EVALUATION OF FOOD ADDITIVES ON THE RHEOLOGIC PROPERTIES OF WINTER WHEAT FLOURS

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ABSTRACT

The effects of different flour additives on the Farinograph, Alveograph and Extensograph properties of BL-80 flour were evaluated. The purpose of the study was to evaluate the way and degree of their influences to establish a subsequent research on their possible substitution by natural ingredients. We found that the effects of flour additives can be measured by rheologic methods and the extends of changes determined by different methods are similar.

1. INTRODUCTION

The significant changes in the baking industry resulted significant changes in the bread making process. A hotly-debated question became the utilization of different flour additives. It is necessary, because the industry must satisfy the quantity requirements, and a part of consumers requires relatively cheap bread with homogenous quality. Opposers emphasizes that the dose-depending long-term effect of the artificial additives is not known, and the reactions between the different additives, consumed by different foodstuffs, is also not clearly revealed.

The main reasons of using optional additives in bread making are the helping the crumb structure development, improvement of nutritional and sensory quality and making longer shelf-life for the products (Singh et al., 2003). The main groups of ingredients are acids, enzymes, surfactants, sugar, milk or milk solids and improvers (Hoseney, 1994) and they have an important effect on dough and bread properties but the consumers are increasingly abandoning the artifical or simply unknown food ingredients. An Eurobarometer survey found in 2006 that 57% of consumers believed that food additives were potential food risk – it is 4% higher value than the rate of those, who were afraid of BSE and the proportion is almost the same in the case of GMOs, dioxin and microbiologic spoilage (Bánáti, 2008).

Research project was started to evaluate the possibility of substitution of artificial additives by natural food components to decrease the non natural components in our general foodstuff, the bakery products. This project includes the evaluation of commercially available complex flour improvers and the possible natural materials and ingredients. Our examinations includes the study of the effect of the type and dose of these additives on the traditional quality parameters (e.g. their effect on the solubility of protein by determination of wet gluten content and gluten properties), rheologic parameters (as Farinograph, Alveograph and Extensigraph parameters) and bread properties (examined by test loaf making).

2. MATERIALS AND METHODS

Analyzed flour samples were made from standard commercial flour type BL-80 from ABO MILL LTD, Nyíregyháza. Flour additives were provided by Stamag-Ireks Ltd and ABO-MILL LTD. The following flour additives and concentrations were applied: Rónapán, Tigris, Negropán, Multec Data HP20, Multec tac 20, Enzypán, Enzy Passat, Intenzív Tornádó "S" and Soja Austria PAN were added in 0.5%; Aromapaszta, enzyme active wheat flour and Buláta were added in 1%; Soy isolate, Soja Austria SAN, Lupisan and artichoke flour were added in 5%; Fevepur fava bean flour and Pur Malt were added in 0.3%, Novo2zm2 Bisc, Multazyme plus optimal enzyme, Multazyme plus Ait enzyme were added in 0.005% concentration of the wheat flour. The amounts of additives were specified by recommendations of producers.

Laboratory tests were made in the accredited laboratory of University of Debrecen, Centre for Agricultural and Applied Economic Sciences, Institute of Food Science, Quality Assurance and Microbiology. Analyzed parameters were the Farinograph value, according to MSZ ISO 5530-3:1995 using Brabender Farinograph (Duisburg, Germany), Alveograph parameters, according to AACC Method 54-30.02 using Chopin Alveograph (Villeneuve-la-Garenne, France) and Extensograph parameters, according to AACC Method 54-10.01 using Brabender Extensograph (Duisburg, Germany).

3. RESULTS AND DISCUSSION

3.1. Effect of flour additives on the Farinograph parameters

The examined flour additives significantly affected the Farinograph value (Table 1). The most of additives increased the baking value of BL-80 wheat flour; Tigris, Negropán, Soy isolate, Multec Data HP20, Multec tac, Lupisan, Fevepur faba bean flour and Multazyme plus optimal enzyme also resulted improved baking value. Whereas, addition of Negropán and Buláta resulted significant decrease in Farinograph value and rushed down the quality of base flour to feed (C) quality. The reactions of additives are more balanced in the case of water absorbtion capacity. It was increased by Soy isolate and Lupisan to a great extend but Artichoke flour resulted high decrease. Other additives slightly decreased or did not influenced the water absorbtion capacity of flours.

Table 1. Effect of flour additives on Farinograph and Alveograph properties of BL-80 flour

	Baking value	Water absorbtion, %	P, mm	L, mm	P/L	G, ml	W, 10^{-4}J
Control	69,0	69,4	140	76	1,86	19,4	374
0,5% Rónapán	71,6	68,6	102	93	1,09	21,5	346
0,5% Tigris	70,7	67,0	93	96	0,97	21,8	324
0,5% Negropan	34,5	66,4	41	175	0,24	29,5	152
5,0% Soy isolate	79,0	72,0	203	26	7,72	11,4	239
0,5% Multec Data HP 20	81,0	69,0	90	107	0,84	23,1	299
0,5 % Multec tac	81,5	69,0	97	89	1,09	21,0	291
5,0% Lupisan	77,1	72,2	135	56	2,43	16,6	284
0,5% Enzypán	54,6	67,4	90	99	0,9	22,2	318
0,5% Enzy Passat	57,2	68,0	94	101	0,93	22,4	342
1,0% Buláta	31,4	67,2	91	96	0,95	21,8	296
0,5% Intenzív Tornádó "S"	58,6	66,4	92	80	1,15	19,9	282
1,0% Aromapaszta	64,0	66,0	93	92	1,01	21,4	285
0,3 % Fevepur fava bean flour	71,6	66,6	70	103	0,68	22,6	241
0,1% Pur Malt enzyme active wheat flour	63	65,8	67	93	0,72	21,6	216
10% Artichoke flour	67,7	58,6	106	29	3,7	11,9	139
0,005% Novo2ym2 Bisc	48,8	66	41	98	0,42	22	87
0,005% Multazyme plus optimal enzyme	70,7	66,8	65	121	0,53	24,5	245
0,005% Multazyme plus AIT enzyme	66,4	66,6	68	105	0,68	22,8	239

3.2. Effect of flour additives on the Alveograph parameters

The P value was increased by more than 25% by the addition of soy isolate. Highest decreases were achieved by addition of Negropan and Novo2ym Bisc; both additives decreased the P value by about 40%. Enzyme products, enzyme active wheat flour and faba bean flour resulted similar effect. L value was significantly increased by Negropan and Multazyme plus optimal enzyme but soy isolate, artichoke flour and Lupisan resulted the highest decrease of extensibility.

These changes of Alveograph curve also resulted differences in P/L values. Emerging increases were observed in the case of addition of soy isolate, artichoke flour and Lupisan, while Negropan and enzyme products resulted the highest decrease in P/L value. Other additives resulted decrease in lower measure. W value was decreased by all the examined additives. Highest decreases were caused by Novo2ym 2 Bisc, artichoke flour and Negropan, but other additives also resulted 15-25% lower W values than original BL-80 flour.

3.3. Effect of flour additives on the Extensograph parameters

The effects and the measure of effects of different additives on Extensograph parameters were different than we have expected by the Alveograph parameters (Table 2). Highest decreases of deformation energy after 45 minutes of dough were resulted by Multec tac, Pan and Lupisan, while Rónapán, Tigris, Enzipan, Enzy passat, Buláta, Intenzív tornádó S, Aromapaszta and faba bean flour resulted increase. The energy of control flour was almost linearly increased by resting time, but only the character of changes remained in the case of additives. Only soy isolate and Multazyme plus optimal enzyme did not affected the value of Extensograph energy of flours.

Resistance to extension of flour was increased by artichoke flour in the highest degree. Other additives also resulted increase, only Negropan resulted decrease in resistance. The resting of dough decreased the improving effect of additives or their resistance values were lower than the values of BL-80 flour. These additives (e.g. soy isolate) stabilized the resistance value of resting dough.

Similarly homogenous are the effects of additives on the extensibility of flours. It was significantly decreased by Negropan and artichoke flour in all examining time, while the effects of other additives are only a small degree increase or decrease. The effect of resting time was not significant on extensibility values.
Maximum resistance to extension was also significantly increased by addition of artichoke flour regarding to control flour, but its effect was observable only after the 45th minute. Lupisan and Multazyme plus optimal enzyme decreased the value of maximal resistance by 25-50%, soy isolate, Multec Data HP20, Multec tac and Multazyme plus AIT had no significant effect, while the other additives unambiguously increased it in the first examination time. These effects were observed in the other examination times or their small increases were found.

4. CONCLUSIONS

We found that all the examined flour additives had significant effect on the rheologic properties of BL-80 wheat flour. The same flour became suitable for pizza and pasta making by the application of adequate additive, regarding the Farinograph parameters. Altough the Alveograph and Extensograph measurement results similar values, the application of different flour additives results different effect on dough energy and extensibility. This means it is not enough to examine the results of either, the other test is required to do to determine the real behaviour of dough.

Table 2. Effect of flour additives on Extensograph properties of BL-80 flour

	Energy, cm^2			Resistance to extension, BU			Extensibility, mm			Max resistance, BU		
	45	90	135	45	90	135	45	90	135	45	90	135
Control	44	34	19	116	114	83	180	165	147	190	157	98
0,5% Rónapán	66	84	84	168	235	262	184	188	167	279	344	384
0,5% Tigris	62	91	74	174	309	280	171	164	156	280	437	374
0,5% Negropan	-	7	26	-	45	88	-	103	165	-	46	122
5,0% Soy isolate	46	40	25	118	138	87	186	157	157	190	187	123
0,5% Multec Data HP 20	43	34	20	120	106	82	176	170	148	185	152	99
0,5 % Multec tac	39	33	25	116	115	104	179	162	141	169	151	135
5,0% Lupisan	27	24	49	76	88	163	171	148	155	123	124	246
0,5% Enzypán	87	102	94	194	278	291	197	173	167	343	470	452
0,5% Enzy Passat	69	92	110	168	258	325	188	179	178	285	411	486
1,0% Buláta	60	64	48	136	162	138	195	188	174	242	261	209
0,5% Intenzív Tornádó "S"	70	108	84	173	331	244	185	168	175	302	495	378
1,0% Aromapaszta	86	74	59	204	208	188	186	171	165	356	326	266
0,3 % Fevepur fava bean flour	54	70	61	138	197	194	180	176	163	231	300	278
0,1% Pur Malt enzyme active wheat flour	56	65	55	132	166	161	186	186	171	235	271	245
10% Artichoke flour	97	182	163	414	850	820	135	137	126	262	1001*	1001*
0,005% Novo2ym2 Bisc	cannot valuable											
0,005% Multazyme plus optimal enzyme	35	33	13	86	87	60	191	180	138	139	138	66
0,005% Multazyme plus AIT enzyme	42	49	43	102	124	126	193	194	176	167	193	186

*Values above 1000 BU are uncertain values

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