

tein structure, and this helps to counteract the negative effects of excessive enzyme activity (e.g. water release). The most suitable preparations are those that stabilize the pH at the level to which it has been adjusted, i.e. so-called buffer substances, mixtures of different salts or acids. In most cases the dosage is in the range of about 50 to 200 g to 100 kg of flour. Fig. 136 shows the effect of an alkaline buffer agent on the Falling Number and on the volume yield.

Nevertheless, with the inorganic phosphates and carbonates care has to be taken not to exceed the limits of the flour grades, as these substances pass into the ash. With sprouted grain it is in any case advisable, whatever the treatment, to use a smaller proportion of the enzyme-rich outer layers of the grain (reduce the yield) and produce lighter-coloured flours that then tolerate the addition of flour improvers containing ash.

18.8 Bleaching Agents

Although there is an awareness of the importance of roughage, minerals and vitamins there is still a demand for a very light-coloured crumb in many wheat products. This is

true of numerous products ranging from Arabian-style flat bread and baguettes to sliced bread for toast. The flavonoids responsible for the colour can be bleached with oxidizing agents.

18.8.1 Benzoyl Peroxide

For a long time, benzoyl peroxide was a familiar oxidative bleaching agent and it is still used to this day in many countries. In addition to its good bleaching effect it has a slight influence on the structure of the gluten, but this is not apparent when other flour improvers such as AA are used.

The dosage for benzoyl peroxide is about 5 - 10 g to 100 kg of flour (50 - 100 ppm) into the flour stream. It is usually sold as a 27 - 32% product (to enable safe transportation it is diluted with an inert carrier), and the dose is then correspondingly higher. The effect of benzoyl peroxide on the flour is already visible after 6 hours of storage and complete after 24 to 72 hours. Benzoyl peroxide decomposes to benzoic acid (Fig. 132), a substance found in various fruits and berries and used as a food preservative, e.g. in cream and fruit fillings for pastry at dosages of 0.05 - 0.15% (500 - 1,500 ppm).

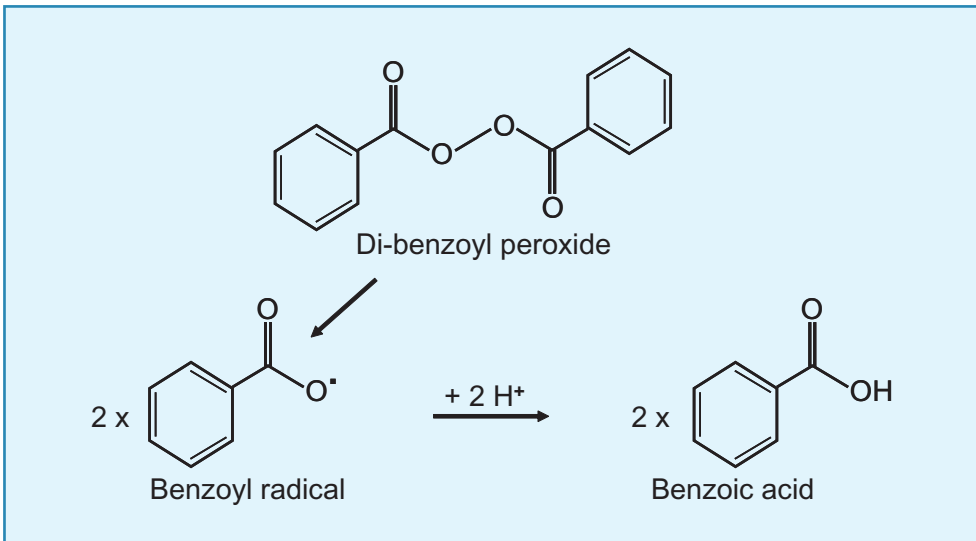


Fig. 132: Decomposition of benzoyl peroxide

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18.8.2 Enzyme-Active Bean Flour and Soy Flour

83 Enzyme-active flour made from soy or horsebeans can also be used to achieve a light-coloured crumb. The quantity that can be used is limited by the formation of an undesirable bitter taste. For this reason the maximum quantities used are usually 0.5% for soy flour and 2% for horsebean flour. Another legume from which flour with a bleaching effect is produced is lupin seed. But again, the efficacy is much lower than with soy flour.

The classic application of soy flour is doubtless French baguettes, in which it is increasingly replacing the less effective bean flour. A typical dose of 0.3% already has a definite bleaching effect. It is used at about the same concentration in flours for toast and flat bread. Soy, horsebean and lupin seed flour only become active after the addition of water; they do not bleach the flour in its dry form.

18.8.3 Other Agents with a Bleaching Effect

The brightening effect noticed when ascorbic acid, emulsifiers or some enzymes are used has a physical cause; the finer texture changes the reflecting properties of the crumb and the colour appears lighter (smaller holes have smaller shadows). On the other hand strong oxidizing agents such as bromate or chlorine really do remove the colour from the dark pigments, although this is only a desirable side-effect.

As already mentioned in the section "steamed bread", lipase also has a bleaching effect provided that enough oxygen is present to convert the liberated unsaturated fatty acids – with the help of flour lipoxygenase – into hydroperoxides that then bleach the carotenoids.

18.9 Vital Wheat Gluten

To describe all the aspects of gluten and its production would fill a separate book, so this section will concentrate on the issues relating to flour improvement. Information on the rheological properties of gluten is also given in chapter 14. But like many other articles, chapter 14 only deals with native gluten, i.e. as it is extracted from wheat flour. If wheat gluten is to be used commercially as an additive, it first has to be extracted from wheat and converted into powder. This is a multiple-step process (Fig. 133), starting with the milling of the wheat grains. Milling is followed by aqueous separation of the starch and soluble substances from the aggregated gluten, disintegration of the gluten in a pin mill or the like and finally hot air drying, for example in a ring dryer.

Only about 82% of the protein of flour is insoluble in water and contributes to wet gluten formation. Furthermore, some of the water-soluble proteins are trapped by the insoluble proteins. But wet gluten is not just water and protein; it also contains about 5 - 10% lipids (d.b.) and a significant amount of non-starch carbohydrates (Pomeranz, 1988).

It is clear that the functionality of extracted

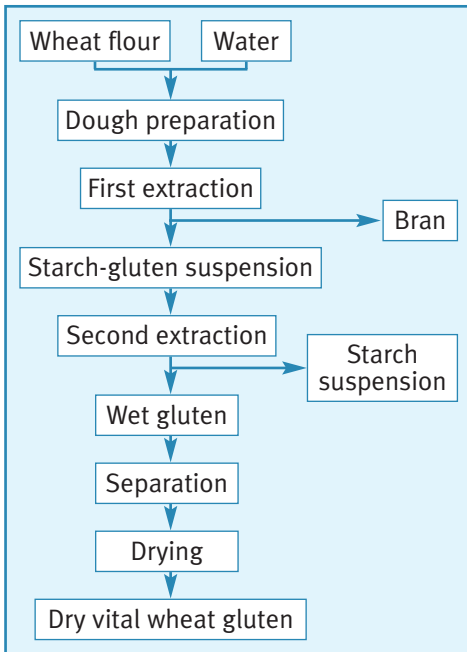


Fig. 133: Gluten extraction by the Martin process (modified from Tegge, 1984)