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Mixing and Dough Processing

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An integral part of all breadmaking is the formation of a smooth and homogeneous dough with a developed gluten structure. As discussed in an earlier chapter, in some breadmaking processes dough development continues during resting after mixing, while in others full development is achieved during the mixing process itself. Whatever the method by which dough development is achieved the next stage in bread manufacture is the subdivision of the bulk dough (dividing) and the shaping of the individual dough pieces (moulding) to conform to the requirements of the bread variety being made. Shaping may be a multi-stage operation and may involve a further resting period between moulding stages (intermediate or first proof). Once finally formed the dough pieces commonly pass on to be proved before baking.

Before the introduction of machinery, dough, all over the world, was made by hand mixing of the ingredients and then by kneading the mixture until a dough was created. The processes of mixing, dividing and moulding can be carried out by hand; indeed this is still the case in many bakeries, for example in India where the production of loaves in Mumbai is still based on hand mixing. Increasingly the operations of mixing, dividing and moulding are becoming mechanized. The purpose of this chapter is to discuss the essential elements of dough mixing and processing, to consider how they are achieved and to consider how equipment design can impact on final product quality.

4.1. Functions of Mixing

All mixing machines available today are designed to incorporate both the mixing and the kneading characteristics of the manual process. In essence, mixing is simply the homogenization of the ingredients, whereas kneading is the development of the dough (gluten) structure by ‘work done’ after the initial mixing. In mixing machines today, this ‘work’ is carried out by a variety of methods, each suiting the output capacity required, the type of dough required for the final product specification and its use in subsequent processing.
Some of the basic requirements for dough mixing have been introduced in previous chapters, but it is worthwhile to summarize them again before considering the different types of mixing machines which are available and how they may or may not meet the basic requirements of dough mixing.

We can summarize mixing requirements as the following:

- to disperse uniformly the recipe ingredients;
- to encourage the dissolution and hydration of those ingredients, in particular the flour proteins;
- to contribute energy to the development of a gluten (hydrated flour protein) structure in the dough;
- to incorporate air bubbles within the dough to provide gas nuclei for the carbon dioxide generated from yeast fermentation and oxygen for oxidation and yeast activity;
- to provide a dough in a suitable form for subsequent processing.

### 4.2. Types of Mixer

We will see that mixing machines vary widely from those that virtually mimic a hand mixing action to high-speed machines which are able to work the mix intensively to the required dough condition within a few minutes. Many mixing machines still work the dough as originally done by hand through a series of compressing and stretching operations (kneading), while others use a high speed and intensive mechanical shearing action to impart the necessary work to the dough.

In many mixing processes the velocity of the dough being flung around within the mixing chamber is used to incorporate the full volume of ingredients into the mix and to impart energy to the dough from the mixing tool during kneading. Where mixing systems rely more heavily on this effect, they tend to require a higher minimum mixing capacity for a given mixing chamber capacity in order to remain efficient because the mixing tool does not come into intimate contact with every ingredient molecule. This practical effect tends to limit the higher-speed mixers to the large-scale bakeries where bread plants are running at near maximum capacities and variations in batch mixing sizes are not common. In smaller-scale production greater versatility of batch size may be required from the mixers, and so lower mixing speeds and more intimate contact between the mixing tool and the dough are an advantage.

In order to describe the most common variants of mixing machines and their applications, they may be divided into five common groupings (the first four being based on batch mixing) as follows:

- Chorleywood Bread Process (CBP) compatible, where the essential features are high mixing speeds and high-energy input, to develop the dough rapidly, and control of the mixer atmosphere;