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INVESTIGATION OF THE UNIFORMITY OF DISTRIBUTION OF DIFFERENT DOUGH COMPONENTS AFTER FOLLOWING DISCHARGE

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Abstract: *One of the indicators for assessing the effectiveness of mixing the yeast dough is the homogeneity of the resulting mixture. The studies on mixing the yeast dough with the working elements of different configurations and their effect on the homogeneity of the distribution have been carried out. Using a high-precision microscope, homogeneity of distribution of yeast dough was investigated. The conducted studies allowed to obtain a fixed image of the distribution of components of the yeast dough after mixing with the working elements of different configurations. The uniform distribution of components is observed in the cam and finger working elements, in the screw working elements there is no part of mixing and adhesion of the components into large clumps. The research revealed a number of homogeneous particles that formed after mixing the yeast dough. Distribution coefficient after kneading by cam operating elements is 84%, there is even distribution of components in the structure of yeast dough. After mixing by the "finger" kneading elements, the distribution factor is 67%, therefore the uniform distribution of components in the structure of the dough is achieved. During the mixing with auger working elements, the distribution factor reaches 58%, for these values uniform distribution of components in the structure of the test cannot be reached, there contains traces of non-conductivity in the structure. A comparative analysis on the distribution and homogeneity of the yeast dough after mixing was carried out.*

Keywords: *Mixing, Yeast Dough, Working Elements, Distribution, Homogeneity.*

INTRODUCTION

The studies were carried out as follows, the prepared recipe components were kneaded by a dough machine of continuous action. After mixing, samples of yeast dough were investigated using an optical microscope Biorex-3, recorded the obtained image of the structure of the yeast dough. Using the ImageJ software complex, the obtained image was processed and the distribution factor was calculated.

The yeast dough was mixed by working elements of various configurations: screw, finger and cam working elements in a dough machine of continuous action.

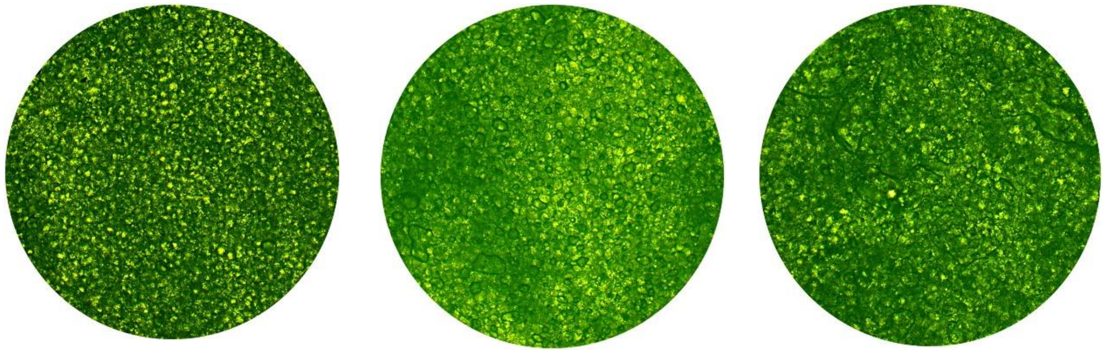
At the beginning of mixing, an inelastic mass is formed. During further mechanical treatment of the dough, depolymerization of gluten proteins occurs as a result of the rupture of disulfide bonds between the peptide chains and splitting of non-covalent bonds occurs as well: hydrogen, hydrophobic and salt bridges. The structure of the gluten-free frame is rearranged, it becomes plastic.

It is believed that the mechanism of plasticization consists in the fact that the spiral polypeptides of the loose protein molecule are cleaved, stretched into protein films and arranged in the form of plates, which include starch grains. As a result of the dissolution of the protein molecule, the weakening of the strength of the micellar framework intensifies osmotic processes, swelling proteins more fully, increasing the amount of bound water, which makes the dough become dry to the touch, elastic, gluten films acquire the ability to retain carbon dioxide.

For the formation of a dough with an elastic structure, it is required that the gluten proteins are elastic and envelop all grains of starch with a thin film. If the number of protein is not enough or the gluten is not elastic, the dough will have low gas retention capacity.

EXPOSITION

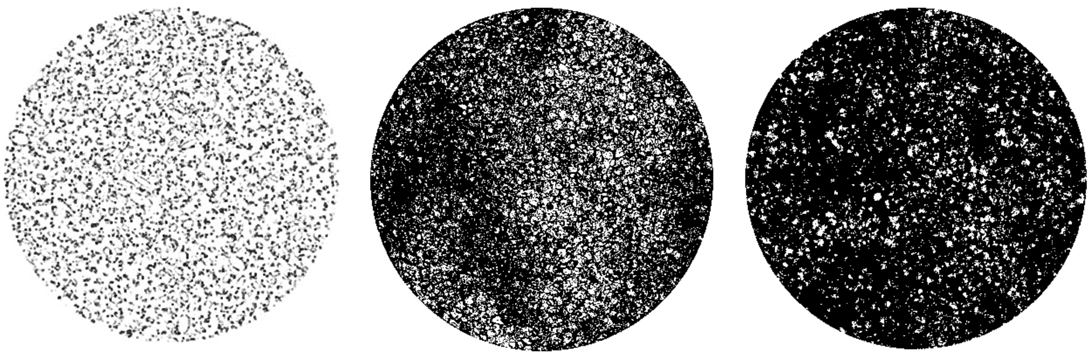
One of the indicators for assessing the effectiveness of mixing the yeast dough is the homogeneity of the resulting mixture., The homogeneity of distribution of yeast dough was investigated by using a high-precision microscope (Fig. 1.).



a.) Cam working element b.)Finger working element c.) Screw working element

Fig. 1. Homogeneity of distribution of components of yeast dough after mixing by working elements of different configurations

The conducted studies allowed to obtain a fixed image of the distribution of components of the yeast dough after mixing with the working elements of different configurations. The equable distribution of components is observed in the cam and finger working elemets, in the screw working elements there is no part of mixing and adhesion of the components into large clumps.



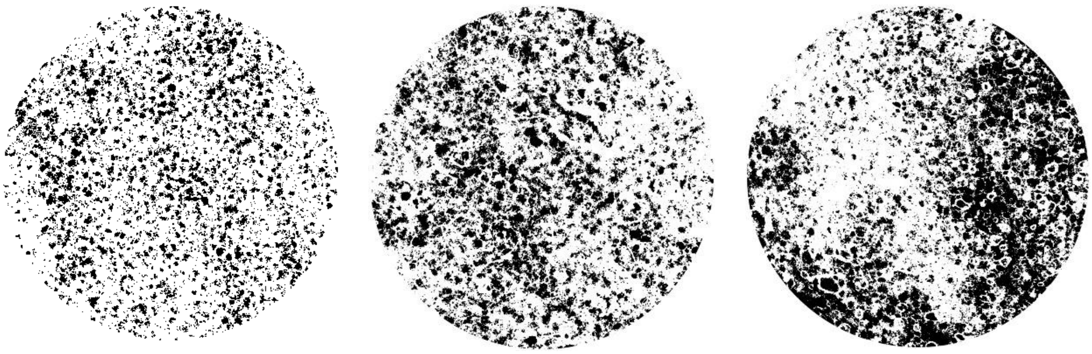
a.) Cam working element b.)Finger working element c.)Screw working element

Fig. 2. Uniformity of distribution of dough components after the processing by complex software ImageJ

The research revealed a number of homogeneous particles that formed after mixing the yeast dough. In cam kneading elements, these indices are the highest (Fig. 2a) and make 2421 pieces of homogeneous particles in the area under examination under a microscope (282600 microns), in fingertips 1439 pcs, in sconces 801 pcs. The average size of parts after kneading by the cam kneading elements is 116.7 microns, the finger working element 196.3 microns, screw working element 352.4 microns. Distribution coefficient after kneading by cam operating elements is 84%, there is even distribution of components in the structure of yeast dough. After mixing with the fingers, the distribution factor is 67% and the equable distribution of components in the structure of the dough is achieved. When mixing by screw working elements, the distribution factor reaches

58%, for these values it is not achieved the equable distribution of components in the structure of the dough, it is contained traces of non-conductivity.

At the beginning of the mixing, an inelastic mass is formed, during the subsequent mechanical processing of the dough the structure of the gluten-free frame is rearranged and becomes plastic. As a result of mechanical processing, during the kneading of yeast dough, volumetric gluten proteins extending beyond the interstitial cracks stick together and form a gluten-free carcass, which provides the dough with the elasticity starch grains impregnated in the gluten-free frame.



a.) Cam working element b.)Finger working element c.)Screw working element

Fig. 3. Formation of the structure of the yeast dough after mixing by the working elements of various configurations (white mesh-gluten-free frame; black inclusions-starch grains)

During the kneading by cam operating elements (Fig. 3a), the dough is formed with an elastic structure, gluten-free proteins acquire elasticity and evenly cover all the starch grains with a thin film, the yeast dough thus has a high gas-retaining ability and subsequently even fine-grained porosity of the finished product. The equable distribution of the dough structure is observed after mixing by the finger working elements (Fig. 3b), but due to its structural parameters, the gluten-free frame is broken down and starch grains are damaged, which absorbs a significant amount of moisture from the gluten-free proteins, thus gluten does not have time to recover, deterioration of the gas-retaining ability and as a result, the porosity of the finished product is deteriorating. After mixing by screw working elements, the dough is poorly mixed and the components are not distributed equally, there is not equable distribution of the structure of the yeast dough (Fig. 3c), large particles of starch grains start to bind water more quickly than the protein, so water is not enough to swell the proteins and the dough does not become elastic.

CONCLUSION

After kneading by the cam operating elements, a high quality yeast dough is achieved, and an equale, fine, thin-walled structure with no cavities is observed. In the dough there are no foreign inclusions in the form of non-stirred flour bundles. During the kneading the yeast dough by the cam operating elements, the gaseous components are evenly distributed in the dough preparation, which further improves the structure of the porosity of the products.

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