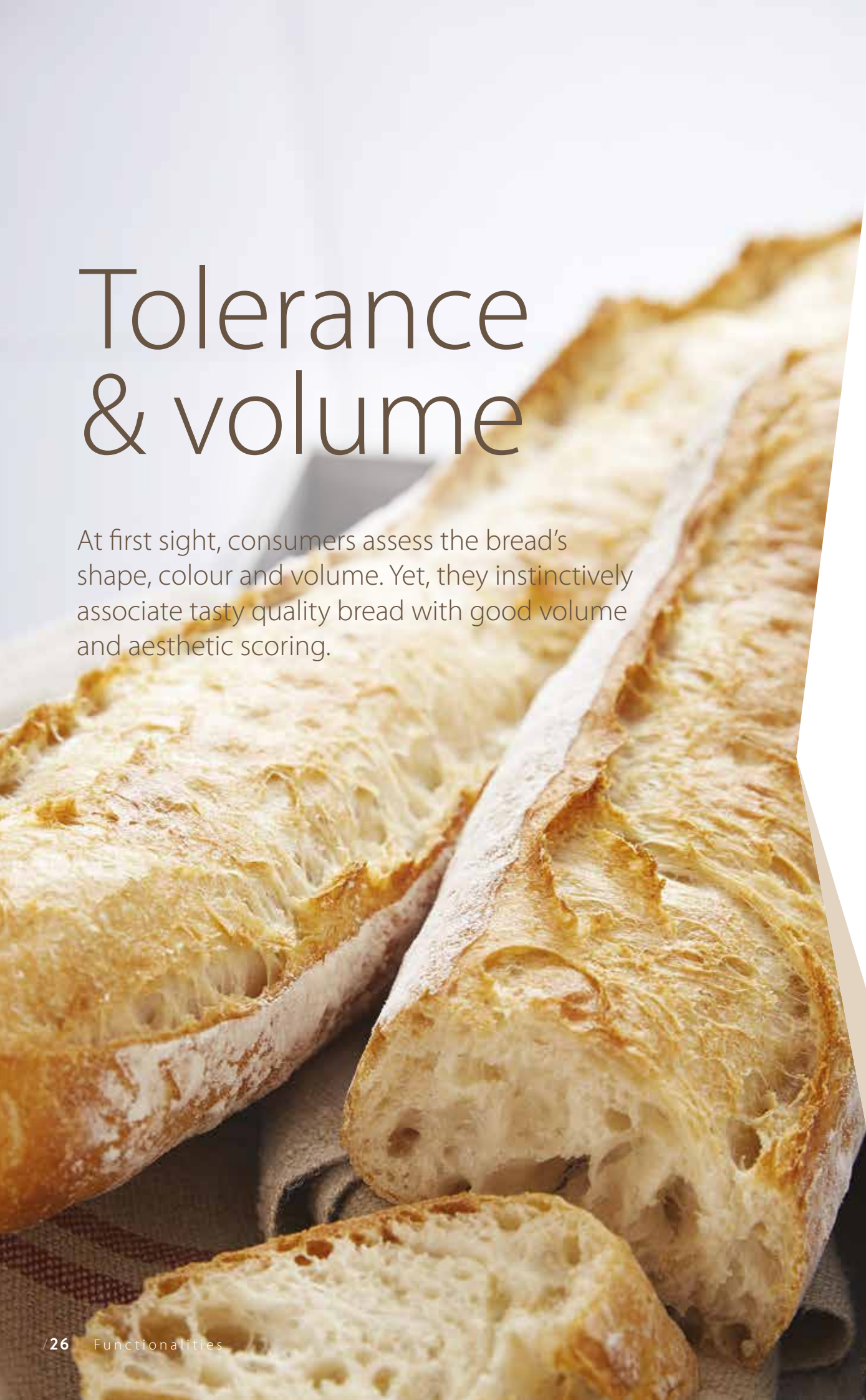
Tolerance & volume

At first sight, consumers assess the bread's shape, colour and volume. Yet, they instinctively associate tasty quality bread with good volume and aesthetic scoring.



THE VOLUME OF A LOAF DEPENDS ON THE FOLLOWING FACTORS:

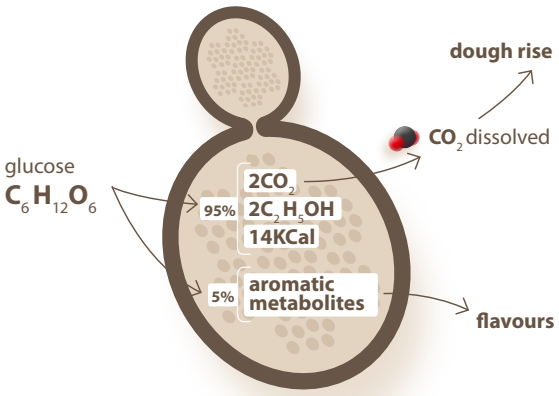
- the ability of the sourdough or yeast to **use the sugar in dough** to produce CO_2 gas during the fermentation phases;
- the dough's ability to **retain CO_2** during fermentation, as well as during baking, when the gases expand under the natural effect of heat;
- the dough's ability to **undergo the various mechanical constraints** applied in bread-making (dividing, shaping, scarring etc.).

OPTIMISING FERMENTATION TO PRODUCE MORE CO_2

Most flour contains amylases, enzymes which act by breaking down starch into simple sugars that are directly fermentable by yeast:

- **alpha-amylases** specifically break the 1-4 glycosidic bonds within the amylose and amylopectin chains, thus liberating maltodextrines of varying size. They are selected for their temperature inactivation profiles when it comes to process adaptability.
- **beta-amylases** are more specifically capable of breaking 1-4 glycosidic bonds starting from the non-reducing terminal end of the amylose or amylopectin chains. However, the beta-amylases found in flour **are not sufficient, in terms of amount and activity, to guarantee optimum dough fermentation.**
- **pullulanases**, in conjunction with flour-specific amylases (beta-amylases) or additions (alpha-amylases), remove the branch structures in amylopectin thus liberating maltose.

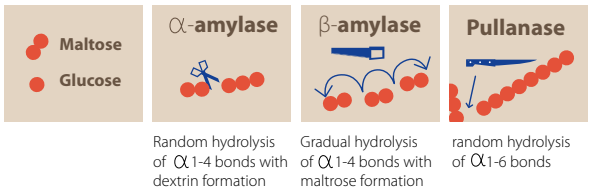
Choosing the right enzymes in the relevant doses is the key to preventing the stickiness in dough, and even in the crumb, that can result from an overdosage.

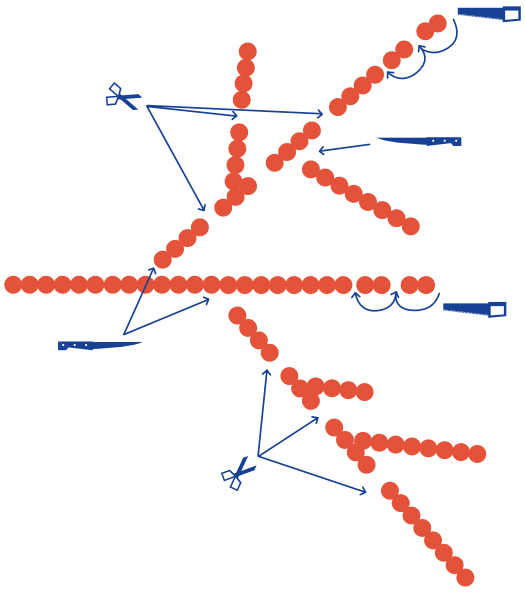


FERMENTATIVE METABOLISM OF YEAST

"Tolerance: dough's ability to tolerate a lack of, or an excessive, fermentation."

ACTION OF THE MAIN ENZYMES USED IN BREAD-MAKING

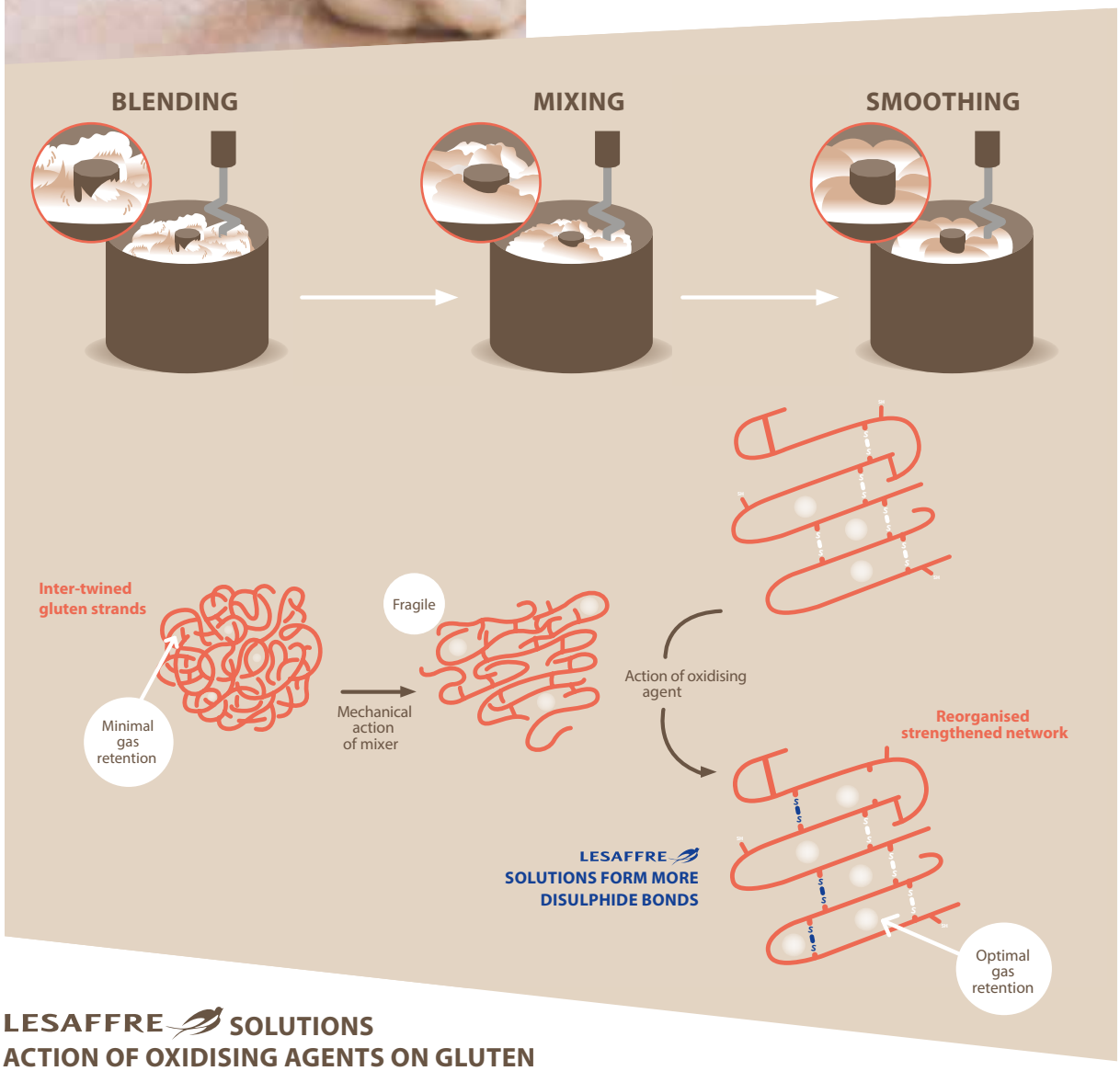




OPTIMISING CO_2 RETENTION IN THE GLUTEN NETWORK

Wheat is characterised by the particular structure of its main protein, gluten. During mixing, gluten forms an extensible, impermeable protein network that traps the CO_2 released during fermentation. The **viscoelastic properties of dough** allow the retention of gases and volume increase during fermentation and baking.

The properties of the gluten network **depend on the flour and type of mixing.** Whatever the mixing method applied to the dough (manual, oblique axis, or spiral mixer, dough break, high speed, etc.), the mechanism remains the same: gluten strands are unknotted, then restructured to form a film. This film's cohesiveness is strengthened through the creation of disulphide bonds, which reduce the dough's porosity (see diagram below).



LESAFFRE SOLUTIONS
ACTION OF OXIDISING AGENTS ON GLUTEN

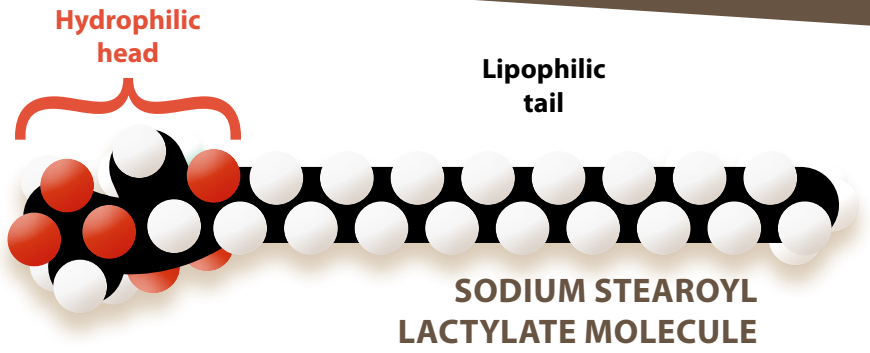
LESAFFRE SOLUTIONS TO STRENGTHEN DOUGH COHESION

Disulphide bonds can be strengthened by using an oxidising agent such as ascorbic acid. Ascorbic acid is used in combination with other active ingredients, such as:

- **EMULSIFIERS** (diacetyl tartaric esters of fatty acid mono- and diglycerides, sodium or calcium stearoyl lactylates), amphiphilic molecules with a high lypophilic portion, some of which act as lubricants during mixing, thereby creating the gluten network.

This specific property also helps the formation of hydrogen bonds, of a lower intensity than disulphide bonds, offering a positive action on gas retention without increasing elasticity.

- **ENZYMES** (such as glucose-oxidases), also strengthen the gluten network by creating bonds between proteins. Other enzymes, such as endo-glucanases, pentosanases or some xylanases, solubilise pentosans (insoluble fibres), thereby improving aqueous-phase distribution and thus participate in the formation of the gluten network.



"Sodium steaoryl lactylate favours the formation of the gluten network during mixing".

THE RIGHT PRODUCT AT THE RIGHT DOSES

Lesaffre masters all of these active compounds and is able to supply them pure, diluted or formulated. Enzymes, emulsifiers or oxidisers are highly active molecules. Precision of dosage and quality is essential to prevent any negative effects (sticky, elastic dough) and to adapt perfectly to the flour quality and the baker's process. In this aspect, formulated products such as improvers, pre-mixes, mixes or blends offer the maximum guarantee.