-Agitation	10.5864447	10.5864447	10.8135981	0.0133	
H-pH	12.4548252	12.4548252	12.7220684	0.0091	
K-SO_2 molecular	36.1483863	36.1483863	36.9240223	0.0005	
Residue	6.85295609	0.97899373			

R^2: 0.9
Model:
Agitation (NO)
Log10 (Biocontroller + 1.00) = - 10.00286856 - 0.086826297 * $FeCl_3$ + 4.075099215 * pH - 4.339041888 * SO_2 molecular
Agitation (YES)
Log10 (Biocontroller + 1.00) = - 11.88138258 - 0.086826297 * $FeCl_3$ + 4.075099215 * pH - 4.339041888 * SO_2 molecular

TABLE S4. Screening results—Interaction BMp29 *vs.* BZr6

Factors		1	2	3	4	5	6	7	8	9	10	11	12
Cl_3Fe	mg mL^{-1}	20	0	0	20	0	20	0	0	20	0	20	20
Agitation		YES	YES	YES	NO	YES	NO	NO	NO	NO	NO	YES	YES
Nitrogen (YAN)	mg mL^{-1}	200	200	300	300	300	200	300	200	300	200	300	200
Reducing sugars	°Brix	23	25	25	25	23	23	23	25	25	23	23	25
Ethanol	% v/v	0	5	0	5	5	5	5	0	0	0	0	5
B/S ratio		1	0.02	0.02	0.02	1	0.02	1	1	1	0.02	0.02	1
Temperature	°C	20	25	20	20	25	25	20	25	25	20	25	20
pH		4	4	4	3.5	3.5	4	4	3.5	4	3.5	3.5	3.5
Glycerol	g/L	5	5	0	5	0	0	5	5	0	0	5	0
SO_2 molecular	mg mL^{-1}	0.6	0	0.6	0.6	0.6	0.6	0	0.6	0	0	0	0
Dummy		-1	-1	1	-1	-1	1	1	1	-1	-1	1	1
Spoilage (BZr6)	cell mL^{-1}	$2.20 *10^5$	$2.69 *10^6$	$1.00 *10^2$	$3.86 *10^6$	$1.41 *10^6$	$3.67 *10^6$	$1.78 *10^6$	$1.15 *10^6$	$1.70 *10^5$	$1.00 *10^5$	$1.17 *10^7$	$3.52 *10^6$
Biocontroller (BMp29)	cell mL^{-1}	$1.00 *10^4$	$5.30 *10^6$	$4.50 *10^5$	$8.45 *10^6$	$2.00 *10^6$	$6.35 *10^6$	$9.75 *10^6$	$2.35 *10^6$	$6.00 *10^5$	$1.25 *10^6$	$1.69 *10^7$	$1.30 *10^7$

TABLE S5. Screening—Interaction BMp29 *vs.* BZr6—Spoilage (BZr6). Statistical analysis

	Sum of squares	middle squares	f value	p value Prob > f	
Model	19.0316464	2.3789558	10.2041793	0.0411	Significant
A-$FeCl_3$	2.47117201	2.47117201	10.5997271	0.0473	
C-Nitrogen (YAN)	0.58688373	0.58688373	2.51735103	0.2108	
D-red. sugars	1.03117224	1.03117224	4.4230609	0.1262	
E-Ethanol	5.0960208	5.0960208	21.858628	0.0185	
G-Temperature	2.7780494	2.7780494	11.9160323	0.0409	
H-pH	2.60430075	2.60430075	11.1707632	0.0443	
J-Glycerol	3.24893578	3.24893578	13.9358298	0.0335	
K-SO_2 molecular	1.21511166	1.21511166	5.21204188	0.1066	
Residue	0.69940631	0.23313544			

R^2: 0.96
Model:
Log10 (Spoilage + 1.00) = + 15.26061 + 0.045380 * $FeCl_3$ - 4.42298 * 10^{-3} * Nitrogen (YAN) - 0.29314 * Red. sugars + 0.26067 * Ethanol + 0.19246 * Temperature - 1.86344 * pH + 0.20813 * Glycerol - 1.59106 * SO_2 molecular

TABLE S6. Screening—Interaction BMp29 *vs.* BZr6—Biocontroller (BMp29). Statistical analysis

	Sum of squares	middle squares	f value	p value Prob > f	
Model	5.92666863	0.84666695	30.9619678	0.0025	Significant
A-$FeCl_3$	0.21964338	0.21964338	8.03219163	0.0471	
C-Nitrogen (YAN)	0.0797463	0.0797463	2.91626169	0.1629	
E-Ethanol	2.70140692	2.70140692	98.7884012	0.0006	
F-B/S ratio	0.42748958	0.42748958	15.6329695	0.0168	
G-Temperature	0.47554025	0.47554025	17.3901462	0.0140	
J-Glycerol	1.91106613	1.91106613	69.886238	0.0011	
K-SO_2 molecular	0.11177608	0.11177608	4.08756627	0.1133	
Residue	0.10938154	0.02734539			

R^2: 0.98
Model:
Log10 (Biocontroller + 1.00) = + 8.47828 - 0.013529 * $FeCl_3$ + 1.63040 * 10^{-3} * Nitrogen (YAN) - 0.18979 * Ethanol + 0.38519 * B/S ratio - 0.079627 * Temperature - 0.15963 * Glycerol + 0.096513 * SO_2 molecular

OPTIMISATION RESULTS

Table S7. Optimisation results—Interaction BWa156 *vs.* BZr6

Factors	pH	SO_2 molecular	Reducing sugars	Spoilage (BZr6)	Biocontroller (BWa156)
Assay		mg mL^{-1}	°Brix	cell mL^{-1}	cell mL^{-1}
1	4.2	0	24.5	$1.50*10^5$	$2.65*10^7$
2	3.7	0.25	24.5	$1.00*10^5$	$1.56*10^7$
3	3.2	0.25	23	$5.95*10^6$	0.00
4	3.2	0.25	26	$7.40*10^6$	0.00
5	3.2	0.5	24.5	$8.20*10^6$	0.00
6	4.2	0.25	23	0.00	$2.39*10^7$
7	3.2	0	24.5	$3.20*10^6$	0.00
8	3.7	0	23	0.00	$9.75*10^6$
9	3.7	0.25	24.5	$1.00*10^5$	$9.60*10^6$
10	3.7	0.25	24.5	$3.40*10^5$	$1.36*10^7$
11	3.7	0	26	$1.00*10^3$	$1.42*10^7$
12	3.7	0.5	23	0.00	$1.87*10^7$
13	4.2	0.5	24.5	0.00	$2.73*10^7$
14	3.7	0.25	24.5	$1.00*10^4$	$1.40*10^7$
15	4.2	0.25	26	0.00	$1.23*10^7$
16	3.7	0.5	26	$1.00*10^3$	$1.60*10^7$

TABLE S8. Optimization—Interaction BWa156 *vs.* BZr6—Spoilage (BZr6). Statistical analysis

	SUM OF SQUARES	MIDDLE SQUARES	F VALUE	P VALUE PROB>F	
MODEL	103.923483	12.9904354	7.53063381	0.0076	Significant
A-PH	59.8780097	59.8780097	34.7116436	0.0006	
B-SO_2 MOLECULAR	2.84104903	2.84104903	1.64697327	0.2402	
C-REDUCING SUGARS	4.64451635	4.64451635	2.69245416	0.1448	
AB	7.79738033	7.79738033	4.52018844	0.0711	
AC	0.00224272	0.00224272	0.00130012	0.9722	
A^2	2.81099303	2.81099303	1.62954963	0.2425	
B^2	4.60033304	4.60033304	2.66684083	0.1465	
C^2	21.348959	21.348959	12.3761204	0.0098	
RESIDUE	12.0750856	1.72501223			
LACK OF FIT	10.8475667	2.71189168	6.62773941	0.0761	No significant
PURE ERROR	1.22751885	0.40917295			

R^2: 0.89
Model:
Log10 (Spoilage + 1.00) = - 571.40452 - 26.71948 * pH + 47.52285 * SO_2 molecular + 50.93682 * Red. sugars - 11.16952 * pH * SO_2 molecular - 0.031572 * pH * Red. sugars + 3.35320 * pH^2 - 17.15871 * SO_2 $molecular^2$ - 1.02678 * Red. $sugars^2$

TABLE S9. Optimisation—Interaction BWa156 *vs.* BZr6—Biocontroller (BWa156). Statistical analysis

	SUM OF SQUARES	MIDDLE SQUARES	F VALUE	P VALUE PROB>F	
MODELO	155.608138	77.8040691	6683.06604	< 0.0001	Significant
A-PH	107.502483	107.502483	9234.04394	< 0.0001	
A^2	48.1056552	48.1056552	4132.08813	< 0.0001	
RESIDUE	0.15134564	0.01164197			
LACK OF FIT	0.12653854	0.01265385	1.53027013	0.4012	No significant
PURE ERROR	0.0248071	0.00826903			

R^2: 0.99
Model:
Log10 (Biocontroller + 1.00) = - 209.89583 + 109.98172 * pH – 13.87165 * pH^2

TABLE S10. Optimisation results—Interaction BMp29 *vs.* BZr6

Factors	Ethanol	pH	Temperature	B/S ratio	Time	Spoilage (BZr6)	Biocontroller (BMp29)
Assay	**% v/v**		**°C**		**days**	**cell mL^{-1}**	**cell mL^{-1}**
1	2.5	3.2	21	0.51	0	1.28*10^{6}	7.20*10^{5}
2	2.5	3.7	21	0.51	2.5	7.11*10^{6}	1.97*10^{7}
3	2.5	3.2	21	1	2.5	1.25*10^{6}	1.40*10^{7}
4	2.5	3.7	21	1	0	1.00*10^{6}	1.00*10^{6}
5	2.5	4.2	25	0.51	2.5	6.63*10^{6}	1.53*10^{7}
6	2.5	3.7	17	1	2.5	1.73*10^{6}	6.89*10^{6}
7	5	3.2	21	0.51	2.5	7.35*10^{6}	8.14*10^{6}
8	0	4.2	21	0.51	2.5	4.49*10^{6}	1.62*10^{7}
9	2.5	3.2	25	0.51	2.5	4.21*10^{6}	1.29*10^{7}
10	2.5	3.7	25	1	2.5	5.48*10^{6}	1.37*10^{7}
11	2.5	3.2	21	0.02	2.5	3.89*10^{6}	1.13*10^{7}
12	2.5	3.7	21	0.51	2.5	4.81*10^{6}	1.21*10^{7}
13	2.5	3.7	17	0.02	2.5	3.79*10^{6}	2.36*10^{6}
14	2.5	4.2	21	0.51	5	3.30*10^{6}	2.29*10^{7}
15	2.5	3.2	21	0.51	5	1.00*10^{7}	3.53*10^{6}
16	0	3.7	21	0.51	5	2.28*10^{6}	2.66*10^{7}
17	2.5	3.7	25	0.51	5	3.60*10^{6}	5.90*10^{6}
18	2.5	3.7	21	0.51	2.5	2.84*10^{6}	7.20*10^{6}
19	2.5	3.7	25	0.02	2.5	7.71*10^{6}	5.69*10^{6}
20	2.5	3.2	17	0.51	2.5	3.10*10^{6}	1.68*10^{7}
21	2.5	3.7	17	0.51	0	1.28*10^{6}	7.20*10^{5}
22	5	4.2	21	0.51	2.5	9.90*10^{6}	1.37*10^{7}
23	2.5	3.7	21	0.51	2.5	6.00*10^{6}	2.52*10^{7}
24	0	3.7	17	0.51	2.5	1.35*10^{6}	2.89*10^{7}
25	2.5	3.7	21	0.51	2.5	4.73*10^{6}	1.67*10^{7}
26	2.5	3.7	25	0.51	0	1.28*10^{6}	7.20*10^{5}
27	2.5	4.2	21	0.51	0	1.28*10^{6}	7.20*10^{5}
28	0	3.2	21	0.51	2.5	3.23*10^{6}	2.38*10^{7}
29	0	3.7	21	0.02	2.5	1.92*10^{6}	8.06*10^{6}
30	2.5	4.2	17	0.51	2.5	3.27*10^{6}	1.76*10^{7}
31	2.5	4.2	21	0.02	2.5	9.53*10^{6}	1.14*10^{7}
32	5	3.7	21	0.51	0	1.28*10^{6}	7.20*10^{5}
33	2.5	3.7	21	1	5	2.13*10^{6}	4.40*10^{6}
34	5	3.7	21	0.02	2.5	1.73*10^{7}	4.16*10^{6}
35	0	3.7	21	0.51	0	1.28*10^{6}	7.20*10^{5}
36	2.5	3.7	17	0.51	5	5.73*10^{6}	1.51*10^{7}
37	5	3.7	21	1	2.5	3.28*10^{6}	1.38*10^{7}
38	2.5	3.7	21	0.02	5	9.05*10^{6}	6.65*10^{6}
39	2.5	3.7	21	0.02	0	1.80*10^{6}	2.00*10^{5}
40	2.5	3.7	21	0.51	2.5	4.43*10^{6}	2.16*10^{7}
41	0	3.7	25	0.51	2.5	2.34*10^{6}	2.49*10^{7}
42	5	3.7	25	0.51	2.5	2.26*10^{6}	7.37*10^{6}
43	5	3.7	21	0.51	5	4.15*10^{6}	3.23*10^{6}
44	2.5	4.2	21	1	2.5	4.07*10^{6}	3.68*10^{7}
45	0	3.7	21	1	2.5	9.10*10^{5}	2.62*10^{7}
46	5	3.7	17	0.51	2.5	4.02*10^{6}	5.46*10^{6}

TABLE S11. Optimisation—Interaction BMp29 *vs.* BZr6—Spoilage (BZr6). Statistical analysis

	SUM OF SQUARES	MIDDLE SQUARES	F VALUE	P VALUE PROB>F	
MODEL	3.14413063	0.31441306	8.816191	< 0.0001	Significant
A-ETHANOL	0.53765506	0.53765506	15.0759313	0.0004	
B-PH	0.05221682	0.05221682	1.46416764	0.2344	
C-TEMPERATURE	0.06706838	0.06706838	1.88060764	0.1790	
D-B/S RATIO	0.67333249	0.67333249	18.8803474	0.0001	
E-TIME	1.09887776	1.09887776	30.8127028	< 0.0001	
A^2	0.10690991	0.10690991	2.99777039	0.0922	
B^2	0.01443595	0.01443595	0.40478629	0.5288	
C^2	0.07537142	0.07537142	2.11342617	0.1549	
D^2	0.03334964	0.03334964	0.93512917	0.3402	
E^2	0.54683704	0.54683704	15.3333952	0.0004	
RESIDUE	1.24820994	0.03566314			
LACK OF FIT	1.15646123	0.03854871	2.10077664	0.2088	No significant
PURE ERROR	0.09174871	0.01834974			

R^2: 0.77
Model:
Log10 (Spoilage + 1.00) = + 4.92412 + 0.16187 * Ethanol – 1.08960 * pH + 0.26013 * Temperature – 0.15605 * B/S ratio + 0.30508 * Time – 0.017709 * $Ethanol^2$ + 0.16268 * pH^2-5.80823 * 10^{-3} * $Temperature^2$ – 0.25746 * B/S $ratio^2$ – 0.040051 * $Time^2$

Table S12. Optimization—Interaction BMp29 *vs.* BZr6—Biocontroller (BMp29). Statistical analysis

	SUM OF SQUARES	MIDDLE SQUARES	F VALUE	P VALUE PROB>F	
MODEL	13.0194893	1.18358994	39.5810483	< 0.0001	Significant
A-ETHANOL	0.66890396	0.66890396	22.3691662	< 0.0001	
B-PH	0.12126002	0.12126002	4.05511972	0.0520	
C-TEMPERATURE	0.00164938	0.00164938	0.05515788	0.8157	
D-B/S RATIO	0.56330327	0.56330327	18.8377182	0.0001	
E-TIME	4.85173474	4.85173474	162.249392	< 0.0001	
AE	0.20955094	0.20955094	7.0077023	0.0122	
BE	0.16511067	0.16511067	5.52155217	0.0247	
DE	0.19286906	0.19286906	6.44983482	0.0158	
C^2	0.09839781	0.09839781	3.29057242	0.0785	
D^2	0.40155452	0.40155452	13.428594	0.0008	
E^2	6.18074251	6.18074251	206.693433	< 0.0001	
RESIDUE	1.01670015	0.02990295			
LACK OF FIT	0.81763073	0.02819416	0.70814899	0.7507	No significant
PURE ERROR	0.19906943	0.03981389			

R^2: 0.93
Model:
Log10 (Biocontroller + 1.00) = + 3.26997 + 9.76692 * 10^{-3} * Ethanol – 0.23223 * pH + 0.26447 * Temperature + 1.68741 * B/S ratio + 0.43453 * Time – 0.036621 * Ethanol * Time + 0.16254 * pH * Time – 0.17925 * B/S ratio * Time – 6.23652 * 10^{-3} * $Temperature^2$ – 0.83956 * B/S $ratio^2$ – 0.12653 * $Time^2$