MICROBIOLOGICAL AND CHEMICAL QUALITY OF ACTIVE DRY YEAST

By

ABDELRAHMAN SALEH ZAKY AHMED
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ABSTRACT

There is an increasing demand for baker's yeast to satisfy the needs of over growing population. This necessitates that efforts be made to ensure their hygienic suitability and functional quality. This study was, therefore, executed to monitor the microbial content of 9 different brands of active dry yeast (ADY) and the Egyptian compressed yeast. In this regard, the compressed yeast recorded the worst microbiological quality where all samples contained a massive amount of total and faecal coliforms as well as 50% of samples contained *salmonella*. On the other hand, ADY recorded better result as percentage of unacceptable samples; total coliforms (23.3%), faecal coliforms (17.8%) and *Salmonella* (4.4%).

The leavening ability of yeast depends on its viability and chemical composition. Concerning yeast cell viability, the compressed yeast revealed the highest viability (96.9%) while the viability of ADY brands ranged from 23 to 78.3%. All samples contained fair amounts of lipids and proteins while the intracellular trehalose - which generally believed to be a critical parameter for its resistance to stress such as drying - ranged from 7.89 to 28.8%.

The most important role of yeast in bread making is raising the dough to produce the characteristic loaf preferred by consumers. Therefore, evaluating the rising power (RP) and the main parameters affecting the RP includes; temperature, amount of yeast, salt and sugar concentrations were considered. Findings of this study recorded far difference in RP between the local and imported brands especially those from UK and China. Most brands required a specific temperature (35 or 40° C) to give the maximum RP while some brands gave almost the same RP value in wide range of temperatures. Results indicated a positive correlation between yeast amount and RP while a negative correlation between salt concentration and RP was occurred. Furthermore, adding sugar up to 1.5% to the dough did improve the RP of some brands by 25%.

It was rather interest to investigate the most efficient conditions for baker's yeast production. Thus, 4 strains of *Saccharomyces cerevisiae* were isolated from different commercial ADY. The Isolates were tested for five parameters including initial yeast level, molasses concentration, urea requirements, pH-value and agitation speed. The results recommend adjusting the cultivation medium at 10% molasses with 0.15% urea at pH 5. The medium was then inoculated by the yeast strain to obtain the initial count of 10^3 cells / ml. Then the flasks were incubated in orbital shaker (150 rpm) at 30°C for 24 hours.

Key words: *Saccharomyces cerevisiae*, microbiological quality, viability, rising power, trehalose, baker's yeast production.

DEDICATION

I dedicate this work to ***my mother****, for all the care, passion and support she lovely offered along with my life, as well as to the soul of my spiritual father,* ***Prof. Moawad Zahra*** *for giving me an endless support and super trust.*

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CONTENTS

	page
INTRODUCTION ……...	**1**
REVIEW OF LITERATURE ..…….…....…	**5**
1. The Role of yeast in bread making ……	**5**
2. Safety of Baker's Yeast ..……...……...	**6**
3. Microbial contamination in baker's yeast ..……..	**7**
a. Total microbial count..…….....……..	**8**
b. Marker groups …..…….....…….	**9**
c. Pathogenic bacteria …….....……..	**10**
d. Wild yeasts and moulds ……..…….....	**12**
4. Baker's yeast chemical composition ……....……	**13**
5. Importance of Trehalose in yeast cells ……..	**14**
6. Baker's yeast production ……....……..	**15**
7. Factors affecting baker's yeast production ……...	**19**
a. Fermentable sugar concentration ……....…….	**19**
b. Nitrogen concentration ……....……....…	**21**
c. Yeast inoculum in fermentor ……....……..…	**21**
d. pH-value ……....……....…….....	**21**
e. Aeration ……....……....…….....	**22**
f. Temperature ……....……....……	**24**
MATERIALS AND METHODS…….…….….....	**25**
1. Baker's Yeast samples ……....……..	**25**
2. Yeast strains ……....……....…….	**25**
3. Culture media ……....……....……	**25**
4. Reagents ……....……....……...	**30**
5. Raw materials ……....……....…….	**31**
6. Enumeration of different microbial groups in the commercial baker's Yeast ……....……..	**31**
7. Confirmation and Identification tests ……....…	**34**
8. pH measurement ……....……....……	**35**
9. Microscopic yeast counting and viability test …….	**35**
10. Chemical composition of baker's yeast ....……..	**36**
11. Raising power (RP) test and the leavening ability of baker's yeast ……....……....…….	**37**
12. Factors affecting the raising power (RP) in dough …	**38**
13. Factors affecting the production of baker's yeast in cane molasses medium using shaking cultures …….	**39**

14. Statistical analysis ……..……..…… **41**
RESULTS AND DISCUSSION…….…… **43**
1. Microbiological analysis and cell viability of baker's yeast ……..……..……..….. **43**
a. Active dry yeast (ADY)…… **43**
b. The Egyptian compressed yeast (brand J) ……..... **58**
c. Microbiological profile of different brands of baker's yeast ……..…….. **60**
d. Microscopic counts and viability for different brands of baker's yeast ……..……... **65**
2. Chemical composition of baker's yeast ……. **67**
3. Leavening ability of baker's yeast ……..…….. **71**
a. Raising power (RP) of different baker's yeast brands … **71**
b. Relationship between raising power (RP) and viability.. **73**
c. Relationship between the rising power and trehalose content ……..……..……..... **73**
4. Factors affecting the rising power of the baker's yeast in dough ……..……..……. **74**
a. Effect of temperature ……..……..…. **74**
b. Effect of yeast amount ……..……..… **77**
c. Effect of sugar ……..……..……. **78**
d. Effect of salt ……..……..…… **80**
5. Factors affecting the production of baker's yeast ….. **81**
a. Effect of initial yeast level ……..……... **81**
b. Effect of molasses concentration ……..…….. **84**
c. Effect of urea concentration ……..…….. **86**
d. Effect of pH-value ……..……..…….. **87**
e. Effect of agitation …… **91**
SUMMARY ……..……..……. **95**
REFERENCES ……..……..…… **101**
ARABIC SUMMARY …….…..……...…. **---**

LISTT OF TABLES

No.	Title	Page
1.	**Microbiological analysis of active dry yeast samples, brand A (Pasha, Turkey)** ……..…….……..	44
2.	**Microbiological analysis of active dry yeast samples, brand B (Aladdin's instant, Turkey) ..**…….….....	46
3.	**Microbiological analysis for active dry yeast samples, brand C (Nurmaya, Turkey) …….**……	48
4.	**Microbiological analysis of active dry yeast samples, brand, D (Right it, China) .**……..…….....	49
5.	**Microbiological analysis of active dry yeast samples, brand E (Golden speed, the UK) ...**……..	51
6.	**Microbiological analysis of active dry yeast samples, brand F (La Royale, Egypt)** ……..…….……..	52
7.	**Microbiological analysis of active dry yeast samples, brand G (El Tayeb, Egypt)** ……..	54
8.	**Microbiological analysis of active dry yeast samples, brand H (Holw Elsham, packed in Egypt)** ……...	56
9.	**Microbiological analysis of active dry yeast samples, brand I (Rehab golden, packed in Egypt)** …….....	57
10.	**Microbiological analysis of the Egyptian compressed yeast samples, brand J** ……..…….	59
11.	**Microbiological loads of 10 baker's yeast brands sold in Egypt .**……..…..……	61
12.	**Yeast counts and viability of 10 baker's yeast brands sold in Egypt** ……..……..	66
13.	**Chemical composition of different baker's yeast** ….……	68

14 **Effect of initial yeast level on the production of baker's yeast** ……..……..……..……..... 83

15 **Effect of molasses concentration on the production of yeast** ……..……..……..……..... 85

16 **Effect of urea concentration on the production of yeast ...** 88

17 **Effect of pH value on the production of yeast** ……... 90

18 **Effect of agitation speed on the production of yeast** ……. 92

LISTT OF FIGURES

No.	Title	Page
1.	**Process flow diagram of the production of baker's yeast..**	17
2.	**Rising power of the different baker's yeast brands** ……..	72
3.	**The effect of temperature on the rising power of baker's yeast** ……...……..	76
4.	**The effect of yeast amount on the rising power of baker's yeast** ……...……..	77
5.	**The effect of sugar concentration on the rising power of baker's yeast** ……..……..	79
6.	**The effect of salt concentration on the rising power of baker's yeast** ……..……..	81
7.	**Effect of inetial yeast level on the production of baker's yeast** ……..……	84
8.	**Effect of molasses concentration on the production of baker's yeast** ……..……..	86
9.	**Effect of molasses concentration on the production of baker's yeast** ……...……...……..	89
10.	**Effect of pH value on the production of baker's yeast** ….	91
11.	**Effect of agitation speed on the production of baker's yeast** ……	94

INTRODUCTION

Yeasts were used to raise bread in Egypt from 4000 BC, early in history (Haider *et al.*, 2003).Yeast (*Saccharomyces cerevisiae*) is widely used worldwide in many industries and it is one of the most extensive studied microorganisms. Baker's yeast is a key baking ingredient and this fascinating food starter has a long history. Since its massive introduction in the 19th century, baker's yeast certainly had a major impact on bread making technology. It is still one of the most important fermentation products based on volume of sales and its use for bread-making which considered as a staple food for large section of world's population.

Baker's yeast, as a commercial product, has several formulations that can be grouped into two main types: compressed yeast that called fresh yeast and dried yeast (Beudeker *et al.*, 1990). Compressed yeast is the traditional form of baker's yeast, and is ready for immediate use. Dried yeast is available in two forms: active dry yeast (ADY) and instant dry yeast (IDY). All baker's yeasts produced and used commercially in the world now, are strains of the species *Saccharomyces cerevisiae* that belongs to the fungal family *Saccharomycetaceae*. It is a unicellular, eukaryotic microorganism, usually diploid, reproduces vegetatively by budding and sexually by ascospore formation (Barnett *et al.*, 2000).

Several studies (Collins *et al.*, 1991; Bailey and von Holy, 1993; Viljoen and von Holy, 1997) have provided evidence that baker's yeast can contain *Bacillus* spores which are heat resistant and survive the

baking process 200 - 300° C (Pattison, 2000). Baker's yeast production is concerned with spoilage-causing wild yeast contamination such as *Candida, Torulopisis, Geotrichum and Hansenula* (Reed and Nagodawithana, 1991). Enterococci are heat resistant and survive adverse environmental conditions in dried products. So, it was found with high numbers in dry yeast samples (Jay, 2000 and O'Brien *et al.,* 2004).

There is an increasing demand for such product - baker's yeast - in order to satisfy the needs of over growing population. This necessitates that should be made to ensure their hygienic suitability. No information concerning the microbial content of these products in Egypt is available. This study was, therefore, executed to monitor the microbial content of baker's yeast taken from retail markets in an attempt to gain some insight into potential microbial related problems associated with these products. The leavening power of the yeast depends on its activity and viability. Hence, the yeast used must be fully active with a high viable cell count. So, determining the yeast cell count and the viability were carried out.

The role of the yeast in bread making is raising the dough to produce the characteristic loaf preferred by consumers. Dough rising occurs as a result of the gases produced by the yeast. During growth, the yeast metabolizes the sugars in the dough with the help of a special enzyme system and produce alcohol and CO_2 (Al-Eid *et al.,* 2010). So, evaluating the raising power of various imported active dry yeast brands available in the Egyptian market and comparing the results with the Egyptian compressed and active dry yeast was among the major

target of this study. In addition, the effects of temperature, amount of yeast, salt and sugar on yeast function in dough were studied.

Among the microorganisms that human consumes every day, yeast is the most represented. Since the content of yeast in bread and bakery products is 2 to 4% (calculated on flour), this microorganism can certainly be considered as food (Rose, 1979 and Walker, 1999). Thus, the chemical composition of the baker's yeast was considered to evaluate the nutritional importance of baker's yeast - especially it has more than 50% of protein - as well as to explain the relationship between the trehalose content and both, viability of yeast cells after drying and raising power of yeast in dough.

The last part of this study dealt with the main factors affecting the production of baker's yeast in molasses medium in order to determine the optimum conditions for yeast production.

REVIEW OF LITERATURE

1. The Role of yeast in bread making

Baker's yeast has a long history of safe use in food (Tucker and Woods, 1995). This microorganism has been used as early as the Stone Age (about 9000 BC) as starter cultures in the production of bread, beer and wine. Pretorius (2000) reported that, between 1857 and 1863, Louis Pasteur demonstrated that the yeast *Saccharomyces cerevisiae* is the microorganism responsible for the fermentation of bread, beer, wine and cider. He discovered that a number of varieties of *Saccharomyces cerevisiae* exist in nature which are more or less adapted to these different fermentations. This is possibly the reason why *Saccharomyces cerevisiae* is also known under various other names. The formally accepted taxonomic name of the species is *Saccharomyces cerevisiae* but taxonomic textbooks list many synonyms, such as *Saccharomyces bayanus*, *Saccharomyces pastorianus*, *Saccharomyces carlsbergensis*, *Saccharomyces uvarum*, *Saccharomyces sake* and *Saccharomyces vini* (Kreger-van Rij, 1984 and Barnett *et at.*, 1990).

The function of yeast in bread making cannot be successfully replaced by any other ingredient, thus it is vital to the baking trade. Baker's yeast is propagated under controlled conditions, in order to ensure consistent end product quality (Pattison and von Holy, 2001). Therefore, the yeast strain used must display constant characteristics, such as the capability of fast growth, good leavening activity and genetic stability (Oura *et al*., 1982).