THE PROTECTIVE EFFECT OF GELATIN ON THE STORAGE STABILITY OF ACTIVE DRY YEAST

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INTRODUCTION

Active dry yeast (ADY) is a dehydrated form of baker's yeast with a moisture content of about 8%. It has an advantage over fresh baker's yeast in the fact that it does not require refregeration, and its shelflife varies from 1-12 months depending on the moisture conditions. Its stability is inversily proportional to the storage temperature, Theissen (1942), Morse and Fellers (1949), and Felsher e al. (1955). Also, atmospheric oxygen has an adverse effect on the storage stability of (ADY), Crane et al. (1955), and it has to be rehumidified with water vapor before reconstitution to give satisfactory beking activity, Sant and Peterson (1958), and Mitchell and Enright (1957).

Mitchell and Enright (1959) could improve the storage stability of (ADY) by incorporating certain fatty esters of sorbitan in the yeast cream before drying. This method did not give enough protection for (ADY) in an air atmosphere. Very recently however, Chen and Cooper (1962) and Chen et al. (1966) could produce what they called «protected» (ADY) by incorporating antioxidants into the yeast cream prior to dehydration. The protected (ADY) proved to be stable in an air atmosphere.

It is generally agreed that protective colloids like peptone, skim milk and serum are necessary to protect microbial cells during freeze — drying, Naylor and Smith (1946), Weisser and Hennum (1947) and Frey (1954), yet to the best of our knowledge, the use of gelatin for protecting (ADY) has not been reported before. The present studies however, present a method for protecting active dry yeast against oxidative deterioration during its storage in an air atmosphere, by incorporating gelatin instead of antioxidants to the yeast cream prior to drying.

Materials and Methods

Test Organism :

The yeast used in the present studies was fresh commercial compressed baker's yeast, a product of (Starch Products and Yeast Co.) at Alexandria A.R.E. It is delivered daily to Cairo as yeast cake in 500 g. portions.

Washing of Cells :

This was carried out by suspending the yeast cells into (1—1 V/V) distilled water at the specified pH. Cells were centrifuged using 25 ml. capacity glass centrifuge tubes for 15 minutes at 3,000 r.p.m. After washing the cells for three times the supernatant was poored off the yeast pellet. The latter was then further compressed to form a cake of about 30% dry yeast solids. This was extruded in the form of short cylindrical strands approximately 3 x 10 mm. and dried in a forced air drier at 40°C. If gelatin has to be incorporated, distilled water was substituted by gelatin solutions at the specified pH and concentrations. Drying time ranged between 60—90 minutes depending on the concentration of gelatin used for washing. The dried yeast was then kept in tightly sealed polyethylene pouches to eliminate moisture and stored in an air atmosphere at 28°C.

Determination of (ADY)'s Storage Stability :

A simple method was used for determining the baking activity of (ADY) described as follows :

300 mg dried yeast cells were reconstituted by suspending them in 18 ml distilled water at 28°C for 10 minutes. Using a glass rod, the suspended cells were thoroughly mixed with 25 g. flour in a 500 ml capacity glass beaker. After the dough has been developed, it was carefully transferred to 250 ml. capacity graduated cylinder containing 10 ml pure paraffin oil at 28°C. The oil floats over the dough making an easy to read reference mark to indicate the initial volume of the dough. Finally the graduated cylinder was kept at 28°C. The dough volume obtained after 90 minutes was considered as the initial baking activity of (ADY). However, the stability of (ADY) was expressed as the percentage of its original baking activity retained after storage.

Moisture Content :

This was determined by calculating the weight loss of 2 g. (ADY) left overnight in an oven at 100°C.

Leached Cell Constituents :

It is generally agreed that the quantity of cell constituents leached from (ADY) during reconstitution is an index of (ADY) quality. It is a measure of the different treatments in minimising leaching. Leaching experiments done in these studies were based on the method presented by Chen et al. (1966). 1 g. of (ADY) was extracted in 30 ml distilled water at 28°C by stirring for 3 minutes in 100 ml capacity glass beaker. Cells were then centrifuged for 15 minutes at 3000 r.p.m. The supernatant was then carefully decanted into a drying pan and dried to a constant weight at 100°C in a forced draft oven. The rehydration loss was expressed as percent yeast solids extracted.

Results and Discussions

Results presented in table 1 show that washing the yeast cells prior to drying with gelatin solutions at pH 6.5 seems to have the highest protective effect over (ADY), especially at 1.5% and 2.0% gelatin concentrations. Also, the pH of the gelatin solution used for washing is critical in reference to the water dispersibility of the dried yeast cells, where they stay in clumps on rehydration. Clumping of the yeast cells at lower and higher pH ranges occurs only after drying. So both lower and higher pH ranges together with drying might have an effect on the hydration properties of gelatin.

Togashi et al. (1961) and Andrew (1959—1961) studied model systems simulating typical food structures to see the lipid stability of dehydrated foods. They found that gelatin has a protective effect against fat oxidation, and the larger the numerical difference pI — pH of gelatin the less the oxidation rate. This difference may be taken as a measure of the residual charge on the protein surface. It suggests that a lipoprotein orientation may account for the reduced oxidation rate of fat spread upon a protein surface. In the present studies however, higher pH ranges of gelatin did not show any significant improvements in its protective power on (ADY) against oxidative deterioration during storage in an air atmosphere.

Data for leached-cell constituents on rehydration presented in table 2 did not show any significance in reference to the protective power of gelatin. This might be due to the fact that on rehydration, gelatin which coats the yeast cells might leave with the cell constituents.

SUMMARY

Conventional active dry yeast (ADY) has a very low storage stability in an air atmosphere, while «protected» (ADY) proved to be stable on storage in an air atmosphere. The latter was developed by the incorporation of an antioxidant into the yeast cream prior to drying.

A method of incorporating gelatin instead of antioxidants to the yeast was developed based on washing the yeast cells with gelatin solutions — at specific concentrations and pH — prior to drying.

Washing the yeast cells — prior to drying — with gelatin solutions at pH 6.5 especially at 1.5% and 2.0% concentrations, proved to have the aptimum protection for (ADY) during storage in an air atmosphere at 28°C.

REFERENCES

1. Andrews, F.A. 1959 — 1961.
Study of Secondary Deterioration in Partially Oxidized Lipids.
Quarterly Progress Reports Nos. 1—4.
Quartermaster Food and Container Inst. Chicago, ILL U.S.A.

2. Chen, S.L. & E.J. Cooper, 1962.
Production of Active Dry Yeast. U.S. Patent, 3, 041, 240.

3. Chen, S.L., E.J. Cooper & F. Gutmanis, 1966.
Active Dry Yeast ; Protection Against Oxidative Deteriorations during Storage. Food Technol. 20, 1585.

4. Crane J.C., H.K. Steele & S. Redfern, 1952.
Techniques for Estimating, the Stability of Food Products : Active dry Yeast. Food Technol. 6, 220.

5. Felsher A.R., R.B. Koch & R.A. Larson, 1955.
The Storage Stability of Vacuum Packed Dry Yeast.
Cereal Chem. 32, 117.

6. Frey R.M. 1954.
The Preservation of Bacteria In : «Biological Applications of Freezing and Drying», Ch. 10, pp. 215—262. Edited by R.J.C. Harris. Academic Press Inc. New York, N.Y.

7. Mitchell J.H. Jr. & J.J. Enright, 1957.
Effect of Low Moisture Levels on the Thermostability of Active Dry Yeast. Food Technol. 11, 359.

8. Mitchell J.H. & J.J. Enright, 1959.
Thermostable Active Dry Yeast Compositions.
U.S. Patent 2, 894, 842.

9. Morse R.E. & C.R Fellers, 1949.
Storage studies on Active Dry Baker's Yeast.
Food Technol. 3, 234.

10. Naylor H.B. & P.A. Smith, 1946.
Factors affecting the Viability of *Serratia. marcescense* during dehydration and storage.
J. Bact. 52, 565.

11. Sant R.K. & W.H. Peterson, 1958.
Factors affecting loss of nitrogen and fermenting power of rehydrated active dry yeast. Food Technol. 12, 359.

12. Teissen, E.J., 1942.
The effect of temperature upon the viability and baking properties of dry and moist yeast stored for various periods.
Cereal Chem. 19, 773.

13. Togashi H.J., A.S. Henick & R.B. Koch, 1961.
The Oxidation of Lipids in thin films.
J. Food Sci. 26, 186.

14. Weisser R.S. & L.A. Hennum, 1947.
Studies on the death of bacteria by drying.
J. Bact. 54, 17.

TABLE 1

STABILITY** OF GELATIN COATED (DAY) AFTER 6 WEEKS STORAGE IN AN AIR ATMOSPHERE AT 28°C.

	Washing Solutions				
pH	Dist. Water	Gelatin Concentrations 0.5%	1.0%	1.5%	2.%
5.0	60.5	66.2*	70.3*	60.9*	59.3*
5.5	56.5	65.1*	68.0*	66.0*	80.7*
6.0	58.5	66.4	78.3	61.8*	78.9*
6.5	60.8	67.4	80.5	92.1	92.9
7.0	60.5	67.6	74.1	77.1	77.3
7.5	61.5	69.2	78.9	77.0	77.6
8.0	59.1	64.5	69.1	70.6*	74.8*

** Percent retention of dough raising power at 28°C.

* Percent yeast solids extracted at 28°C after 6 weeks storage.

TABLE 2

STORAGE STABILITY OF (ADY) WASHED WITH GELATIN SOLUTIONS AT pH 6.5

Concentration	ADY Moisture %	Rehydration Properties *	(Stability) (Weeks of Storage) 6	8	10
			%	%	%
Dist. H_2O	4.2	9.4	60.8	59.4	56.9
1.0%	4.0	8.5	80.5	73.6	66.3
1.5%	3.9	9.3	92.1	73.7	72.3
2.0%	3.9	9.0	92.9	81.8	80.2

* The yeast cells stayed in clumps on rehydration.