# TECHNOLOGICAL PROCESS OF OBTAINING OF ACID DOUGH FOR MAKING BREAD

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**Abstract:** The bread manufacturing technology aims to provide the most digestible products, at an organoleptic level agreed by consumers and with high nutritional value. The technological process of bread making comprises a series of technological operations, as a result of which the raw and auxiliary materials are transformed into a finished product. White bread is the bakery product that is made from white flour type 650, which is mixed with water, yeast, salt and auxiliary materials. By the name of bread is generally meant the product obtained by baking a leavened dough, prepared from wheat or rye flour, possibly mixed with other cereal, legume or potato flours. Bread and bakery products according to quality indices must comply with the minimum conditions provided in the STAS. The sampling conditions for the analysis, the analyzes and the methodology for their performance, as well as the norms for the quality indices of the different bread varieties are regulated by STASor internal rules.

**KEYWORDS:** Bakery , technology , bread , flour .

## 1. INTRODUCTION

The bread reflects the nutritional value of the flour from which it was obtained, the auxiliary materials used and the technology applied. It is an important source of protein, B vitamins and mineral salts. The degree of assimilation of bread proteins is 85% if the bread was obtained from 96% extraction flour and 92%, when 75% extraction degree flour was used. Bread proteins are of particular importance for human nutrition, but it is known that they are deficient in amino acids primarily in lysine. It has been calculated that in order to provide the daily requirement of lysine in bread, 2.6 kg of white bread must be consumed. As a result, a consumption of 500 g of white bread per day provides only 19.2% of the required lysine. The use of wholemeal bread in the diet increases this percentage, but it is far from providing the daily requirement. Of the body in lysine. It is now known that bread proteins are deficient, in addition to lysine and tryptophan and methionine, the deficit being even more pronounced the lower the degree of extraction (so the whiter the flour). The amino acid content of rye bread is more balanced, but without achieving a perfect balance.

***The preparation of the dough*** includes the operations of kneading, fermentation and re-kneading.

*Kneading* is the operation that mixes the raw and auxiliary materials that form the dough, while also achieving its viscoelastic structure. The parameters of this operation influence the qualities of the dough.

*Bulk* dough fermentation is the operation that follows immediately after kneading and lasts until the beginning of the division. During this period, numerous biochemical, microbiological and colloidal processes take place in the dough, which ensure the maturation of the dough.

*Kneading* is the short-term kneading operation, which improves the structure and rheological properties of the dough.

## 2. PREPARATION OF RAW AND AUXILIARY MATERIALS

**Preparation of flour and** consists in mixing, sieving, retaining ferrous metal impurities, heating.

**The preparation of water** for the preparation of the dough mainly requires its heating to a certain temperature, which usually varies between 25 $^0$C and 35 $^0$C, depending on the temperature of the prepared dough, the temperature of the flour and the working season. . The temperature to which the water must be heated is determined by specialists mathematically.

**Yeast preparation** . If it is compressed, it is not used as such, it is first dissolved in hot water and mixed, resulting in the yeast suspension. As a result, its distribution in the dough is easier and more uniform.

The suspension is prepared in the ratio of (yeast / water1: 3; 1: 5; 1:10) 1k g of yeast to 5 or 10 *l of* water heated to a temperature of 30… 35 ° C. For this use the simple mechanical stirrer or a centralized training facility, used in large factories.

**The preparation of the salt** consists in dissolving it in water in order to distribute it as evenly as possible in the mass of the dough and to remove the existing impurities.

In order to be used in the bread-making process, auxiliary materials must be prepared in different ways, depending on the specifics of each, as follows:

*Consistent fats* (butter, margarine) are usually melted in the salt solution ,sugar and milk, when they are used together in the manufacture of the assortment. *The sugar* is dissolved in hot water ,and the obtained solution is strained to remove any impurities that have entered the sugar packaging or during the execution of this operation.

*Honey, glucose and malt extract* are transformed into solution to homogenize more easily in the dough. *The eggs* are first broken in a small bowl, beaten and then strained through a stainless steel sieve with 1mm $^2$ mesh and passed into a larger bowl. *Potatoes* are used in the form of pasta or flour, which is added to the dough

### 2.1. Dosing of raw and auxiliary materials

It aims to obtain the dough with optimal rheological properties and compliance with the composition of the product being manufactured.

For 100 kg of flour, depending on the extraction and quality of the flour and the product to be manufactured, the following quantities of raw materials are used:

- water: 40 - 70 l;
- yeast: 0.4 - 3 kg;
- salt: 0 - 1.8 kg, the usual dose being 1.3 - 1.5 kg.

The amount of water used depends on the consistency of the dough in the dough, to leaven and freshies, very important parameter because CONSIS ence influence the process speed of the dough and therefore ***the quality of bread.*** They run at higher speeds in lower consistency doughs and are slower in high consistency doughs. The consistency is chosen according to the speed with which you want the processes to take place in the dough and it depends on the quality of the flour. For poor quality flours, higher consistencies are used, while for very good quality ones, lower consistencies. It is estimated that most bread defects are due to the wrong consistency of the dough and its phases.

The amount of water used to make the dough depends on the quality, extraction and moisture of the flour and the amount of ingredients in the dough. It increases for very good quality flours, high extractions and low humidity and decreases with the addition of sugar, fats, eggs, milk in the dough. The amount of yeast varies with: its quality, the dough preparation process, the season, the amount of sugar and fat in the dough. The proportion of yeast increases when it is of poor quality, for the preparation of the dough by the direct

method, in the cold seasons and to important additions of sugar and fats in the dough (over 10%). The use of poor quality yeast is not recommended when processing lean flours, as it introduces low glutathione which activates proteolysis in the dough and the amount of which will increase by increasing the yeast addition. For the same reasons, the use ***of dry yeast*** is not recommended when processing lean flours, as it contains 3-4 times more *glutathione.*

The proportion of salt in the dough varies with the quality and extraction of the flour and the assortment made. The addition increases for poor quality flours and high extractions, for salty products (pretzels) and in the hot season. In the case of processing weak flours, a part of the salt (0.5% of the total flour) can be introduced into the mayo phase.

## 3. DOUGH PREPARATION AND PROCESSING

### *3.1. The direct method*

The direct method of preparing the dough consists in mixing, kneading and fermenting in a single phase all the raw and auxiliary materials. It is the simplest and fastest method, but it consumes a larger amount of yeast (maybe even double) than the indirect method.

Two slightly different processes are used to prepare the dough by the direct method. The first process ,the *classic* ,consists in kneading the dough in the mixing classical ,slow ,for 10 ... 15 minutes ,after which it is allowed to firm carrier guidance for 2 ... 3 h at 30 ... 32 $^{0}$C ,using 1 ,5 ... 3% yeast. The *fast* process , which consists in kneading the dough in fast mixers ,with high speed of the kneading arm ,followed by a short kneading ,for 10… 20 minutes ,which is performed in the hopper of the dividing machine.

The preparation of the dough by the fast process requires the use of oxidizing substances for kneading ,the most used of these being ascorbic acid and increasing the amount of yeast to 3… 5%.

Due to the pronounced reduction of fermentation before division , the doughs obtained by this method are much easier to shape (process) ,but the products obtained by this method are weaker in quality ,they have a weak taste and aroma.

This method applies to small extraction flours.

### *3.2. Indirect method*

The indirect method has two variants: biphasic and three-phase ,applied exclusively to obtain regular bread. Both methods involve obtaining in advance some semi-preparations called *mayonnaise* and *freshn ess,* which are then used to obtain the dough itself. These semi-prepared methods provide a more favorable environment for the multiplication of yeasts ,which will loosen the dough very well by fermentation and will form lactic acid, which improves the qualities of the dough and contributes to the formation of the taste and aroma of the bread.

***The biphasic method*** includes mayonnaise and dough, involves the preparation of mayonnaise from flour ,water and yeast. In order to ferment the mayonnaise, to this is added a portion of fermented *mayonnaise* called *bas*. Its proportion varies with the quality and extraction of flour between 5 and 20% ,in relation to the processed flour , the lower values used for low extraction flours and good quality, and the higher values for high extraction flours and poor quality.

The whole technological process and the quality of the products is influenced by the way the jars are driven ică that is by the size, consistency, their temperature and fermentation time.

Depending on the consistency, the **mayo** can ***be fluid and consistent*** .

***The consistent mayonnaise*** has a humidity of 41 ... 44% and is prepared

from a quantity of *flour* that represents *30 ... 60%* of the quantity of processed flour, depending on the quality of the flour. In order to obtain a good quality bread, it is estimated that the flour introduced by the mayonnaise in the dough must not fall below 25% of the quantity of processed flour.

The consistency of the jelly will be higher for poor quality flours and lower for very good and strong flours. This is given by the amount of water used to prepare the mayonnaise and will represent about 25% of the hydration capacity for weak flours, 40… 45% for medium quality flours and about 60% for very good and strong flours. The temperature of the jelly varies between 25… 29 $^0$C, and the fermentation time between 90… 180 minutes. The use of higher values for these parameters worsens the porosity structure of the dough.

***The fluid mayonnaise*** has a humidity of 63 ... 75% and contains 30 ... 40% of the processed flour and is obtained from flour, water and bas. The amount of water used can represent 80 ... 82% of the amount of water calculated according to the hydration capacity, and the added salt 0 ,7 ... 1% compared to the total processed flour.

Due to the introduction of salt into the fluid mayonnaise, the gluten hardens, so that the dough prepared with salty fluid mayonnaise has improved rheological properties, reduces the rate of increase of acidity (important for the warm season), reduces the viscosity of the mayonnaise and the formation of foam, what interests in transport mayonnaise dosing.

The fluid mayonnaise is prepared at a temperature of 27… 29 ° C and is fermented for 3 ... 4 hours, depending on the quality and extraction of the flour. Organoleptic , the end of the fermentation of mayonnaise is found by the formation of a dense foam on the surface. The mayonnaise is kneaded for 8… 12 minutes,depending on the quality of the flour.

The preparation of the dough is made from fermented mayonnaise and the rest of the flour,water and salt and auxiliary materials. The technological parameters of the dough are chosen according to the quality of the flour, according to the same principles as for the preparation of mayonnaise, using higher consistencies, lower temperatures and durations of kneading and fermentation when processing weak flours, lower consistencies ,temperatures ,kneading times and higher fermentation in the processing of stronger flours. The kneading time of the dough is 8 ... 15 minutes , the temperature is 25… 32 ° C,and the fermentation time is 0… 60 minutes.

***The three-phase method*** includes fresh , mayonnaise and dough.

It is especially recommended for the processing of high extraction flours, those of poor quality and degraded.

*Fresh* is a culture of bacteria and yeast that is used to initially increase the acidity of mayonnaise and dough, necessary to strengthen gluten and thus limit its enzymatic degradation,as well as to obtain products with pleasant aroma and taste.

The freshness is prepared from 5 ... 20% of the total processed flour, depending on its quality, from water and yeast. It is kneaded for 6… 8 minutes and fermented for 4 ... 6 hours at a temperature of 27 ... 28 $^0$C, depending on the quantity and quality of the flour (extraction).

*Maya* is prepared from fermented fresh flour, flour, water and yeast, which after fermentation is used to prepare the dough. In the three-phase method, the preparation of mayonnaise and dough, is done similarly to that in the two-phase method.

***Calculation of water temperature.***

The temperature of the mayonnaise and the dough is essential, the speed of the processes that take place during kneading and later during fermentation being influenced by this parameter.

The temperature of the mayonnaise and the dough is given by the temperature of their components. In the case of high speed mixers of the kneading arms, the heat resulting from the transformation of a part of the mechanical energy into caloric energy is important.

Currently only the two components of the dough are considered: flour and water or their substitutes.

Considering the temperature at which the dough must be obtained at the end of kneading and the temperature of the flour as known, the temperature at which the water must be heated is calculated in order to obtain the desired dough temperature. The following relationships are used:

- for the dough prepared directly or for mayonnaise:

$$t_w = t_{al} + \frac{F \cdot c_F (t_{al} - t_F)}{W \cdot c_w} + a, \quad (1.\ a)$$

- for indirectly prepared dough:

$$t_w = t_{al} + \frac{F \cdot c_F (t_{al} - t_F) + M \cdot c_M (t_{al} - t_M) + n}{W \cdot c_w} \quad (1.\ b)$$

wherein: $t_w$ is the desired water temperature, in ° C; $t_{al}$, - the temperature of the dough (jelly) at the end of kneading, in ° C; $t_F$ - temperature of flour used for kneading, in ° C; $t_M$ - temperature of the yeast introduced when kneading the dough, in ° C; $c_F$ - capacity ness of the thermal mass of the flour with humidity *U* %, in kJ / kgK; for flour with a moisture content of 14% $c_F$ = 2036 J / kg K; $c_w$ - mass thermal capacity of water, in kJ / kgK; $c_w$ = 4186 J / kg K; *F* - the amount of flour introduced during kneading, in kg; *M* - the amount of mayonnaise used to knead the dough, in kg; *W* - the amount of water introduced to the kneading, in *l* ; *n* - coefficient that includes the heat resulting from the transformation of mechanical energy into thermal energy, heat losses in the environment. Its value depends on the season; *n = 0* summer, *n = 1-2* spring and autumn; *n = 3 in* winter; $c_M$ is calculated by the weighted average method, taking into account the flour ($F_M$) and water ($W_M$) used to prepare the mayonnaise (the yeast is neglected being in a much smaller quantity):

$$c_M = \frac{F_M \cdot c_F + W \cdot c_w}{M}$$

In addition to these relations resulting from the thermal balance of the kneading operation, empirical relations are also used:

$t_w$ = 49-0, $7t_F$ for the cold season; $t_w$ = 47-0.7 $t_F$ for the warm season.

The mass thermal capacity of the flour (J / kg K) varies with its humidity. For a value of the thermal capacity of the dry matter of 1675 (J / kg K) and the humidity of the flour u%, the mass thermal capacity of the flour is calculated with the relation:

$$c_p = 1675 + 25.11\ u$$

The humidity of wheat flour is 13.6%.

| Flour moisture, u% | Mass thermal capacity of flour, $c_p$ |
|---|---|
| 10 | 1926 |
| 11 | 1951 |
| 12 | 1976 |
| 14 | 2036 |
| 16 | 2077 |

The temperature of the mayonnaise and the dough is chosen according to the quality of the flour and the desired intensity of the biochemical and microbiological processes in the dough.

In the conventional, for good quality flours for yeast, temperature shift is considered optimal ***28 ° C and the dough***

***30 ... 31 ° C*** . It ensures sufficient intensity for biochemical and microbiological processes and a good taste of the product. Increasing the temperature above this value worsens the porosity structure, due to the acceleration of proteolysis and the increase of the acidity of the product, as a result of the acceleration of acid fermentation.

For strong flours, the temperature of the mayonnaise can rise to 29 ° C, maximum 30 ° C, and for the dough to 32 ° C.

For low quality flours, low temperatures of ***25 ... 26 ° C*** are preferred **, *which for the dough can reach 28 ... 29 ° C.*** They ensure a better stability of the dough by reducing the intensity of the processes in the dough.

In the intensive kneading process, the optimum dough temperature is 25 ... 26 ° C.

At the preparation temperature of mayonnaise and dough, the main role in the formation of dough acidity is played by mesophilic bacteria with optimum activity at 30… 35 ° C, thermophilic bacteria with optimum activity at 48 ... 52 ° C having a minor role.

The value of acidity and pH depends on the flour extraction, the applied technology, the parameters of the technological process and the technological phase (table 1).

**Table 1.** *Acidity and fermentation time of semi - finished products*

| The blank | Final acidity, in degrees | | | Fermentation time | | |
|---|---|---|---|---|---|---|
| | Flour white | Semi-white flour | Black flour | Flour white | Semi-white flour | Black flour |
| Fresh girls | 3-4 | 6 - 6.5 | 8 - 9 | 4 - 5 h | 5 - 6 h | 5 - 6 h |
| Lea ven | 3,5 | 5.5 | 7 | - 3 h | 3 h | - 2 h |
| It took | 2.5 - 3 | 4 - 5 | 5 - 6 | 50 - 60 min | 30 - 40 min | 10 - 30 min |

## CONCLUSIONS

Acids formed in lactic fermentation increase the acidity of the dough and shift the pH to more acidic values. This influences the rheological properties of the dough, the activity of the enzymes, the taste and aroma of the product. Therefore, the final acidity of the freshness, the mayonnaise and the dough is taken as an index of maturation of the semi-finished products. Lactic acid plays a special role. It improves the physical properties of low gluten, activates the yeast cell, has a favorable effect on the taste of the product. The lowering of the pH is also favorable for combating the disease of mesentericus bread and for processing flours from sprouted wheat, rich in α amylase.

Semi-finished products (fresh, mayonnaise, dough) prepared from high extraction flours have higher acidity than those prepared from small extraction flours, and indirectly prepared doughs have higher acidity than those prepared directly.

Due to the fact that high extraction flours contain higher amounts of buffering substances for the same acidity, doughs prepared from high extraction flours have a higher pH than those prepared from small extraction flours.

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