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PREPARATION AND MANAGEMENT OF  
BREAD YEAST

Thesis for the Degree of B. S.

Alice M. Cimmer

1900

THESIS.

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The object of this investigation was to determine the best media for the yeast, and the best method of managing the yeast.

#### A. Determination of Best Media.

The object of experiments Nos. 1, 2 and 3 was to determine the value of sugar in yeast. In each of these experiments, the batter was put into a sterile glass fruit jar and covered with sterile cotton-wool.

(1). A thin batter was made of flour and boiling potato water, to which a Fleischman yeast cake was added after the batter had become cool. This batter was kept at a temperature of  $26^{\circ}\text{C}$ . A mold formed on this batter but no fermentation was evident. A repetition of this experiment produced the same result.

(2) A batter was made as in (1) with the addition of one teaspoonful of cane sugar to one-half pint of the batter. In this case fermentation was active at the end of twelve hours.

In the above experiments no definite amount of flour and potato water was used and the conditions under which the batters were kept, varied. In the following experiment, a definite amount of flour and potato water was used and the batters were kept under the same conditions.

(3). (a) A batter was made of one-fourth cup flour and one cup boiling potato water, and when cool, the batter was inoculated with one tablespoonful of yeast from (2). (b) A batter was made as in (a) to which was added one teaspoonful of sugar. After twelve hours, (a) showed no fermentation while in (b) the fermentation was active.

The results of these experiments show that sugar is essential

for the rapid fermentation of the yeast plant. The next experiment was to determine the effect of different amounts of sugar.

(4) A batter was made of potato water and flour and 50cc of this batter was put into each of nine Erlenmeyer flasks which had been previously plugged with cotton wool and sterilized in dry heat. To these flasks were added 4gms., 3 1/2 gms., 3 gms., 2 1/2 gms., 2 gms., 1 1/2 gms., 1 gm., 1/2 gm., 0 gms. sugar respectively. Each of these flasks was inoculated with a pure culture of yeast isolated from a Fleischman yeast cake. The flasks which contained the 4 gms. and 3 1/2 gms sugar showed active fermentation after twelve hours; the flasks containing 3 gms., 2 1/2 gms., 1 1/2 gms., and 1 gm. showed fermentation after twenty-four hours, but the flasks containing 1/2 gm. and 0 gm. sugar showed no fermentation at the end of one week. Thus, the fermentation was most rapid in the flasks which contained the most sugar.

(5) In this experiment, the object was to determine the value of potato water in the media.

(a) A thin batter was made of flour, clear boiling water, and 7gms. sugar. This flask was inoculated, when cool, with one teaspoonful of a pure yeast batter made from a Fleischman yeast cake.

(b) A thin batter was made of flour, boiling potato water and 7 gms. sugar. This batter was inoculated with the same batter as that used in (a) and both flasks were kept at the same temperature. The fermentation in (b) was active after twenty-four hours but no fermentation was apparent in (a) until the fifth day after inoculation. Thus, the potato water is favorable for the rapid fermentation of the yeast.



(6) The object of this experiment was to determine the value of flour in the media. One hundred fifteen grams potato were boiled in one liter of water until tender, the potato was removed, put through a sieve and then mixed again with the water in which the potatoes were boiled.

(a) A batter was made of  $1\frac{1}{2}$  gms. flour,  $1\frac{1}{2}$  gms. sugar and 50cc. of the potato water. This batter was inoculated, when cool, with a pure culture of yeast isolated from a Fleishman cake. This batter showed fermentation after four days.

(b) A batter was made of  $1\frac{1}{2}$  gms. sugar and 50 cc. of the boiling potato water. When cool, this batter was inoculated from the same culture as (a). This showed no fermentation until the sixth day.

(c). A batter was made of  $1\frac{1}{2}$  gms. flour,  $1\frac{1}{2}$  gms. sugar and 50 cc. clear boiling water. When cool, this batter was also inoculated from the same culture as (a). This showed no fermentation at the end of the eighth day.

In this experiment, sterile flasks were used and the different flasks of batter were all kept under the same conditions. Therefore, these experiments show that potato water and flour together are more favorable for the rapid fermentation of yeast than either alone, and that the potato water alone is more favorable than flour.

The following table is a summary of experiments bearing on the first part of the investigation.

Amount of Media.					Remarks.
No.	Flour	Potato Water	Clear Water	Sugar	
1	Indefinite.	Indefinite.	None	None.	No fermentation.
2	"	"		One <sup>1</sup> / <sub>2</sub> tsp.	Fermentation after 12 hours.
3(a)	1/4 cup.	1 cup.		None	(a) No fermentation after 12 hours.
	(b)	"	"	One tsp.	(b) Fermentation active after 12 hours.
4(1)	Indefinite.	Indefinite.		4 gms.	Fermentation after 12 hours.
	(2)	"	"	3 1/2 gms.	Fermentation, 24 hours in 2, 3, 4, 5, 6, 7.
	(3)	"	"	3 gms.	
	(4)	"	"	2 1/2 gms.	
	(5)	"	"	2 gms.	
	(6)	"	"	1 1/2 gms.	
	(7)	"	"	1 gm.	
	(8)	"	"	1/2 gm.	No fermentation after 1 week.
	(9)	"	"	0 gm.	No fermentation after 1 week.
5(a)	"		Indefinite.	7 gms.	Fermentation, fifth day.
	(b)	"	"	7 gms.	Fermentation after 24 hours.

# teaspoonful





No.	Flour.	Media.		Remarks.
		Potato Water.	Clear Water.	
6.(a)	1 1/2 gms.	50 cc.		1 1/2 gms. Showed fermentation after 4 days.
(b)		50 cc.		1 1/2 gms. Fermentation, sixth day.
(c)	1 1/2 gms.		50 cc.	1 1/2 gms. No fermentation at end of eighth day.

#### B. Management of Yeast.

The second part of the investigation was to determine a practical method for keeping yeast pure. The ordinary method of keeping yeast in cans was first tested.

(1) A wort gelatin plate was made from a Fleischman yeast cake and from this a colony of yeast was isolated in a test tube of ordinary wort. After fermentation had ceased in the test tube, the yeast was transferred to a Pasteur flask of wort. A batter was made of flour, sugar and boiling potato water. This batter was put into a one-quart glass fruit jar which had been previously sterilized in steam for three-fourths hour. The porcelain was removed from the cover and the metallic part perforated to admit air. After placing the cover on the can, the top of the can was covered with sterile cotton and then the whole was sterilized in steam for one-half hour. When the batter had become cool, the yeast from the Pasteur flask was added. One week later, this can was opened and a portion of the batter was removed by means of a sterile spoon for the inoculation of the second can of batter. A

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microscopic examination showed that the batter was free from bacteria. One week later, another examination was made which showed the presence of mold and bacteria. At this time the batter gave off no strong odor, but two weeks later, a strong acid odor was given off and the batter was covered with mold.

(2) One week after the first batter was made, a second batter was made, put into a sterile jar, covered and sterilized in the same manner as the first batter but was inoculated with one tablespoonful of the batter which had been taken from the first jar. After two months this jar was opened and the batter was apparently in good condition; but a microscopic examination showed that bacteria were present.

Experiments (1) and (2) were repeated three times and in every case the batter became contaminated in removing the batter for the second inoculation.

3. In this experiment, the Erlenmeyer flasks were used. The flasks were cleaned, plugged with cotton-wool, and sterilized in dry heat at a temperature of 140° C. for one hour. A batter was made of flour, sugar, and boiling potato water, and a small amount of the latter was placed in each flask. These flasks of batter were then sterilized in steam for fifteen minutes for three successive days before inoculation. A pure culture of yeast from a Fleischman cake was used for inoculation. Among thirty of these flasks, four became contaminated but these four had been opened several times for examination. In each of these four flasks, the odor of "spoiled yeast" was strong and a mold had formed on three

of them.

Thus, it is not practicable to keep yeast pure by the ordinary can method since yeast becomes contaminated in removing a portion for use and soon spoils. Instead of cans, Erlenmeyer flasks or small sterile bottles may be used. A batter can be made and placed in several of these flasks or bottles, thoroughly sterilized, and when cool inoculated with a pure culture of yeast. In this way, the yeast could be kept pure an indefinite time and would always be ready for use.

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