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STUDY ON THE EFFECT OF ALPHA-AMYLASE ON COMMERCIAL BREAD PRODUCTION TECHNIQUES IN BANGLADESH

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Abstract: Enzymes are proteins specialized to catalyze biological reactions. Enzymes play a vital role in everyday activities at home and in the baking industry for bread manufacture. In an effort to increase the shelf life of backed goods through conventional baking agents, sodium meta-bi-sulfite or commercial yeast and alpha amylase enzymes were considered in this study. The materials of the study were yeast and alpha amylase. Methodology followed for the experiment was straight and sponge dough method. Temperature, P^H, alpha amylase and leavening agents were the parameters considered in bread making recipes instead of using baking yeast for a specific strain. At 60^0C, amylase showed only 60 % of its optimum activity at P^H 5.5 to 6.0 which coincided with the value given at fermentation period and it was observed that most effective power of enzyme was 12 gm%. The experimental results showed that, the use of one per cent alpha amylase was most effective for the leavening of bread. On the other hand, 1.5 per cent yeast required for leavening of the bread and no doubt was very expensive compared to utilization of alpha amylase. Therefore, the study reveals that, utilization of alpha amylase in bread manufacturing industry might reduce backing cost compared to yeast which is being imported from foreign countries. Moreover, it is possible to produce alpha amylase at large scale using raw materials available in the countries like Bangladesh.

Key Words: Alpha amylase, commercial bread preparation.

Introduction

Enzymes play an important role in everyday activities at home and in the baking industry for bread manufacture. Enzymes are proteins specialized to catalyze biological reactions. Acting in organized sequences, the enzymes catalyze hundreds of stepwise reactions in metabolic pathways by which nutrient molecules are degraded, chemical energy is conserved and transformed, and biological macromolecules are made from simple precursors. The study of enzymes also has immense practical importance. Enzymes have become important practical tools, not only in medicine but also in the chemical industry, in agriculture and in food processing (Nagodawithana and Reed, 1999). Year after year, large quantities of bread and rolls are lost because they become unstable. Extending the shelf life of baked goods is much in the bakers' interest as in that of consumers. For this purpose, carefully selected starch splitting amylase, which influences the structure of dough, permits prolonged fresh keeping on a longer shelf life (Malik and Dhingra, 1995) was used in the present study. The enzymes modify starch and other constituents in a way that starch retrogradation are inhibited. Thus, enzymes can save baking cost and reduce loses through bread making. Alpha amylases hydrolyze the α-1, 4 bonds of amylase and amylo-pectine in a random manner liberating maltose. Fungal enzymes can also be used to prolong the shelf life of bread (Fraizier, 1962). CSRI Australia has established different improvers of different bakery products (Ken, 1999). The study was undertaken to study the effect of alpha amylase on commercial bread production techniques in context of Bangladesh.

Materials and Methods

Various raw materials viz. wheat flour, sugar, salt and yeast were used as baking agents. In addition, freshly prepared alpha amylases (BCSIR) was used as bread improving agent. The standard sponge method was followed for the preparation of the bread which involves the mixing of flour, water, alpha amylase, sugar and fat. For the production of bread, at first fermentation was completed within 6 hours at 25^0C in a moist conditioned room. In the second phase, the remaining ingredients viz. flour and shortening agents were mixed in a kneader machine. Mixing was completed within 10 minutes at 4 psi pressure. The prepared dough was transferred through divider machine and then to baking oven. Fermentation was performed using the methodology of sponge dough method as per diagram shown in Fig.-1. Sample was collected from the store and proximate analyses were performed (Samuel and Bernard, 1937).

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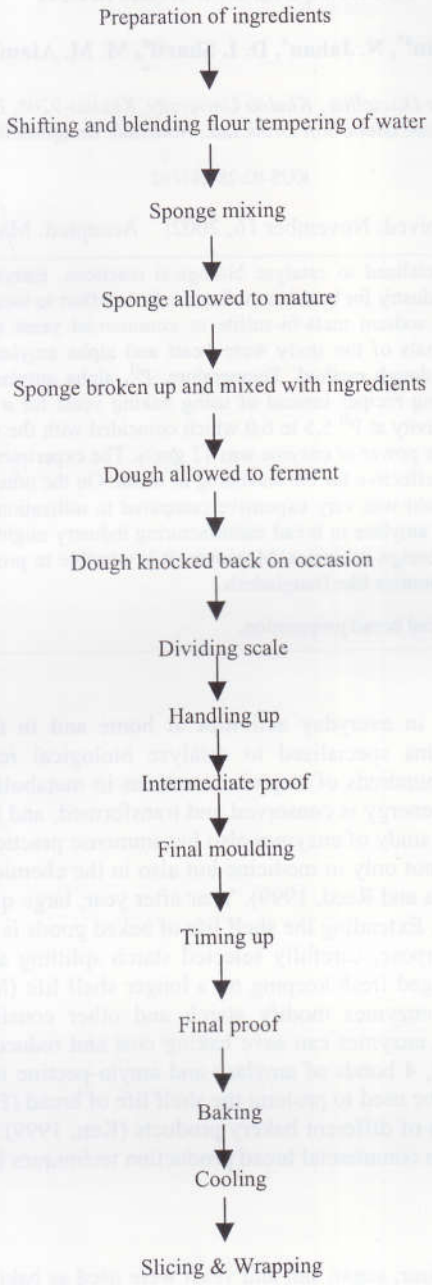

Fig.-1. Flow diagram of preparation of Bread by Sponge Dough Method

Two standard methods of bread making, the straight dough method and the sponge dough method were followed. The sponge dough method (semi-automatic) included mixing & fermentation, makeup, proofing and baking, cooling, slicing and wrapping steps. Proximate analyses of bread was performed which included determination of solid content of bread, P^H of bread, determination of acid insoluble ash, crude fiber and drop test of bread. The fermentation stability by drop test, which included yeast as leavening agent (control) and alpha amylase (enzymes), is shown in Fig.-2.

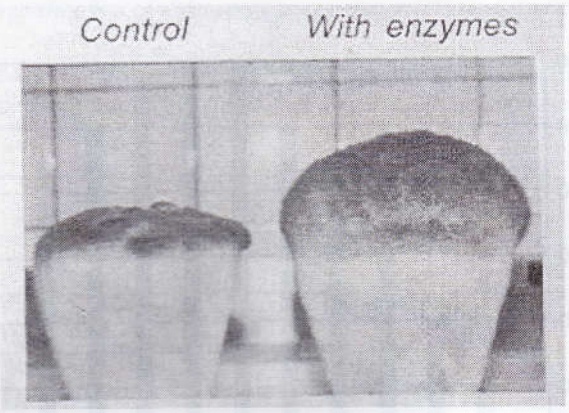

Fig. -2. Fermentation stability–drop test

Results and Discussions

The proximate analysis of the sample was completed using AOAC method and the moisture (15%), ash (2.5%), fiber (0.5%) and solid mass (60%, w/w) contents of bread were determined. Alpha amylase was found to be particularly suitable for baking as was detected by baking test in a specific strain. At temperature below 30°C, amylase showed 45% of its maximum possible activity. During baking, the temperature within the bread and amylase activity did rise as well. The highest activity of the enzyme was reached at 60°C. At temperature above 80°C, it was inactivated within a very short time (Table 1). Amylase in bread making period displayed over 60% to 70% of its maximum achievable activity between P^H 5.5 to 6.0 (Table 2).

Table 1. Alpha Amylase activity at different temperature ranges during bread baking

Serial No.	Temperature °C	Amylase Activity (%)
1	30	0
2	35	10
3	40	20
4	45	30
5	50	45
6	55	50
7	60	60
8	65	60
9	70	55
10	75	50
11	80	45

Table. 2. Activity of alpha amylase in the bread baking period at different P^H

Serial No.	Amylase activity as a function of P^H	P^H Value
1	10	3.0
2	20	3.5
3	30	4.0
4	40	4.5
5	50	5.0
6	60	5.5
7	70	6.0
8	80	6.5
9	90	7.0
10	100	7.5

At temperature below 30°C, amylase showed only 45% of its maximum activity. The highest activity of the enzyme was reached at 50°C. At temperature over 80°C, it was inactivated within a very short time. A reaction period of one hour at temperatures below 70°C was sufficient to destroy the enzyme activity. Graphical presentation of enzymatic activity at different temperature has been shown in Fig.-3.

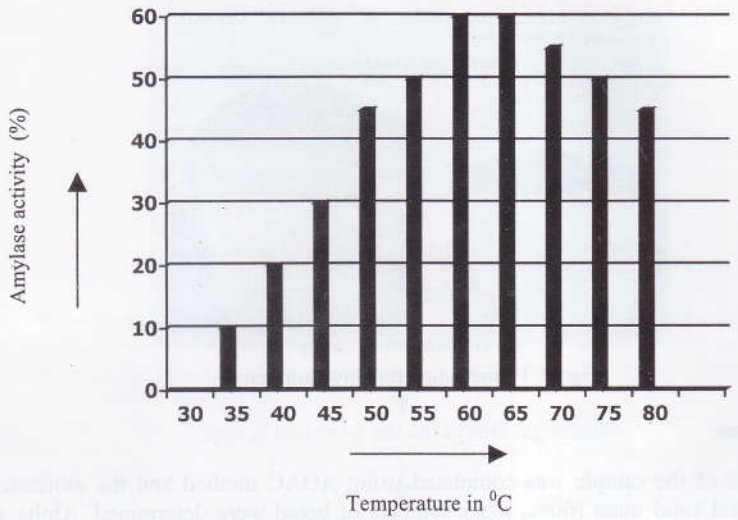

Fig. -3. Enzymatic activity at different temperature

Amylase activity in bread making time displayed over 85% of its maximum achievable activity between p^H 5 and 7. The p^H of optimum activity is 6.0, which coincides with the value given at the start of fermentation (Fig.-4). Alpha amylase showed much higher activity than the conventional yeast in bread (Fig.-5)

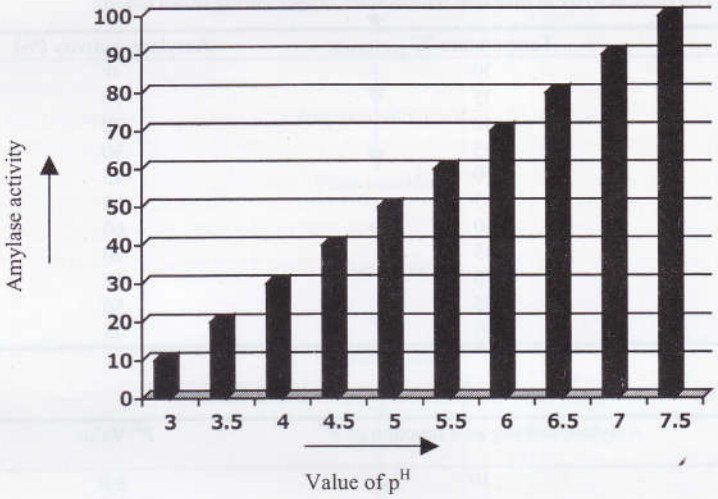

Fig. -4. Enzymatic activity at different p^H

Bread was leavened using different percentages (0.5%, 1.0%, 1.5%, 2% etc.) of alpha amylase for the observation of leavening power of enzymes and found 12 gm% was the most effective bread improving power (Table 3).

Table 3. Activity of alpha amylase in bread leavening period

Time (min)	10	20	30	40	50	60
alpha amylase used (%)	Volume used (%)					
0.5	21	35	51	72	86	96
1.0	34	54	79	110	143	157
1.5	31	49	71	95	120	141
2.0	43	53	77	112	141	156

Fig.-5 shows the activity of alpha amylase in bread leavening period. It shows the fermentation stability by drop test, which contains yeast as leavening agent (control) and the alpha amylase (enzymes).

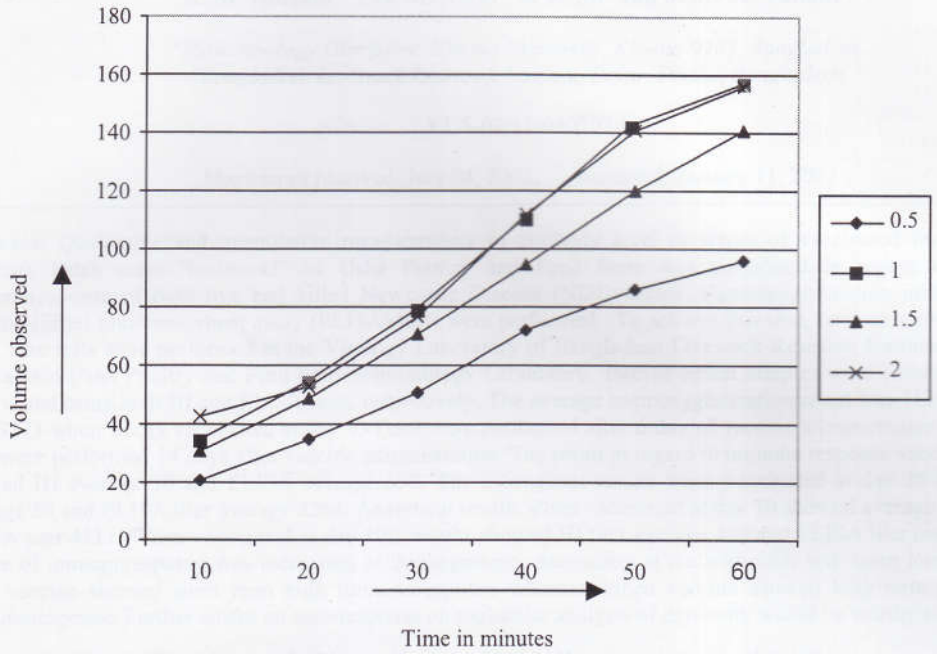

Fig. -5. Activity of alpha amylase in bread leavening period

In Bangladesh, the commercial baking agent yeast is imported from foreign countries and is expensive. On the other hand, alpha amylase can be produced at large scale by using local raw materials like Bengal gramm, khesari, dal, soybean with calcium, magnesium, potassium, iron and manganese. Therefore, the present study encourages the production and utilization of alpha amylase locally, instead of using imported yeast as sole baking agent.

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