SUPPLEMENTARY MATERIAL















Table S1. Regression coefficients of SOP of the bread with yeast extract model for chemical composition

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Proteins | Starch | Fat | Total sugars | Cellulose |
| β0 | 19.48823\* | 60.25488\* | 2.233773\* | 0.112927 | 2.527256\* |
| β1 | 0.66427 | -0.22688 | -0.026401\* | 0.210073 | -0.037756 |
| β11 | 0.09820 | 0.01303 | 0.000220 | 0.009180 | -0.002332 |
| β2 | -2.75701 | 2.52659 | 0.130632\* | 2.611951 | 0.255671 |
| β22 | 0.60488 | -1.39415 | -0.064125\* | -0.810488 | -0.128293 |
| β3 | -0.38412 | -0.86644\* | -0.026597\* | 1.069037\* | -0.028628 |
| β33 | 0.00505 | -0.00234 | 0.000220\* | -0.008705 | -0.000283 |
| β12 | -0.20322 | -0.34146\* | 0.001035 | -0.182878 | 0.019073 |
| β13 | -0.01312 | -0.00095 | 0.000443\* | -0.016288 | 0.000307 |
| β23 | 0.09739 | 0.20727\* | 0.001075\* | -0.015439 | 0.006537 |
| R2 | 0.975 | 0.998 | 0.999 | 0.999 | 0.935 |
| Kind of local extremum | max | max | min | min | max |
| Calculated critical value (% d.m.) | 22.09 | 61.39 | 1.97 | 1.55 | 2.65 |
| Yeast extract (% d.m.) | 5 | 0 | 5 | 5 | 0 |
| Salt (% d.m.) | 1 | 1 | 1 | 2 | 1 |
| Sugar (% d.m.) | 0 | 0 | 10 | 0 | 0 |

\* Statistically significant at p<0.05 level

Table S2. Regression coefficients of SOP of the bread with yeast extract model for mineral composition

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Zn | Cu | Mg | Ca | Fe |
| β0 | 21.05561\* | 5.905732\* | 238.2642\* | 95.7865\* | 43.74018\* |
| β1 | 0.56339\* | -0.064232\* | 26.4998\* | 11.3420\* | 0.63632 |
| β11 | 0.01643 | -0.001405 | -0.1098 | -0.4297 | -0.04075 |
| β2 | 3.05707\* | 0.345488 | 80.8633 | -18.2048 | 1.78762 |
| β22 | -1.22927\* | -0.185122\* | -28.3049 | 5.5468 | -0.84878 |
| β3 | -0.19630\* | -0.082116\* | -4.1025 | -0.9203 | -0.66209\* |
| β33 | 0.00191 | 0.002049\* | 0.0308 | -0.0045 | 0.01511 |
| β12 | 0.04732 | 0.020780 | -2.4269 | -0.3957 | -0.10380 |
| β13 | -0.00327 | 0.001078 | -0.2997 | -0.0220 | -0.01158 |
| β23 | -0.02634 | 0.002390 | 0.4837 | 0.0511 | 0.06510 |
| R2 | 0.999 | 0.998 | 0.996 | 0.994 | 0.981 |
| Kind of local extremum | max | max | max | max | max |
| Calculated critical value (mg kg-1) | 26.49 | 6.07 | 409.74 | 127.12 | 46.32 |
| Yeast extract (% d.m.) | 5 | 0 | 5 | 5 | 5 |
| Salt (% d.m.) | 1.34 | 1 | 1.21 | 1 | 1 |
| Sugar (% d.m.) | 0 | 0 | 0 | 0 | 0 |

\* Statistically significant at p<0.05 level

Table S3. Regression coefficients of SOP of the bread with yeast extract model for instrumental colour and bread crumb quality

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | L\* | a\* | b\* | C\* | Bread crumb quality |
| β0 | 64.22543\* | 4.427622\* | 19.18201\* | 16.53756\* | -2.29909 |
| β1 | 0.25357 | -0.382622 | 0.98349\* | 0.23244 | -0.05341 |
| β11 | -0.03402 | 0.006966 | -0.00506 | -0.02772 | 0.03624 |
| β2 | 0.05945 | 1.510915 | -2.90616 | 2.85171 | 5.68811 |
| β22 | -0.09049 | -0.485854 | 1.38341 | -0.89293 | -1.84390 |
| β3 | 0.30854 | 0.013939 | -0.05651 | 0.09072 | 0.65704\* |
| β33 | -0.03660 | -0.000359 | 0.00003 | -0.01013 | -0.02344 |
| β12 | 0.47912 | -0.006537 | -0.29585 | 0.14273 | 0.14098 |
| β13 | -0.03149 | -0.001254 | 0.01321 | 0.01147 | -0.05590 |
| β23 | 0.03056 | -0.008268 | 0.01307 | -0.01463 | -0.05451 |
| R2 | 0.937 | 0.979 | 0.965 | 0.969 | 0.932 |
| Kind of local extremum | max | max | max | max | max |
| Calculated critical value (% d.m.) | 69.50 | 5.60 | 21.10 | 20.92 | 4.75 |
| Yeast extract (% d.m.) | 5 | 0 | 5 | 5 | 5 |
| Salt (% d.m.) | 2 | 1.54 | 2 | 1.95 | 1.64 |
| Sugar (% d.m.) | 2.90 | 1.67 | 10 | 5.90 | 6.14 |

\* Statistically significant at p<0.05 level

Table S4. Regression coefficients of SOP of the bread with yeast extract model for sensory characteristics

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Appearance | | | | | Taste | | | | |
| Chara-cteristics | Crust colour intensity | Crumb colour intensity | Colour uniformity | Chara-cteristic | | Sweet | Sour | Salty |
| β0 | 7.33780\* | -5.59817 | 0.41220 | 8.079878\* | 1.099.573 | | -498.720 | -241.707 | 0.91159 |
| β1 | 0.21220 | 0.29817 | 113.280 | 0.350122\* | -2.59073\* | | 0.21720 | 0.52707 | 0.44341 |
| β11 | 0.00741 | -0.03951 | -0.11941 | -0.029366 | 0.11220 | | 0.26741\* | 0.12878 | 0.00976 |
| β2 | -409.146 | 11.27.622 | 394.146 | -0.138415 | -214.451 | | 8.63354\* | 502.195 | -105.061 |
| β22 | 178.537 | -3.58780 | -128.537 | 0.065854 | 0.10488 | | -2.91463\* | -158.049 | 154.390 |
| β3 | 0.19110 | 0.36159 | -0.11860 | -0.077439 | -0.16787 | | 0.09110 | -0.00146 | -0.16579 |
| β33 | 0.00585 | 0.00112 | 0.00415 | 0.003659 | -0.01695 | | -0.02215 | -0.01780 | 0.00144 |
| β12 | 0.09366 | 0.60195 | 0.18634 | -0.161463 | 0.60878 | | 0.03366 | 0.01512 | -0.24098 |
| β13 | -0.00663 | -0.00980 | -0.01537 | -0.006146 | 0.10488\* | | -0.03463 | 0.00151 | 0.06390\* |
| β23 | -0.09317 | -0.10902 | 0.13317 | 0.029268 | -0.06561 | | 0.12683 | 0.10756 | 0.02951 |
| R2 | 0.936 | 0.926 | 0.912 | 0.875 | 0.952 | | 0.996 | 0.967 | 0.968 |
| Kind of local extremum | max | max | min | max | max | | max | min | min |
| Calculated critical value (% d.m.) | 8.78 | 10.28 | 3.07 | 8.31 | 8.96 | | 9.57 | 1.02 | 0.19 |
| Yeast extract (% d.m.) | 5 | 5 | 0 | 3.21 | 0 | | 5 | 0 | 0 |
| Salt (% d.m.) | 2 | 1.84 | 1 | 1 | 1 | | 1.57 | 1 | 1 |
| Sugar (% d.m.) | 10 | 10 | 0 | 0 | 0 | | 2.63 | 0 | 10 |
|  | Aroma | | | | | Texture | | | | |
|  | Chara-cteristic | Sour | Yeast | Pungent | Firmness | | Elasticity | Wall thick-ness | Pores unifor-mity |
| β0 | 971.037 | -239.024 | 0.548171 | 7.71768\* | 744.207 | | -15.6585\* | 1.123.415 | -451.707 |
| β1 | -2.72037\* | 0.32024 | 1.661829\* | 1.17732\* | 134.293 | | 14.185 | 0.78585 | -0.17793 |
| β11 | 0.12810 | 0.16127 | -0.140488\* | -0.03395 | -0.14078 | | -0.1636 | -0.04556 | 0.05278 |
| β2 | -0.43476 | 497.317 | 1.873.780 | -692.988 | -0.44695 | | 25.3610\* | -494.390 | 1.022.195 |
| β22 | -0.39756 | -156.829 | -0.512195 | 225.122 | 0.58049 | | -8.6902\* | 186.098 | -338.049 |
| β3 | -0.22268 | 0.07012 | -0.116585 | -0.52384\* | -114.104 | | 1.1993\* | -110.707 | 1.21604\* |
| β33 | -0.01298 | -0.01768 | 0.003878 | 0.01651 | 0.01380 | | -0.0929\* | 0.01261 | -0.04680 |
| β12 | 0.62439 | 0.05707 | 0.058049 | -0.08780 | -0.93512 | | -0.1224 | -0.85024 | 0.33512 |
| β13 | 0.11644\* | 0.00171 | -0.008195 | 0.01122 | 0.15449\* | | -0.1202\* | 0.14298\* | -0.09249 |
| β23 | -0.07780 | 0.06854 | 0.119024\* | 0.26610\* | 0.18244 | | 0.1588 | 0.21488 | -0.09244 |
| R2 | 0.957 | 0.970 | 0.998 | 0.989 | 0.881 | | 0.920 | 0.900 | 0.942 |
| Kind of local extremum | max | min | min | min | min | | max | min | max |
| Calculated critical value (% d.m.) | 8.88 | 1.01 | 1.91 | 2.01 | -0.63 | | 8.58 | 0.49 | 9.36 |
| Yeast extract (% d.m.) | 0 | 0 | 0 | 0 | 0 | | 1.21 | 0 | 0 |
| Salt (% d.m.) | 1 | 1 | 1 | 1.15 | 1 | | 1.51 | 1 | 1.378 |
| Sugar (% d.m.) | 0 | 0 | 0 | 6.61 | 10 | | 6.97 | 10 | 10 |



\* Statistically significant at p<0.05 level