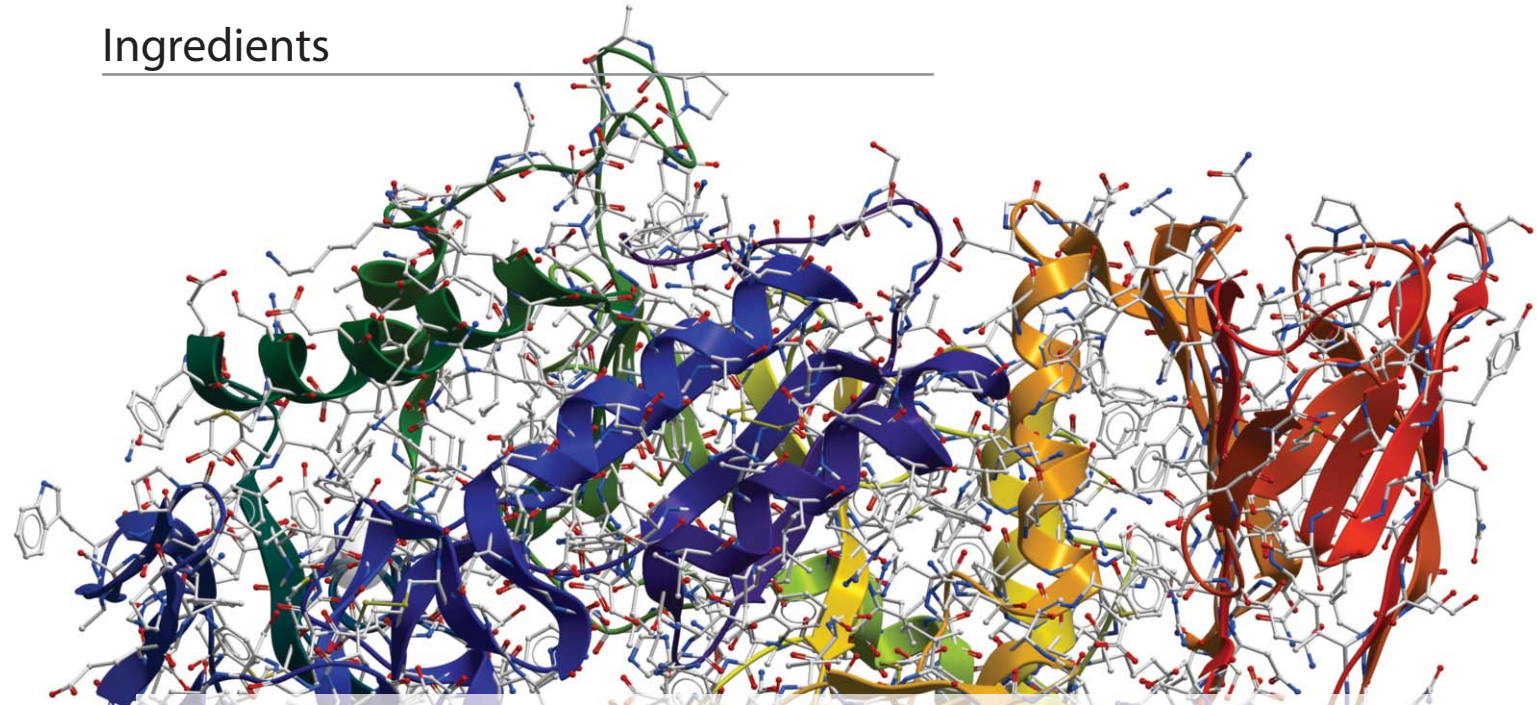

Enzymes for every purpose

It is a common practice to use mixtures of enzymes as catalysts in baking processes. How can such combinations be controlled for the desired results and what are the benefits of achieving the optimum mix? Enzyme specialists from the Baking Enzymes department of AB Enzymes have all the answers.

By Catalina Mihu

All traditional bread-making processes are nowadays unthinkable without the use of enzymes. Via bread improvers, enzymes are widely used around the world in various baking processes, ranging from European artisanal, crusty craft bakery type of breads to plant-baked sandwich loaves. Oscar Diez, Product Director, and Ralf Neumann, Customer Solutions Director with AB Enzymes share specialist know-how with European Baker.

MEET THE ENZYMES

There are three main categories of enzymes in use in bakery: the endogenous enzymes in flour, enzymes associated with the metabolic activity of the dominant microorganisms and exogenous enzymes which are added to the dough. Independent of the source of the different enzymes, all enzymes are proteins and they catalyze specific chemical reactions. All enzymatic activities do influence each other. This might lead to positive technological improvements or disadvantages, says Ralf Neumann.

"The enzymatic activity of flour depends on the grain variety, the region and the general harvest circumstances. One important endogenous enzyme activity is amylase. This activity is often measured via the Falling Number which indicates the enzymatic activity of the flour. If the falling number is too high (meaning low enzymatic activity) this could be adjusted by exogenous amylase's addition to achieve the right dough volume and crust color for the baked good. This would be an example of how to create a combination of endogenous and exogenous enzyme activity to support the technological effect for baking. Another could be protease. If the user of the flour is confronted with the fact of a too-strong gluten quality and low endogenous enzyme activity, it is possible to add protease from a fungal or bacterial source to adjust the flour quality and its rheological properties to the specific need," explains Neumann.

There is also an interaction between the yeast and exogenous amylase activity. The addition of amylase provides the yeast with more sugar for its metabolism. Yeast can metabolize glucose, fructose and maltose; the yeast cell contains an enzyme system to further ferment the sugar and finally produce CO2 and alcohol, which is required for the baking process to get a leavened and tasty baked product.

The three different sources of enzymes interact, and finding the right balance is one of the main competences of the bread-improver industry.

"The three different sources of enzymes interact, and finding the right balance is one of the main competences of the bread-improver industry."

Ralf Neumann, AB Enzymes

ONLY WITH ENZYMES

Crumb softness and, at the same time, crumb elasticity are two characteristics of baked goods that can only be achieved with enzymes/improvers. "Softness is defined as the force needed to compress the crumb and elasticity, defined as the ability of the product to return to its original size and shape when a force is removed, is only achie-

vable with maltogenic amylase. Traditional solutions, like enzyme active malt flour or bacterial amylases, provide only crumb softness but the crumb stays inelastic. This behavior might lead to problems for sliced-bread production because the crumb may stick to the cutting blades," Neumann tells us.
In general, it is much easier to achieve a reproducible and constant quality by applying the right enzymes to the right improver. "Enzymes are primarily selected for their technological effect. They have to be able to solve a technological problem or need. And if such an effect can be achieved at lower cost without compromising quality, that will definitely be a buying decision, too," says Diez.

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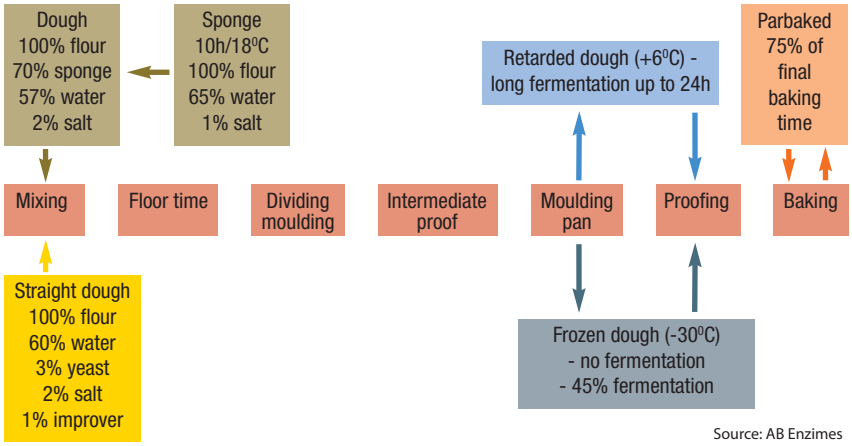
The process flow indicates the basic baking-production flow



Source: AB Enzimes

WHAT DO ENZYMES DO?

The baking industry provides the consumer with a lot of different varieties of baked goods. Next to the raw materials involved, the process defines the end product quality.
It also indicates that there are many possible varieties applied, e.g., different temperature profiles or retarded dough processes, adds Neumann.
In general, the improver, and also the enzymes as part of the improver formulation, are eliminating quality fluctuations, especially those of the flour. Despite the efforts of the milling industry to provide the baker with a constant quality, flour is a natural raw material and has different properties with each new harvest. Dough properties and proof tolerance are very often critical quality parameters that are supported by the improver. The volumes of the baked good, crust color and dough machinability are important factors, too.

DOUGH STABILITY – UNIFORM FLOUR PERFORMANCE

Flour contains different amounts of starch, protein, pentosanes and lipids, which are all technological relevant. "Next to enzymes, the main improver ingredients are emulsifiers to strengthen the gluten network (e.g., DATEM) or support the crumb softness (e.g., DMG), which can be efficiently enhanced by the use of maltogenic amylase as an additional processing aid. Hydrocolloids like guar gum are used to increase the water uptake of the dough and, therefore, positively improve the crumb texture," explains Neumann. These are just some examples of possible ingredients to use with a technolo- gical effect, but endless combinations are possible.

NEW DEVELOPMENTS

"Enzymes which are strengthening the dough structure in a smart way will be part of the future of enzymes. New production technologies are demanding enzymes to modify the dough at the right moment when the effect is required versus today where the enzyme always starts to act at the beginning of the process. Another aspect will definitely be anything that supports us to make baked goods even healthier," concludes the specialist. •

How to influence these main ingredients technologically

Wheat flour	Enzyme	Action in the dough	Effects
Starch	α-Amylase	Dextrins → Maltose (β-Amylase +yeast) → CO_2	Falling number Dough processing Volume Crust color
Protein	Proteinase Transglutaminase Glucose oxidase	Gluten softening Gluten strenghtening	Extensograph Dough processing
Pentosan	Xylanase	Degradation of insoluble pentosans	Baking volume Dough processing Crumb structure
Lipids	Phospholipase	Modification of (polar) lipids	Dough processing Baking volume Crumb structure and crumb color

Source: AB Enzimes