J. Agric. Sci. Mansoura Univ., 28 (7): 5637 - 5651, 2003

EFFECT OF HEAT STABILIZATION PROCESS ON STORAGE PERIOD AND QUALITY DETERIORATION OF RICE BRAN

Matouk, A. M.[1]; S. M. Abd El-latif[1]; M. M. El-Kholy[2] and Y. T. Hendawy[2]

1- Agric. Eng. Dept., Faculty of Agric., Mansoura Univ.

2- Agric. Eng. Res. Inst., Dokki, Giza.

ABSTRACT

The persent study was carried out to evaluate the use of high temperature short time conduction heating technique for rice bran stabilization. The effect of type of storage sacks on the changes in some chemical composition of the stored heat treated bran was also investigated. Five nominal levels of heating surface temperature of (85, 95, 105, 115 and 125 °C)and five levels of exposure time of (5, 10, 15,20 and 25 mins) were used for heat stabiliztion experiments, while two different types of storage sacks of (burlap and poly ethelene) were used for storage experiments. The results show that, rice bran moisture content was decreased with the increase of heating surface temperature and exposure time while it was increased with the increase of storage period depending upon heat treatment and type of storage sacks. The average bran bulk temperature during storage period was fluctuated between 12.7 to 17.8 °C and it was relatively lower for the treatments stored in burlap sacks in comparison with polyethelene sacks. Quality evaluation tests showed a reduction in fungal growth rate and percentage of (FFA) with the increase of heating surface temperature and exposure time and also for the treatments stored in polyethelen sacks in comparison with burlap sacks.

INTRODUCTION

The bran, which is mainly produced during rice milling operation amounts to 10 % of the weight of rice grain. It is rich in protein 13-16 %, oil 15-22 %, fiber 6.2-14.4 %, ash 8-17.75 %, vitamins, and trace minerals Daniel et al.,(1993). In many developing countries bran is considered as a by-product, which is mainly used for livestock and poultry feeding or the production of oil.

The major problem in oil production from rice bran is associated with rapid deterioration. This is due to the presence of lipolytic enzyme (lipase) in the bran which is immediately activated by milling and led to increase the free fatty acids (FFA) content of oil to about 5-7 % of the weight of oil per day (Desikachar, 1974 and Gupta, 1989).

In order to extend the storage period of rice bran, it must be stabilized immediately after milling to minimize free fatty acids (FFA) content. Once the bran is stabilized it can be transported and stored for 30-90 days at ambient conditions without appreciable increase in FFA content. In many countries lipase activity of rice bran is inhibited by extruding at 130 °C for 3 min, other processes are also applied for such purpose. These processes included chemical treatment, parboiling process, microwave heating, and conduction heating (Abd El-Rahman, 1996).

Elaine and Robert (1992) found that brown rice has a short shelf life (about three to six months) because of hydrolytic and oxidative deterioration of bran lipases in a rates depending upon storage condition. FFA is precursors of off-flavor and off- odors associated with lipid degradation products generated in subsequent oxidation reaction.

Sevil and Selma (1993) obtained bran oil which has low or high acidity, depending on stabilization conditions and duration of storage. The rapid increase of free fatty acids (FFA) in the bran after milling has been recognized as a serious problem for rice bran oil industries. The principal cause of oil deterioration in the bran during storage is activity of lipase enzyme which led to generation of free fatty acids.

Wakako et al., (1994) reported that, accumulation of free fatty acids (FFA) in rice seed and the associated rancidity is a problem during storage. Rapid degradation of the polished rice bran oil into FFA through lipolytic hydrolysis prevents rice bran from becoming a major source of edible oil. Several kinds of lipases are involved in lipid degradation and it can be inactivated by different methods of stabilization process.

Venkatesan et al., (1984) reported that, there was a significant increase in FFA during storage but varied among the container tested. Rapid increase in FFA was arrested in bran stored in B.Twill gunny /PVC /HDPE loose liner, sandwiched and tubular sacks, cotton bag, and 3 ply bag up to 30 days with less than 10 % level of FFA compared to 21.56 % in gunny bags. After this period although FFA increased rapidly in bran stored in all other containers the increase was relatively less in bran stored in B.Twill gunny /PVC / HDPE loose liner.

The present work aims to study and evaluate the use of high temperature short time conduction heating technique in rice bran stabilization. In addition, the effect of type of storage sacks on the changes in some chemical composition of the stored heat-treated bran was also investigated.

MATERIAL AND TEST PROCEDURE

Fresh rice bran used for this experiments was taken from a rice variety (Giza177) which was harvested from the experimental farm of Rice Mechanization Center (R.M.C) and milled immediately after natural sun drying to a moisture level of about 14 % w.b. The produced rice bran of 10.2 % (w.b.) moisture content was stored temporarily in a freezing room adjusted at a temperature of (-5 °C) in order to suppress fungal growth and minimize quality changes. Before each experiment, rice bran samples were taken out from the freezing room and left at the ambient air temperature until the initial temperature of the bran become in equilibrium with that of ambient temperature. For the experimental work, a small-scale conduction heating rotary unit was designed and fabricated in the workshop of Rice Mechanization Center (R.M.C). The unit consists of a rotary cylinder (0.6 m diameter and 0.2 m long) inserts into a fixed insulated cylinder (0.8 m diameter and 0.3 m long). One side of the rotary cylinder was covered with a steel sheet connected to a driving system. The driving system consists of

0.15 m diameter steel flange fixed with the side cover of the rotary cylinder and welded to a steel bar riding with a heavy duty ball bearing. A 0.5 kW low speed motor with different sizes of bully was used for power supply and speed control. The other side cover of the rotary cylinder serves as an inlet for rice bran samples through a 0.1m diameter center hole. The rice bran was discharged through a perforated removable sector of the cylinder bottom. For heating and temperature control of the rotary cylinder surface, a two kW electric resistance heaters were placed between the rotary cylinder and the insulated exterior cylinder to heat the surface of the rotary cylinder. The surface temperature of the rotary cylinder could be raised up to 125 °C and maintained within ± 5 °C using a precise thermostat controlled by an electric contactor. Figure (1) s hows t he s tructure f eature o f t he c onduction h eating stabilization unit.

Experimental treatments

Five levels of stabilization temperature of (85, 95, 105, 115, and 125 °C) and five levels of exposure time of (5, 10, 15, 20, and 25 mins) were used for studying the effect of heating temperature and exposure time on rice bran stabilization and quality changes of the stabilized rice bran. After stabilization process, the heat-treated rice bran samples were divided into two similar groups, the first group was filled in a 5 kg weight burlap sacks and the second group was filled in a similar polyethylene sacks. The two groups of sacks were stored in a typical concrete rice storage room for a period of 90 days.

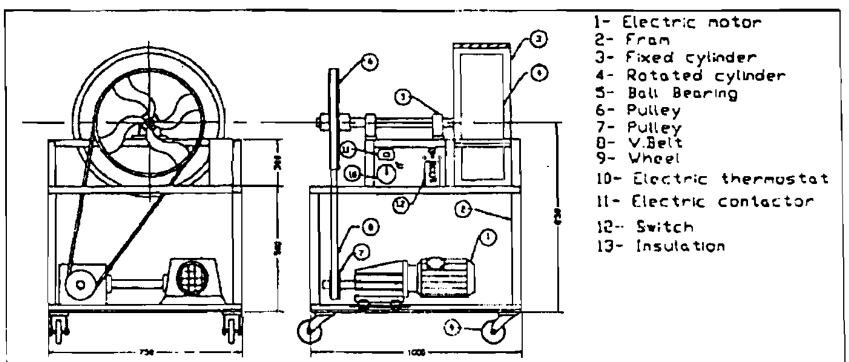


Figure. (1): Elevation and side view of the experimental conduction-heating unit.

Experimental measurements

Moisture content of rice bran:

The standard air oven method using five grams sample placed in air oven a t 1 35 °C f or 3 h . w as u sed f or m easuring bran moisture content as recommended by A.O.A.C. (1990).

Temperature measurements:

The remote –type-infra red spot thermometer model (HT-11) was used to measure the rotary cylinder surface temperature of the heating unit. The emmisivity of the thermometer was adjusted to 0.85 for iron sheet surface. It was also used for measuring the rice bran bulk temperature at the discharge point of the heating unit after changing the emmisivity range to 0.98. For measuring the bran bulk temperature during storage period, the universal digital measuring system model (Kaye Dig. 14) connected to a 36 channel scanning box with thermocouples was used. Copper constantan thermocouples were placed at three different points of each sack and the average temperature of 10 scans was recorded for each treatment.

Ambient air temp. and R.H inside the storage room:

Ambient air temperature and relative humidity inside the storage room were measured using a temperature and relative humidity meter SATO model (SK- 73 D). The data was recorded daily and the average of each 10 days was taken throughout the storage period.

Fungal colony counts:

The spread plate method recommended by Flannigan (1977) was used to determine the fungal colony counts in rice bran samples, every 10 days of storage period.

Free fatty acids percentage (FFA%):

The FFA % of oil samples were calculated as oleic acid using the corresponding acid number of each sample according to A.O.A.C.(1990) as follows:

$$\text{FFA \%} = \frac{282 \chi\ 100 \chi \text{ Acid Value}}{56.1 \chi 1000} \quad \ldots\ldots\ldots\ldots\ldots\ (1)$$

Where: the values 282, and 56.1 refers to the equivalent weight of oleic acid and KOH respectively.

RESULTS AND DISCUSSION

Stabilization experiments of rice bran:

Bran bulk temperature:

Figure (2) presents the change in bran bulk temperature as related to exposure time for different levels of heating surface temperature. The results show that, bran bulk temperature was increased with the increase of exposure time and approached a level lower than that of heating surface temperature. The recorded minimum and maximum bran bulk temperature were (75.6 – 84.6 °C), (86.5–94.1°C), (94.9–102.9 °C), (105.7–113.8 °C) and (111.3–121.9 °C) for the nominal heating surface temperatures of (85, 95, 105, 115, and 125 °C) respectively. The above mentioned results revealed that, longer exposure time give a chance for the bran to gain heat until approaching a level close to the nominal heating surface temperatures. The dependence of rice bran bulk temperature on heating surface temperature and exposure time could be described using a multiple regression analysis. The empirical equation relating the change in bran bulk temperature with different levels of heating surface temperature and exposure times was as follows:

$$T_b = 1.54 + 0.879\, T_n + 0.387\, t \quad \text{.........................}(2)$$
$$(R^2 = 0.998\ ;\ SEE = 1.181)$$

Where: T_b = Bran bulk temperature, (^oC)

T_n = Nominal heating surface temperature, (^oC)

t = Exposure time, (mins)

From the time-temperature history of bran during conduction heating process, the values of mean bulk temperature (T_{mb}) were also computed for various heating time by dividing the area under the bran time-temperature curves by the heating times. The calculated bran mean bulk temperature using the above procedure are shown in figure (3).

Rice bran moisture content:

Figure (4) illustrates the changes in rice bran moisture content as related to exposure time for different heating surface temperatures. The figure shows that, rice bran moisture content decreased with the increase of heating surface temperature and exposure time. The reduction percentage of moisture content was ranged from 2.57 to 9.1 % (w.b), depending upon exposure time and the nominal heating surface temperature.

Considering the experimental parameters used for this study, a generalized empirical representation for predicting the bran moisture content as a function of exposure time (t) and the nominal heating surface temperature (T_n) was developed as follows:

$$M.C\ (\%\ w.b) = 11.74 - 0.0558\, T_n - 0.1374\, t \quad \text{................}(3)$$
$$(R^2 = 0.874\ ;\ SEE = 0.762)$$

Subsequently the bran bulk temperature (T_b) and the bran mean bulk temperature (T_{mb}) used as independent variable in place of the nominal heating surface temperature (T_n) using a multiple regression analysis. The following relationships were also developed for predicting the bran moisture content:

$$M.C\ (\%\ w.b) = 11.78 - 0.0641\, T_b - 0.112\, t \quad \text{................}(4)$$
$$(R^2 = 0.891\ ;\ SEE = 0.7141)$$
$$M.C\ (\%\ w.b) = 11.062 - 0.0669\, T_{mb} - 0.0172\, t \quad \text{............}(5)$$
$$(R^2 = 0.889\ ;\ SEE = 0.722)$$

In general, all the above-mentioned equations could be used alternatively but in equally satisfactory manner to estimate the changes in moisture content of bran during conduction heating stabilization process. The empirical equations (3 and 4) are equipment specific, and applicable only for the experimental equipment used in this study, thus it has a limited application in view of possible difference in the time-temperature history of rice bran when using different equipment. So, bran mean bulk temperature (T_{mb}) used for equation (5) may describe the behavior of moisture changes of rice bran when using different types of conduction heating equipment. Figures (5) present the observed and predicted moisture content at (45 degree) for equation 3,4 and 5 at the maximum and minimum levels of heating surface temperature.

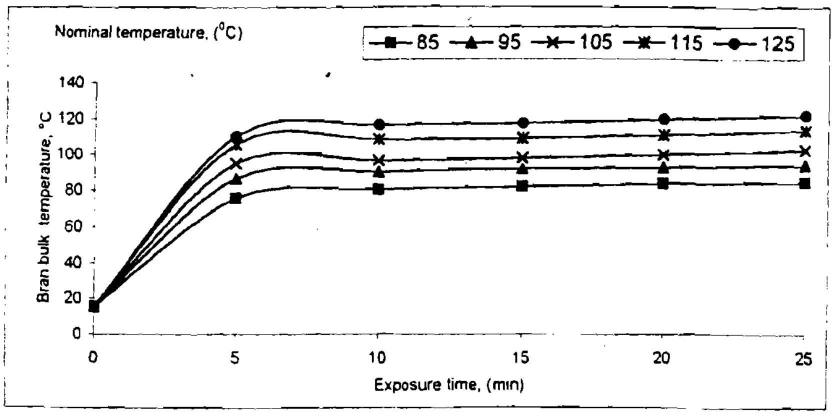


Figure (2): Effect of heating surface temperature and exposure time on the change of bran bulk temperature.

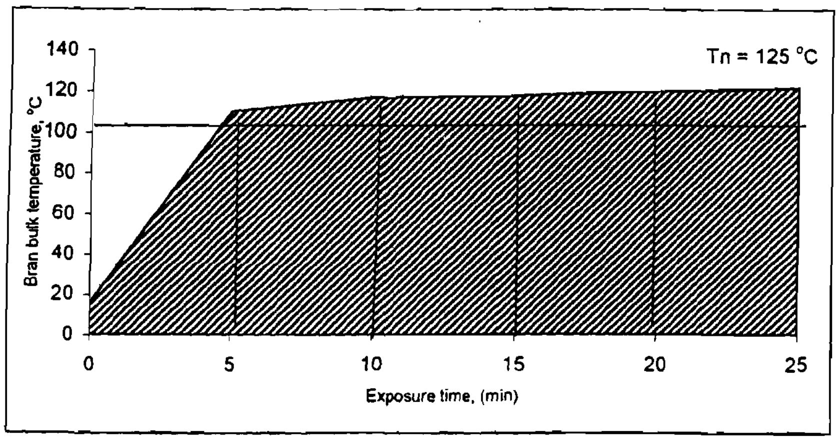


Figure (3): Calculation method of bran mean bulk temperature (T_{mb}) for the maximum level of heating surface temperature.

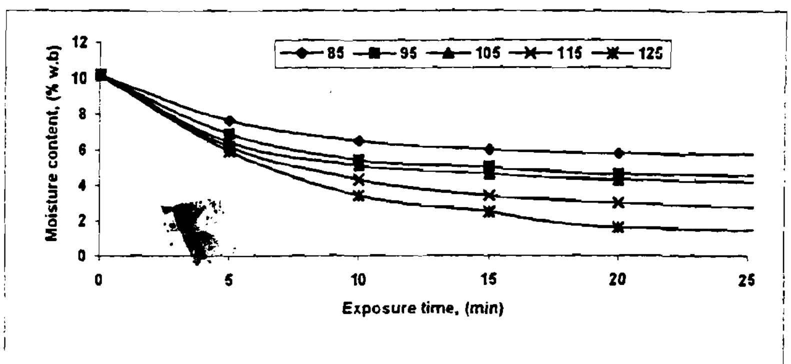


Figure (4): Effect of heating surface temperature and exposure time on the change of rice bran moisture content

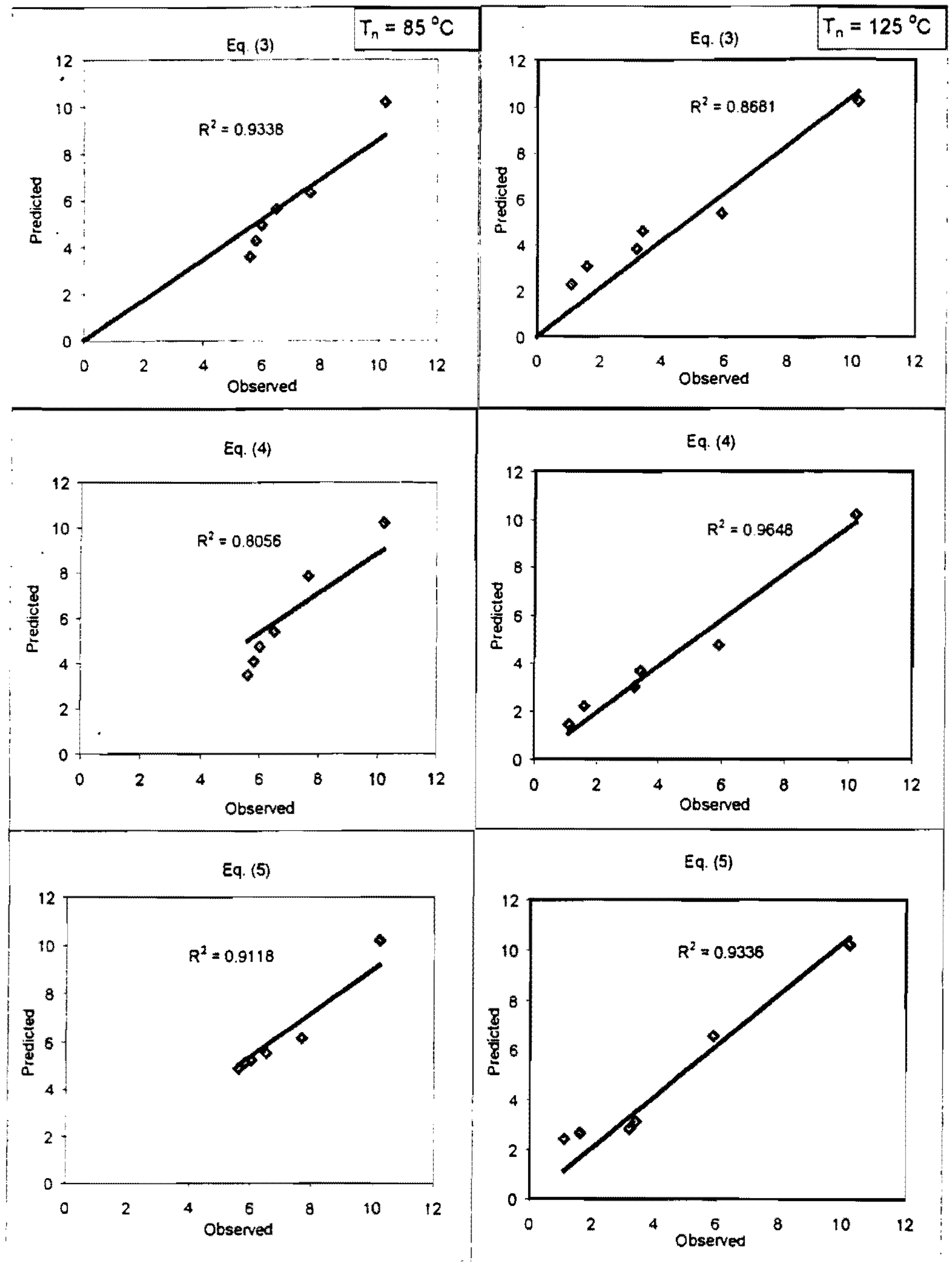


Figure (5): Observed and predicted moisture content using equation (3), (4) and (5) for the heating surface temperature of 85 and 125 °C.

Storage experiments of rice bran:

Effect of typé of storage sacks on bran bulk temperature

The average bulk temperature of rice bran during stabilization process was fluctuated between 12.7 to 17.8 °C and it was relatively lower for all the treatments stored in polyethylene sacks in comparison with burlap sacks. On other hands, the range of temperature variation was wider for the bran stored in burlap sacks due to the faster respond of this type of sacks to any changes in the surrounding air in comparison with polyethylene sacks. Figure (6) present and compares the effect of ambient air temperature and relative humidity on bran bulk temperature over the storage period for both types of storage sacks.

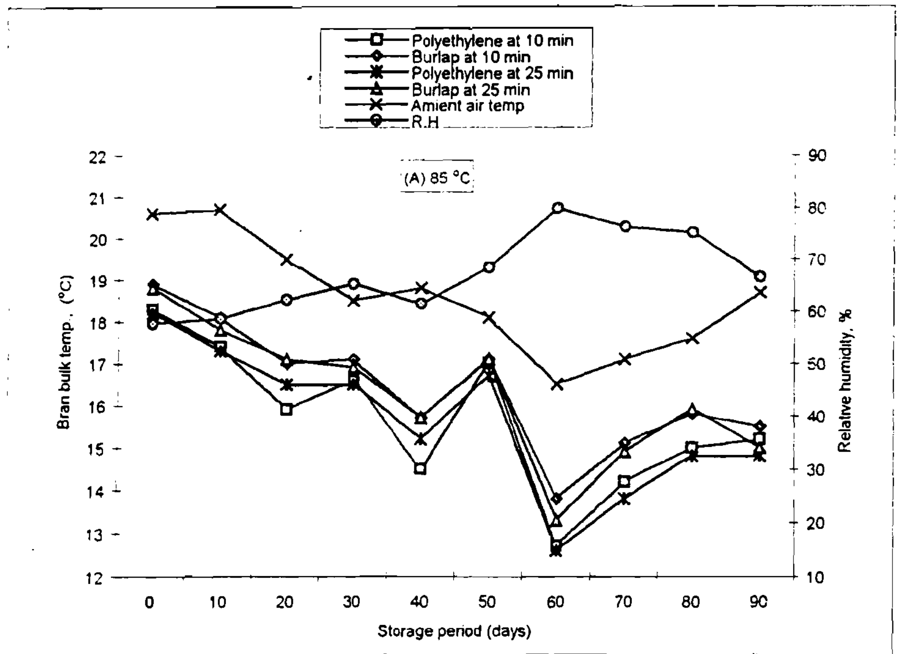
Effect of type of storage sacks on bran moisture content:

Figure (7) illustrates the effect of different heat treatments on moisture content of heat treated bran stored in polyethylene and burlap sacks respectively. At zero time of storage the bran initial moisture content was about 10.2 % for the control samples while it was ranged from 1.1 to 6.5 % for the heat treated samples. During the storage period, the bran moisture content was increased with the increase of storage period depending upon type of storage sacks, initial moisture content of bran and the ambient air condition. After 90 days of storage, the moisture content was ranged from 4.4 to 9.8 % for the bran stored in polyethylene sacks and from 7.8 to 10.8 % for the bran stored in burlap sacks. This means that, polyethylene material provide more resistance to moisture exchange between the stored bran and the surrounding air as compared to burlap material. In other words, the rate at which rice bran moisture responds to any changes in the surrounding air temperature and relative humidity was much faster for the samples stored in burlap sacks in comparison with that stored in polyethylene sacks wither in rewetting or in drying. This situation may leads to different rates of bran deterioration especially fungal growth and lipase activity as mentioned by (Abd El-Rahman 1996, Venkatesan et al, 1984, Chakraverty and Patel, 1983.)

To relate the changes in bran moisture content (M.C) with the nominal heating surface temperature (Tn), exposure time (t), storage period (S), and relative humidity (RH). A regression analysis was employed for both types of storage sacks and presented in Table (1).

Effect of type of storage sacks on fungal growth rate

The effect of different heat treatments and type of storage sacks on fungal count (colonies /g) showed that, fungal growth rate decreased with the increase of heating surface temperature and exposure time for all treatments, and it was higher for the samples stored in burlap sacks in comparison with polyethylene sacks. Meanwhile, the fungal growth rate increased with the increase of storage period, and the increasing rate was affected by heat treatments and type of storage sacks as shown in figure (8)and (9).



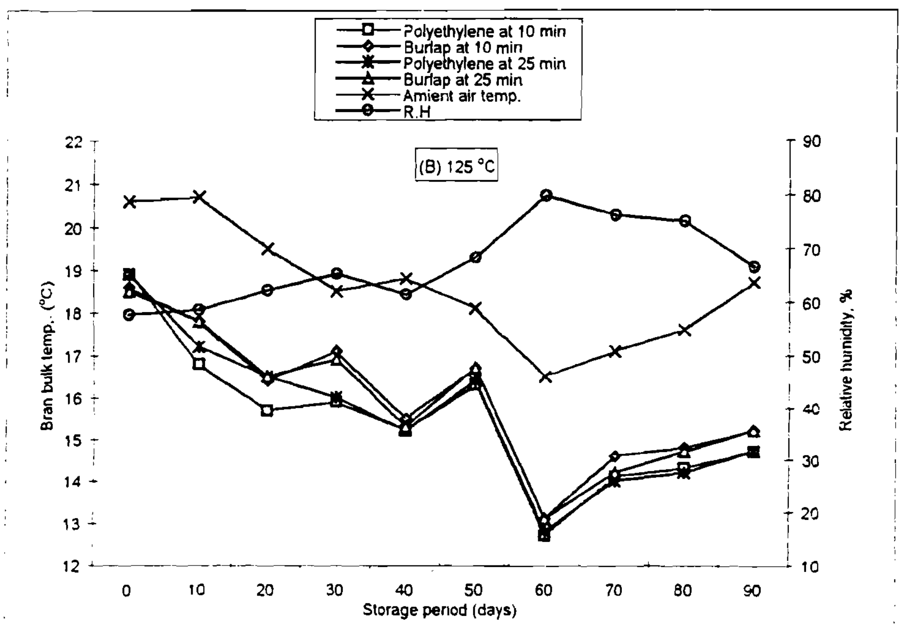


Figure 6 (A, B): Effect of type of storage sacks on bulk temperature of bran at max. and min. heating temperature and exposure time.

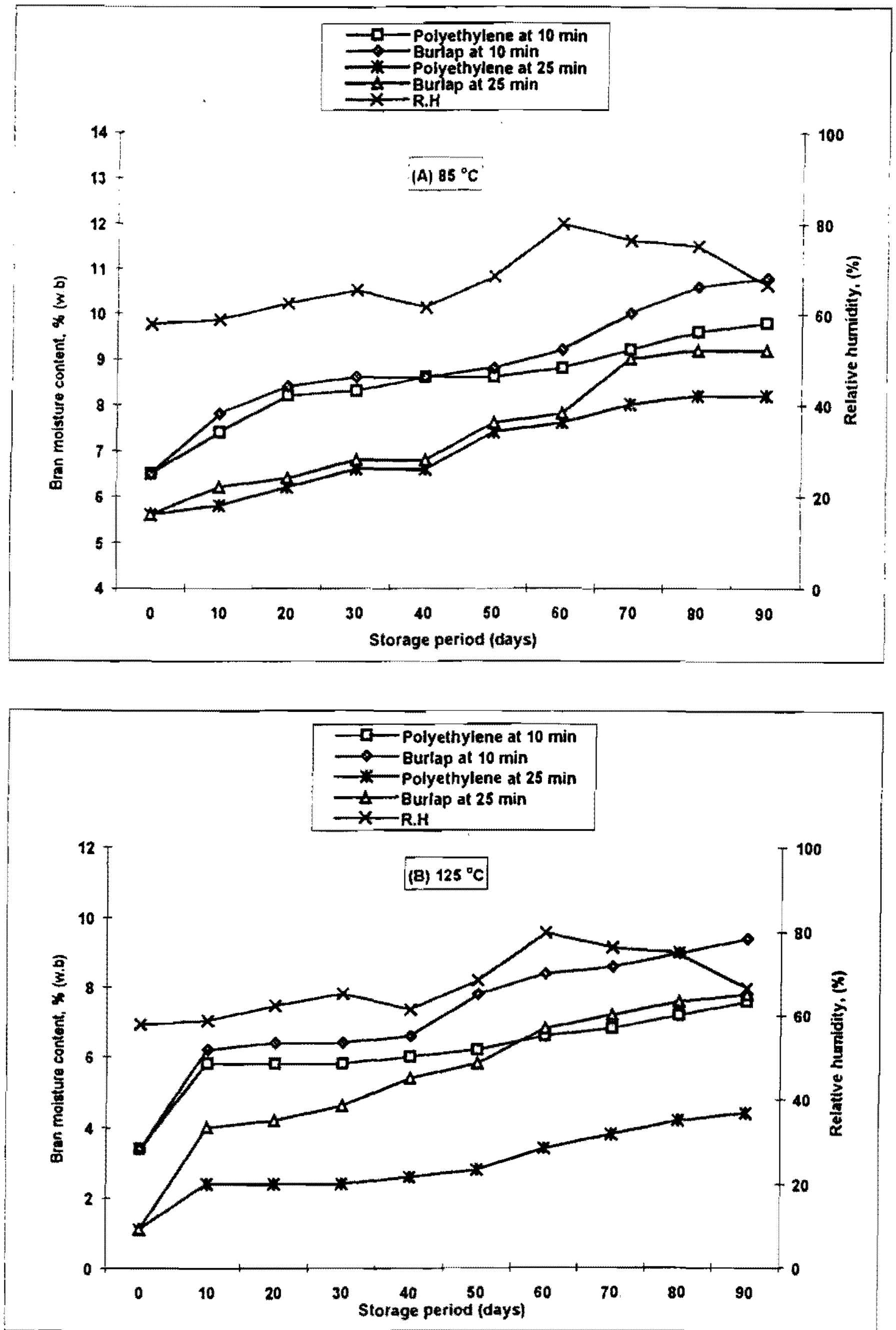


Figure 7 (A, B): Effect of type of storage sacks on moistur content of bran at max. and min. heating temperature and exposure time.

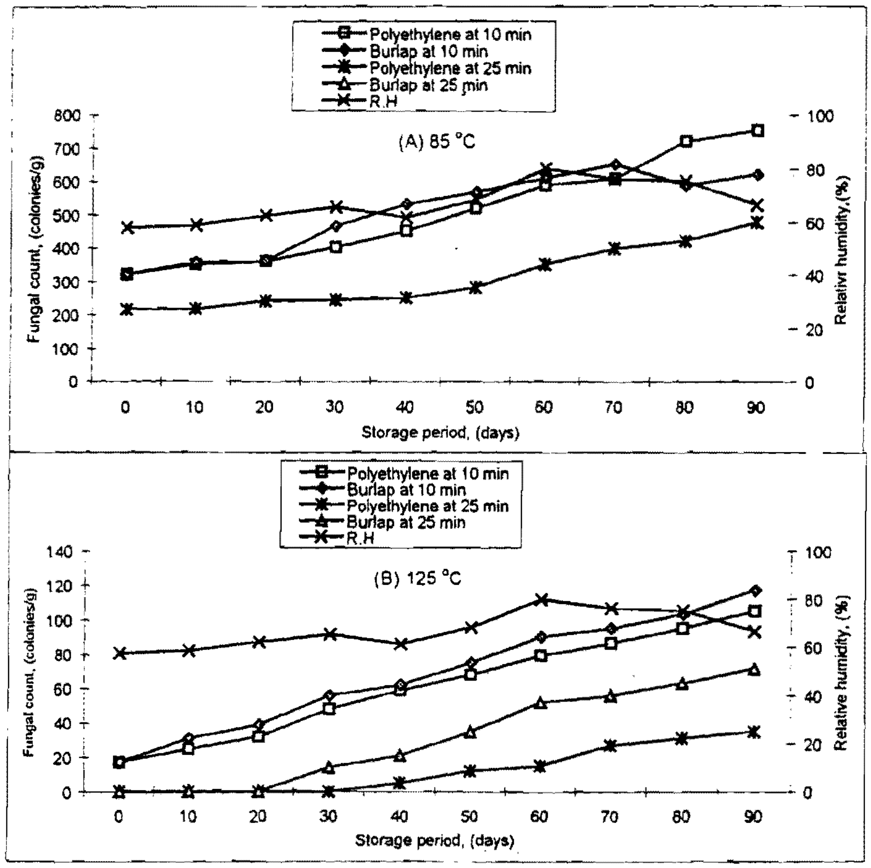


Figure 8 (A, B): Effect of type of storage sacks on fungal count of bran at max. and min. heating temperature and exposure time.

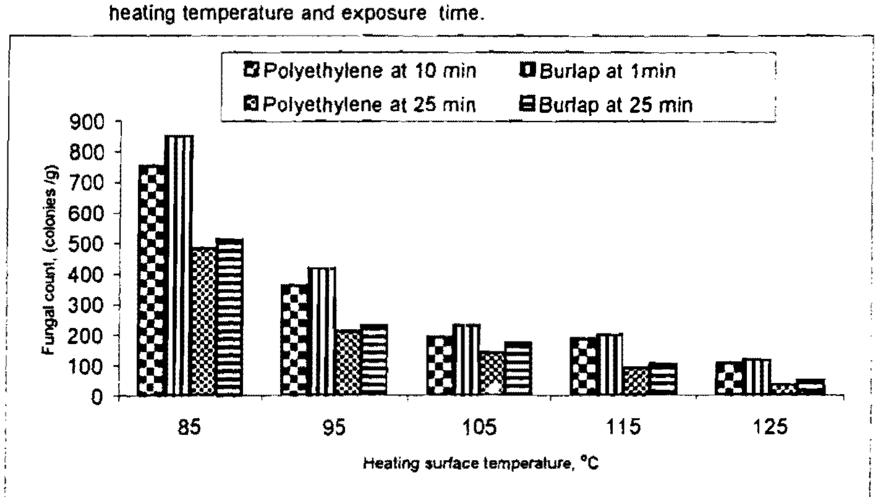


Figure 9: Fungal count at the end of storage period for different heat treatments and different types of storage sacks.

Table (1): Regression equations relating bran moisture content (M.C) with the heat treatments for different types of storage sacks.

Type of storage sacks	Regression equations	R^2	S.E.E
Polyethylene	M.C = 15.164 – 0.076 Tn – 0.141 t + 0.027 S + 0.0025 R.H	0.885	0.586
Burlap	M.C = 11.75 – 0.041 Tn – 0.098 t + 0.041 S + 0.0011 R.H	0.948	0.317

Effect of type of storage sacks on FFA content of the stored bran

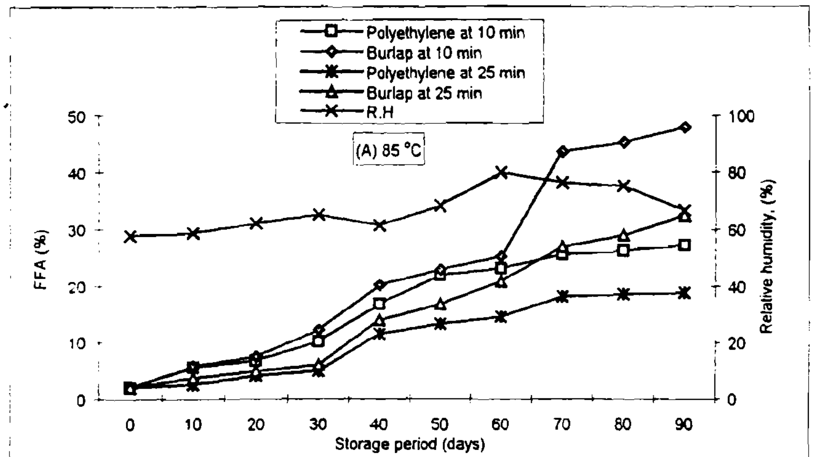
Immediately after milling, lipase is released and hydrolyzed the oil into free fatty acids and glycerol. At zero time of storage, the average free fatty acids (FFA) of control samples recorded 1.92 % and then increased to 86.18 % and 92.90 % after 90 days of storage for the polyethylene and burlap sacks respectively. However, the levels of free fatty acids for different heat treated samples were not affected by heating temperature, and exposure time, while it was higher for the bran samples stored in burlap sacks in comparison with polyethylene sacks. At the end of storage period the estimated (FFA) was ranged from (10.15 to 27.18) for the samples stored in polyethylene sacks and from (14.50 to 47.80) for the samples stored in burlap sacks as shown in figure (10) and (11).

Safe storage period of rice bran:

Considering (10 %) as a maximum level of (FFA) for safe storage of rice bran (Abd El- Rahman, 1996). The safe storage periods of rice bran treated with different heat treatments and stored in polyethylene and burlap sacks were assessed and presented in table (2).

Table (2): Safe storage periods for the heat treated bran stored in different types of storage sacks.

Heating surface temperature, °C	Exposure time, (min)	Maximum safe storage (days)	
		Polyethylene	Burlap
85	10	30	20
	15	30	30
	20	30	30
	25	30	30
95	10	40	30
	15	40	30
	20	40	30
	25	50	40
105	10	40	30
	15	50	30
	20	60	30
	25	60	50
115	10	50	30
	15	60	40
	20	60	40
	25	70	50
125	10	50	40
	15	70	50
	20	80	60
	25	90	60



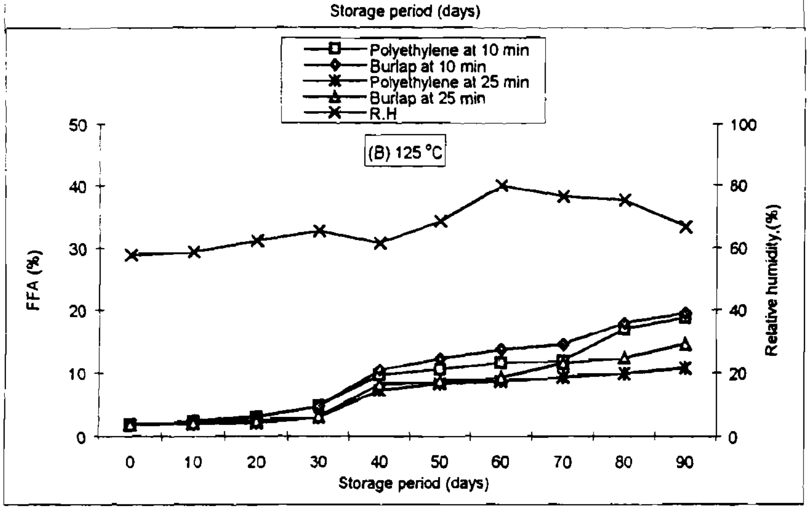


Figure 10 (A, B): Effect of type of storage sacks on (FFA) of bran at max. and min. heating temperature and exposure time.

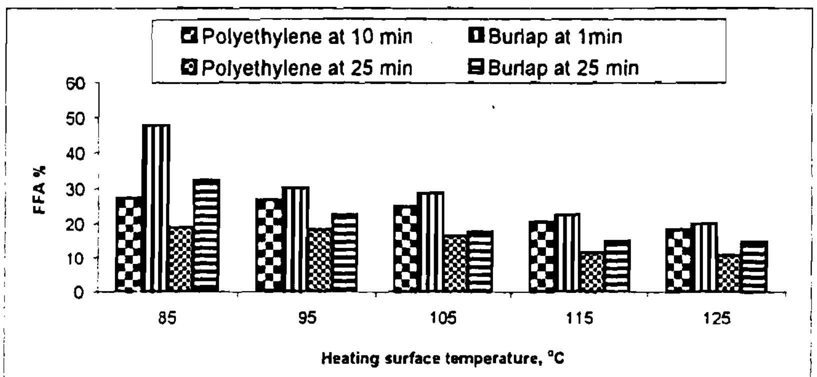


Figure 11: Percent (FFA) at the end of storage period for different heat treatments and different types of storage sacks.

The results in table (2) revealed that, heating or roasting rice bran could prevent enzyme acidity by lowering the bran moisture content. This effect was increased with the increase of both heating surface temperature and exposure time. On the other hands, sealed material such as polyethylene sacks could prevent moisture content of bran to be increased during the storage period beside it could eliminate the presence of oxygen inside the storage sacks which finally inactivate the lipase and increase the storage period in comparison with burlap sacks.

CONCLUSIONS

1- Rice bran moisture content has decreased with the increases of heating surface temperature and exposure time. The reduction percentage of moisture content was fluctuated between 2.57 and 9.1 % (w.b) and it was increased with the increase of storage period depending upon type of storage sacks.
2- The average bulk temperature of the stored bran was fluctuated between 12.7 to 17.8 °C and it was relatively lower for the treatments stored in polyethylene sacks in comparison with burlap sacks.
3- Fungal growth rate was decreased with the increase of heating surface temperature and exposure time and it was higher for the samples stored in burlap sacks in comparison with polyethylene sacks.
4- Free fatty acids (FFA) recorded 1.92 % for the control sample at zero time of storage and it was increased up to a levels of 86.18 % and 92.90 % for the polyethylene and burlap sacks respectively. After 90 days of storage the recorded (FFA) was ranged from (10.15 to 27.18) for the samples stored in polyethylene sacks and from (14.50 to 47.80) for burlap sacks.
5- The recorded safe storage period for the bran stored in polyethylene sacks ranged from (30-90) days in comparison with (20-60) days for the bran stored in burlap sacks.

REFERENCES

Abd El-Rahman, S. N. (1996). Biochemical studies on rice bran as a valuable source of edible oil. Unpulished M.Sc. Thesis, Dep.Of Agr. Biochemistry. Fac. of Agr. Cairo Univ., Egypt.

A.O.A.C (1990). Official Methods of Analysis of Association of Official Agriculture Chemists, 11 th ed. Washington, D.C.

Chakraverty, A and N. C. Patel. (1983). Stabilization of rice bran by conduction and humid heat treatment. AMA. Vol 14 No. 2: 72-76.

Daniel, E., L. Verma,s. Godber and J, Wells. (1991). Extrusion processing of rice bran. American Society of Agricultural Engineers. Paper No. 91

Desikachar H. S. R. (1974). Preservation of by-products of rice milling in Proc. rice by products utilization Int. Conf, 2: p 1. Valencia, Spain.

Elaine T. C. and J. H. Robert. (1992). Stabilization of brown rice to lipolytic hydrolysis by ethanol vapors. Cereal Chemistry 69: 152-156.

Flannigan B. (1977). Enumeration of fungi and assays for ability to degrade structural and componentes of grain. In Biodeterioration Investigation Techniques (ed. H. Walters) London, Applied Science Publishers, PP. 185-199.

Gupta H. P. (1989). The solvent extractors Associton of India. Rice bran offers India an oil source. J. AOCS, Vol 66.

Sevil, O. and T. Selma. (1993). Institute esterification of rice bran oil with methanol and ethanol. J. Am. Oil Chem. Soc. 70: 145-147.

Venkatesan, V.,S. A. Raj and K. Singaravadivel. (1984). Evaluation of container sacks for effective rice bran storage. AMA,. Vol.15 No.(3): 68-70.

Wakako T., H. Kasumimoto, S. Kobayashi and T. Suzuki. (1994). Esterase activity and free fatty acid accumulation in the bran of selected rice cultivars. Cereal Chemistry 71 (2): 162-165.

تأثير عملية التثبيت الحرارى على فترة وجودة التخزين لرجيع الأرز

أحمد محمود معتوق[١] ، صلاح مصطفى عبد اللطيف[١] ، محمد مصطفى الخولى[٢] و ياسر طلبة هنداوى[٢]

١ – قسم الهندسة الزراعية كلية الزراعة – جامعة المنصورة

٢ – معهد بحوث الهندسة الزراعية – الدقى – جيزة.

أجريت تلك الدراسة بهدف تقييم تأثير إستخدام درجات الحرارة العالية لفترات زمنية قصيرة على التثبيت الحرارى لرجيع الكون بغرض تخزينه لفترة زمنية طويلة بالإضافة إلى ذلك تم دراسة تأثير بعض أنواع عبوات التخزين المختلفة على بعض التغيرات الكيميائية للرجيع المخزن والمعامل حراريا."و قد تم إجراء ثلاثة مجموعات من التجارب خلال تلك الدراسة ، إختصت المجموعة الأولى بدراسة تأثير المعاملات الحرارية عند فترات زمنية مختلفة على عملية التثبيت الحرارى للرجيع باستخدام وحدة تجريبية للتثبيت الحرارى تعمل بخاصية التوصيل الحرارى المباشر بينما إختصت المجموعة الثانية من التجارب بدراسة وتحديد فترة التخزين الأمن لرجيع الأرز المعامل حراريا باستخدام نوعين مختلفين من عبوات التخزين) الخيش و البولى إثيلين .(و أخيرا إختصت المجموعة الثالثة من التجارب بإجراء مجموعة من الاختبارات المعملية لتقييم بعض التغيرات الكيميائية التى تحدد درجة الجودة لرجيع الكون المخزن بعد كل مجموعة من التجارب السابقة.

وقد أمكن تلخيص النتائج المتحصل عليها فيما يلي:

١- انخفض المحتوى الرطوبى للرجيع انخفاضا ملحوظا "أثناء عملية التثبيت الحرارى وكان الانخفاض بدرجات متفاوتة زادت بزيادة كلا من درجة حرارة السطح وزمن التعرض وتراوحت نسبة الانخفاض فى المحتوي الرطوبى للرجيع المعامل حراريا بين (٣,٧- ٩,١) ٪ (على الأساس الرطب).

٢- زاد المحتوى الرطوبى للرجيع المخزن بزيادة فترة التخزين و تأثرت درجة الزيادة فى المحتوى الرطوبى بنوع عبوات التخزين و المحتوى الرطوبى الابتدائي للرجيع حيث تراوح المحتوى الرطوبى للرجيع المخزن بين (٤,٤ إلى ٩,٨) ٪ لعبوات البلاستيك بينما تراوح بين (٧,٨ إلى ١٠,٨) ٪ للعبوات الخيش و ذلك بعد فترة ٩٠ يوم من التخزين.

٣- انخفض معدل النمو الفطرى بزيادة كلا من درجة حرارة سطح التسخين وزمن التعرض فى جميع المعاملات المخزنة وكان معدل النمو الفطرى أقل فى المعاملات المخزنة فى عبوات بلاستيك بالمقارنة بالمعاملات المخزنة فى عبوات خيش حيث تأثر معدل الزيادة باختلاف حالة التثبيت الحرارى و كذا نوع العبوة المستخدمة.

٤- زادت نسبة الأحماض الدهنية الحرة (FFA) فى العينة الغير معاملة حراريا من ١,٩٢عند بداية التخزين إلى حوالى (٨٦,١٨ ، ٩٢,٩٠ %)لكل من العبوات البلاستيك والخيش على التوالي ، بينما تراوحت تلك النسبة للمعاملات المعاملة حراريا بين (١٠,٧٥ - ٢٧,١٨) فى حالة التخزين فى عبوات من البلاستيك بالمقارنة ب (١٤,٥- ٤٧,٨) فى حالة التخزين فى عبوات من الخيش.

٥-باعتبار أقصى فترة للتخزين الأمن لرجيع الكون تحدد بعدم تجاوز نسبة الأحماض الدهنية الحرة .%10 (FFA) فقد تراوحت فترة التخزين الأمن بين (٣٠-٩٠) يوم فى حالة العينات المخزنة فى عبوات من البولى إثيلين بالمقارنة ب(٢٠-٦٠) يوم فى حالة العينات المخزنة فى عبوات من الخيش.