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Technical Paper

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PROCESSES USED IN THE MANUFACTURE OF BREAD AND OTHER FERMENTED PRODUCTS

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The historical development of different bread varieties and different breadmaking processes are closely linked, but this does not automatically mean that any given breadmaking process can only produce one type of bread (or other fermented product such as buns, or rolls). Just as there is no 'ideal' product, so there is no 'ideal' breadmaking process. In practice each baker uses a breadmaking process which is unique, in that the chosen combinations of ingredient qualities, formulations, processing conditions and equipment reflect the qualities of the products he or she is seeking to achieve. There are many variations in breadmaking processes, though some are small and commonly consist of minor variations around a central 'standard' process. This allows us to group many of the different breadmaking methods into a smaller number of more generic processes with the same underlying principles of dough development. The latter is an ill-defined term which used to describe the suitability of the dough for processing into our chosen products. There is no standard definition for dough development, and it is often judged by stretching a piece of dough between the fingers to assess a series of complex and related rheological properties associated with the development of the gluten network in the dough.

Common Functions in Breadmaking Processes

All breadmaking processes have a single, common aim, namely, to convert wheat flour into an aerated and palatable food. There are a number of largely common steps which are used.

- The mixing of wheat flour, water, yeast, salt, and other specified ingredients in appropriate ratios.
- The development of a gluten structure (hydrated proteins) in the dough through the application of energy during mixing (by hand or machine). This may be referred to as 'kneading'.
- The incorporation of air bubbles within the dough during mixing.
- The continued 'development' of the gluten structure created as the result of kneading, to modify the rheological properties of the dough and to improve its ability to expand when gas pressures increase as the result of the generation of carbon dioxide gas in the fermenting dough. This stage of dough development may also be referred to as 'ripening' or 'maturing' of the dough.
- The subdivision of the dough mass into unit pieces.
- A preliminary modification of the shape of the divided pieces (sometimes referred to as rounding).
- A short rest after first shaping to modify further the rheological properties of the dough pieces (this may be referred to as first or intermediate proof).
- The shaping of the dough pieces to achieve their required configurations.
- The fermentation and expansion of the shaped dough pieces during 'proof'.
- Further expansion of the dough pieces and fixation of the final bread structure during baking.

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Definition of Terms

The terminology used in baking can be confusing; this is especially true for the terms fermentation and proof. Fermentation refers to the action of baker's yeast (or wild yeasts in the case of sour dough naturally occurring in the flour or added), with the subsequent evolution of carbon dioxide gas and small quantities of alcohol. Fermentation will occur in the dough whenever the conditions are 'right' for the yeast (mainly the availability of food and an appropriate temperature). There are two main times when fermentation occurs; after the dough has been mixed and before it has been divided into unit pieces, and after the dough has been finally shaped and before it enters the oven. The former is often referred to as 'bulk fermentation' or simply fermentation, while the latter is most commonly referred to as 'proof'. This change in terminology logically allows the baker to understand which part of the process the dough has reached. In both cases 'fermentation' in the true sense occurs, though the temperatures at which the stages are carried out are different, with proof commonly being carried out at higher temperatures than bulk fermentation. A further complication is that bakers may refer to 'first' or 'intermediate' proof to define a short rest period which occurs after first moulding and before final moulding.

Foam to Sponge Conversion

The underlying principle of breadmaking may be described as a 'foam to sponge conversion', with the foam being the dough and the 'sponge' being the baked loaf. Foams are composed of many gas bubbles dispersed in a matrix; in the case of breadmaking the matrix is the gluten network which has been created during mixing. An important feature of foams is that each gas bubble is separated from all other gas bubbles in the matrix and gases cannot pass directly from one to bubble to another. As bread dough is processed there may some modification of the foam either mechanically (e.g., during moulding) or as the result of changes in size (e.g., during proof). In the oven the structure is heat-set and the gluten network surrounding the gas bubbles becomes rigid and broken. The cellular structure which is formed (the sponge) is comprised of an open and interconnected network such that gases and vapours may readily pass through the network. This principle of foam to sponge conversion applies to all breadmaking processes.

Note on Terminology

The use of the technical term sponge to describe an open network of cells in the final crumb structure should not be confused with its use to describe the preparation of a pre-dough used in the sponge and dough breadmaking process. The sponge is this case is technically a 'foam' since it comprises discrete gas bubbles trapped in a gluten network.