US Open Food Science & Technology Journal
Vol. 1, No. 4, August 2014, pp. 1 - 6
Available online at http://arepub.com/Journals.php

Research article

Storability of Packed Bread Wheat flour

Esam Eldin Bashir Mohamed Kabbashi and Shereen Mohamed Awad

Food Research Center, Ministry of Science and Communications, Khartoum, Sudan.
Corresponding Author: Shereen Awad (mobash@windowslive.com) Tel:00249924199200

Abstract

Wheat is a major cereal crop in many parts of the world. This study was carried out to test the effect of heating on the insect infestation and nutritional quality of wheat. Two groups of packed bread wheat flour (1kg), were subjected to 50º C for 2 hours, and 55º C for 1 hour, stored in a laboratory for six months and sieved every month to detect insect infestation and every two months for nutritional quality (moisture, protein, fat acidity and ash). The results showed no insect infestation reported in the first three months of storage in the treated and untreated packets, fourth month recorded 3 infested packets reported in the treated ones with 50º C / 2h. Insect infestation also reported in the control packets in the 3rd month (one packet) and three packets in the last month of this study. The flour treated with 55º C for one hour reflected no alive insect throughout the test period. Moisture content was decreased in the second and third tests compared to zero time (3.26, 2.79 and 11.97%), respectively, and increased again in the months of rainy season. Protein content results showed no difference between control and treated flour. Fat acidity started from 31.83 mg KOH /100 gm at the zero time and increased gradually during storage period up to 58.64 mg KOH /100 gm and there was no negative effect of the treatments reported. The results showed no differences in ash content during test period which changed in case of insect infestation. The results of the proximate analyses reflected that there is no significant difference between the treated and the untreated control flours regarding the figures of the Codex Alimentarius.

Keywords: storability - insect infestation - heat treatment

Introduction

Wheat is the second most important cereal crop after sorghum in the Sudan. Wheat consumption is increasing progressively, as a sorghum substitute, during the last decades due to a shift in the food habits. Sudan

imports about 1.1 million tons of wheat grain and flour to cover demands. Post harvest losses have been estimated to about 30%. In countries like Sudan, insects cause a lot of damage to stored grains and flour where the prevailing climates create conditions favorable to insect multiplication. (Lal, 1990). FAO (2002) estimated that the world wide losses due to insect attacks in stores have been given as 10%. However, Kabbashi and Suliman (2006) reported, in a survey, that insect infestation reduces sorghum prices by 10 – 50%. The stored flour, unlike grain, deteriorates rapidly with increase in time and temperature. Limited research was concentrated on storage pest control particularly chemical control for weevils. Elshazali (personal communication) stated that the damage in flour is due to the essential pest of it (*Tribolium castaneum* Hrbst) which is itself considered a minor pest of intact grains since it is incapable of invading them. Yet it is responsible for rather the major losses in grains (due to grain cracking for a variety of reasons) and flour. Storage pests usually develop resistance to chemicals. Most storage pests have developed resistance to chemicals e.g. malathion and lindane (Ecresam, 2005). Therefore development of improved alternative technology (ies) for appropriate control of storage insect pests is needed. This experiment focused on the use of temperature / time regime for the disinfestation of packed bread wheat flour from stored pests aiming at increasing the shelf life of stored bread wheat flour and upgrading its quality. However, a preliminary study in this concern was done (Kabbashi, 2004). It concluded that 50º C and two hours and 55 º c and one hour disinfested the used flour in beakers from *Tribolium castaneum* Herbst adults.

Materials and Methods

Materials

Packed bread wheat flour (1 kg wt.), and ordinary oven (Gallen Kamp Ov – 160®), 0.27 inch aperture fine mesh (Tyler Standard Screen scale®), fine camel hair brush, plastic basins, magnifying lens, a hygrometer, etc…… were all needed to run the experiment. 0.27 inch aperture fine mesh (Tyler Standard Screen scale®), fine camel hair brush, plastic basins, magnifying lens, a hygrometer, etc…… were all needed to run the experiment.

Methods

Two groups, each of 50 packets, were subjected to 50º C, and 55º C, respectively, using an ordinary oven (Gallen Kamp Ov – 160®). A corresponding group, of fifty packets, was used as a control. All this lot was stored in a laboratory whose average temperature and average relative humidity were 29º C and 33%. A group of 5 packets was sieved via 0.27 inch aperture fine mesh (Tyler Standard Screen scale®) for any adult or juvenile stages of store pests, monthly six times. A proximate analysis of the flour samples, representing the three test groups, was performed three times every two months for a number of parameters that include ash, moisture, fat acidity, and protein.

Results and Discussion

Table 1 displays the insect infestation of the treated and untreated stored packets of the bread wheat flour. There is no insect infestation reported in the first three months of storage in the treated and reported in one of untreated packets. However, the incidence of the infestation was reported in the fourth month in three packets

treated with 50º C & 2 h. This result agreed with the opinions of the dura merchants in Khartoum in a questionnaire done in 2004, that is, the infestation reported in dura after three months of storage also it goes in harmony with the opinion of a number of house keepers and grocers (Kabbashi unpublished data). This infestation in packed flour may be due to the eggs of the *T. castaneum*. However, the stages of the milling process do disinfestation for the grains before been milled which include (1) cleaning using dry and wet scourer. The former is to get rid of foreign materials and the latter is to release dirt and to maintain the bacterial population (2) rolls pressing, between two rolls, which affects the insect stages during the flow of grains (3) sifting (sieving) of flour through minute apertures, this *may* block the passing of the insect stages except eggs. These steps of the milling process advocate the cleanliness of the flour from larvae, pupae and beetles in the early three months of storage. However, the later appearance of the different stages stands for the presence of insect eggs in the packed flour which might be dormant (Table 1). The high infestation of the packets treated with 50º C & 2 h in the fourth month might be due to high dormant egg infestation and / or the parthenogenesis that marks *T. cataneum*. This beside the fact that this degree might provoke vigor of these insects. However, the absence of entiulator, which eliminates the eggs, may account for the infestation in the test flour and that of the control. The flour treated with 55º C for one hours lacking the presence of any insect except a deformed, blackish and dead larva in the fifth month inspection. This might reflect the negative effect of the treatment on this insect as been reported in the control by neem extracts, formamdines (e.g. Amitraz) and insect growth regulators (e. g. juvenile hormones).

Table 2 displays the proximate analysis of the moisture content (MC) of the test flour and that of the control through the 6 months of storage. The MC varies according to the treatments. It decreases as the temperature increases. This is clearly illustrated by the figures of the 2nd and 3rd analysis (after two and four months, respectively) which are far lower than the MC of the zero time analysis (3.26, 2.79 and 11.97%, respectively) (table 2). Beside that the moisture at 6 months storage increases (in July, rainy season) due to the increase in the relative humidity of the laboratory (10.18%). However, the difference in the MC due to the treatments is negligible compared to the control and all the readings are within the accepted range of the Codex Alimentarius (a maximum of 14%).

Table 2 displays the proximate protein content (PC) of the test samples. The PC of the treated samples and the control are within the normal range of the Codex Almentarius (14 – 16%). This indicates no negative effect of the treatments on the protein content of the tested flour. It is worth to mention that there is a minor drop in PC of the control in the analysis of fourth month and the sixth month below 14%.

The fat acidity (FA) of the test samples shown in table 2. Although the test product was taken from the production line in the same day of the packaging the FA was 31 mg KOH / 100 gm at the zero time analysis. Since the acidity increases gradually during storage up to 50 mg KOH / 100 gm (the maximum limit specified) due to Codex Alimentarius. There is no negative effect of the treatments. That is, the increase in FA can be abrupt due to the effective conditions. However, it is worth to report that the usual zero time FA of the bread wheat flour is around 21 mg KOH / 100 gm and often starts at 13 mg KOH / 100 gm. Therefore there is no significant difference in the FA between the test and the control samples.

Table 2 demonstrates the ash content (AC) of the test and control samples during the test period. These results indicate no difference in AC throughout the test time which changes in cases of high insect infestation.

Conclusion

From the results obtained in this study, it can be concluded that the heat treatment used (50°C for two hours and 55°C for one hour) is very successful treatment for insect infestation and has no negative effect on nutritional value of wheat flour.

Table 1: Infestation of the Packed Wheat Flour in Six Month Storage

Treatment	Rep.1	Rep.2	Rep.3	Rep.4	Rep.5	Rep.1	Rep.2	Rep.3	Rep.4	Rep.5
	Month 1					Month 2				
55º C & 1 h	0	0	0	0	0	0	0	0	0	0
50º C & 2 h	0	0	0	0	0	0	0	0	0	0
Control	0	0	0	0	0	0	0	0	0	0
Month 3						Month 4				
55º C & 1 h	0	0	0	0	0	0	0	0	0	0
50º C & 2 h	0	0	0	0	0	0	0	2 L*	54 B* + 45 L	2 L*
Control	1 B*	0	0	0	0	0	0	0	0	0
Month 5						Month 6				
55º C & 1 h	1 DL*	0	0	0	0	0	0	0	0	0
50º C & 2 h	1DL*	0	0	0	0	0	0	0	0	0
Control	0	0	0	0	0	0	2 B*	1 L*	0	1 B*

* B = Beetle, L = Larva and DL = Dead Larva.

Table (2): Proximate composition (%) of the test flour during the test period

Date of analysis	Ash content			Moisture content			Fat acidity			Protein content		
	Samples											
	Control	50°C/2 hrs	55°C/1 hr	Control	50°C/2 hrs	55°C/1 hr	Control	50°C/2 hrs	55°C/1 hr	Control	50°C/2 hrs	55°C/1 hr
Zero	0.72^{a} (±0.01)	0.70^{a} (±0.01)	0.73^{a} (±0.01)	11.97^{a} (±0.06)	9.40^{ab} (±0.68)	9.09^{bc} (±0.88)	31.83^{h} (±0.00)	31.14^{h} (±0.00)	30.80^{h} (±0.00)	15.53^{d} (±0.23)	15.43^{de} (±0.35)	18.80^{b} (±0.17)
2months	0.71^{a} (±0.06)	0.71^{a} (±0.03)	0.73^{a} (±0.05)	3.26^{d} (±0.65)	2.59^{d} (±0.01)	2.45^{d} (±0.03)	44.45^{e} (±1.03)	43.12^{f} (±0.00)	41.00^{g} (±2.05)	15.52^{d} (±0.37)	16.25^{c} (±0.19)	16.14^{c} (±0.18)
4months	0.72^{a} (±0.04)	0.73^{a} (±0.01)	0.75^{a} (±0.01)	2.79^{d} (±0.03)	2.48^{d} (±0.03)	2.63^{d} (±0.05)	53.44^{a} (±1.05)	49.22^{d} (±0.01)	51.43^{c} (±0.06)	13.84^{g} (±0.06)	15.94^{a} (±0.01)	15.18^{e} (±0.01)
6months	0.71^{a} (±0.00)	0.72^{a} (±0.00)	0.73^{a} (±0.00)	10.18^{b} (±0.07)	8.02^{c} (±1.98)	9.96^{b} (±0.19)	58.64^{b} (±0.04)	55.17^{i} (±0.00)	56.88^{i} (±0.00)	13.96^{g} (±0.00)	14.51^{f} (±0.00)	15.30^{de} (±0.00)
$Lsd_{0.05}$	0.05329*			1.152*			1.227*			0.3153*		
SE±	0.1826			0.3945			0.4203			0.108		

Values are mean±SD.

Mean value(s) sharing same superscript(s) are not significantly different (P≤0.05).

References

[1] ECARSAM 2005. Sorghum and Millet Research for Development in Eastern and Central Africa, 2005-2010. Regional Priorities.

[2] Kabbashi, E. B. M.; and Ali, A. M. (2004). Control of Wheat Flour Beetle [Tribolium castaneum (Herbst)] by Temperature / Time Regimes. Annual Report, Food Research Centre, ARC, Sudan.

[3] Kabbashi, E. B. M. and Suliman, A. M. A. (2006). Sorghum (Sorghum bicolor L.) Store Pests, Dura Merchants View In Khartoum State. Annual Report (2005/'6), FRC, ARC, Sudan.

[4] Lal, S. (1990) Losses in wheat due to insects at farm level storage. Bull. Grain Technol. 28(3):210-220.