

Tracking down the flavor

HOW DOES FLOOR TIME AFFECT THE QUALITY OF ROLLS? THIS WAS INVESTIGATED AT THE UNIVERSITY OF WÄDENSWIL, SWITZERLAND

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+ When rolls are not baked at the place where they have been made, it is important to consider the methods available for separating these two processing steps. Methods of choice are for example freezing of the dough pieces or par-baked rolls, respectively, or the application of processes to retard fermentation.

When compared to freezing processes, long floor time development methods consume less energy and may be beneficial for the end product quality because they promote flavor development and fresh-keeping properties. The Kolb-Kälte company, Rüthi, Switzerland, has developed such a process for controlled fermentation which is mainly used in Switzerland, Austria and Southern Germany. It is called PATT which stands for programmed cooling of partly fermented dough pieces. Key principle of the PATT process is the targeted control of temperature, humidity, and time while keeping the surface and core temperature of the dough piece as identical as possible in order to prevent the dough surface from

drying out. The PATT process is divided into three stages: proofing, cooling, storage. The storage time can be up to 24 h at temperatures around 0°C.

The traditional bread and roll flavors will mainly develop during proofing and later in the oven. During proofing, alcohols, aldehydes, acids and esters are formed, and during baking roasting flavors such as pyrazines and pyrroles develop. Key substances of the bread flavor are said to be the malt-like substances 2-/3-methylbutanal and 2-methylpropanal. Due to analytical-methodological reasons, acetylpyrroline which is of similar significance could not be analyzed.

Reducing the dough temperature affects the activity of the yeast. The yeast's metabolism is retarded, and the proofing process slows down. Below 5°C, this process almost stops completely. However, enzymatic reactions are still taking place at this temperature. Cold temperatures can restrain ►

Table 1 Aroma compounds	Concentration crumb / crust [µg/kg]		Odor threshold value [µg/kg]		Aroma quality
	min.	max.	in starch	in water	
Ethylhexanoate	n.n	n.n		1	fruity
Ethyl octanoate	1,1	9,3		5	fruity
2-Phenethylacetate	1,3	5,5			fruity
Ethyldecanoate	0,7	10,4			fruity
2-Methoxy-4-vinylphenol	343,1	846,1		3	clove
2-Phenylethanol	478,3	1976,4	125	1100	honey
Nonanal	12,5	139,1		1	greenish
(E)-2-Nonenal	29,6	176,3	0,53	0,8	greenish
Decanal	5,0	261,4		2	greenish
(E)-2-Decenal	35,4	104,7		0,4	greenish
(E,E)-2,4-Decadienal	146,3	279,1	2,7	0,2	greenish
3-Methylbutanal	10,6	218,6	32	0,4	malty
3-Methylbutanol	50,0	524,4		1000	malty
2-Methylbutanol	n.n	84,7		320	malty
2-Methylbutanal	69,3	308,9	32	3,7	malty

++ table 1

Detected compounds, their aroma features, odor threshold values as well as minimum and maximum amounts found



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Experiment design

Several samples were produced and used to bake rolls from the PATT process after a storage period of 0, 6, 12, 18, and 24 hours.

An expert panel assessed shape, formation of bubbles, intensity of browning, crust texture, odor and flavor of PATT rolls and conventionally produced rolls (direct dough make-up) while a consumer panel consisting of 40 consumers was asked to rank them according to popularity. Rolls that were baked off after a storage period of 12, 18, and 24h as well as conventionally produced rolls were then subjected to gas chromatographic analysis (GC). Since the PATT process, in general, involves storage periods of more than 6 hours, the batches with zero and six hour storage times were not included in this elaborate analysis. +++

	PATT	direct
	quantity [g]	
Wheat pastry flour	1.000	1.000
Water	639	639
Yeast	35	50
Salt	22	22
Baking agent	20	20
Mixing	6 min	6 min
Kneading	4 min	4 min
Bench time	20 min	20 min
Final proofing	PATT-process	30 min
Baking process	240 °C	21 min

	Processing parameters PATT		
	Proofing S1	Cooling S2	Storage
Temperature [°c]	20	steadily to -2	-2
Humidity [% RH]	80	80	95
Time [h]	2	2	0 - 24

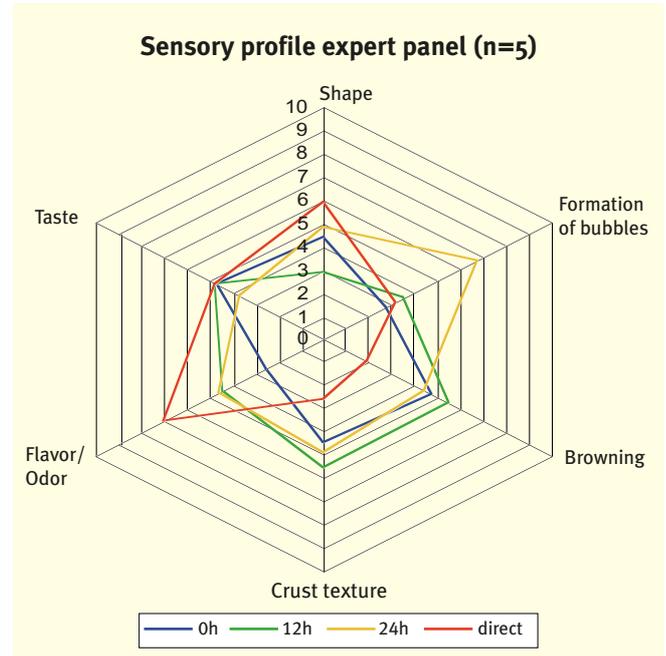
the activity of amylases and proteases to a limited extent. Both enzymes have a large impact on the quality of the baked goods. They produce so-called aroma precursors as well as sugars and amino acids which are of decisive importance for the browning process.

I. Assessment by the expert panel

The expert panel found only a few differences in their sensory evaluation within the group of PATT rolls compared to direct method rolls.

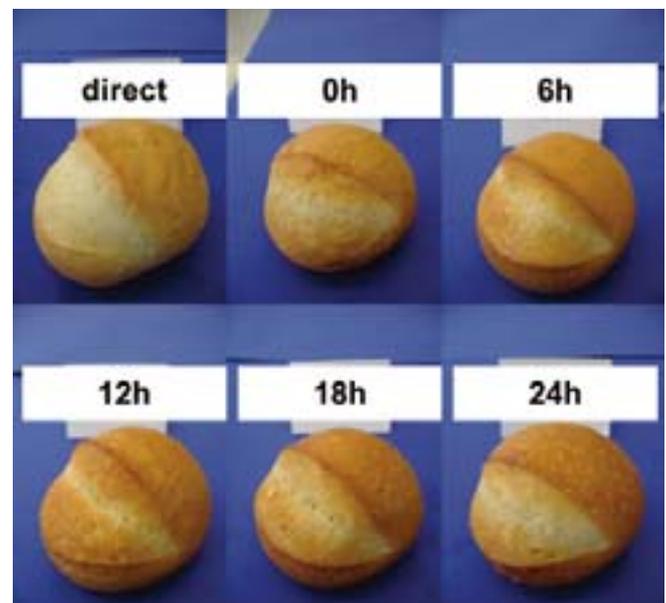
Within the group of PATT rolls, the ones with a storage period of 12 and 24 hours were assessed as having a well bal-

anced odor because the malty note was dominating and no green note was found as for the directly processed comparison products.



++ figure 1 Sensory expert evaluation of rolls (direct method, 0 h, 12 h, and 24 h storage time)

The length of storage time of the PATT rolls has a positive impact, showing a clearly visible, slight bubble formation on the surface and a more intense browning.



++ figure 2 Pictures of the rolls subjected to sensory evaluation.

II. Assessment by a consumer panel

As can be seen from the figure, the consumers clearly favored the PATT rolls in this comparison. Some consumers found that the conventionally produced rolls had too strong a yeast and fat odor. ▶



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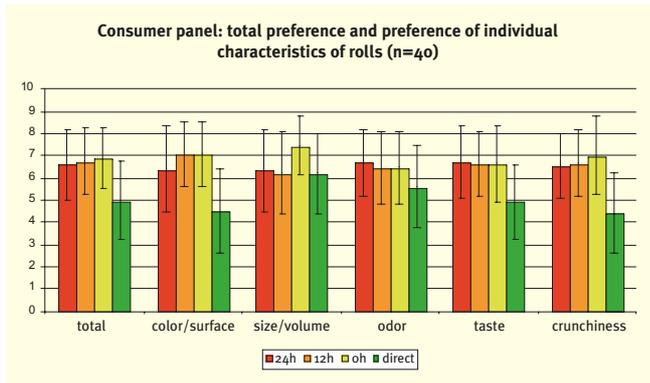


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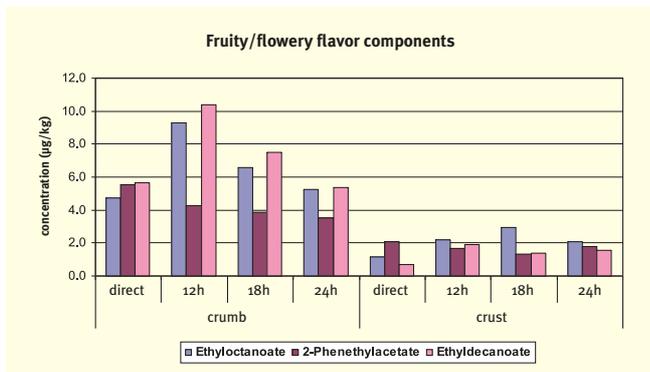
++ figure 3
Preferences of rolls baked off after 0, 12, and 24 h storage time and direct method rolls

III. Analysis results

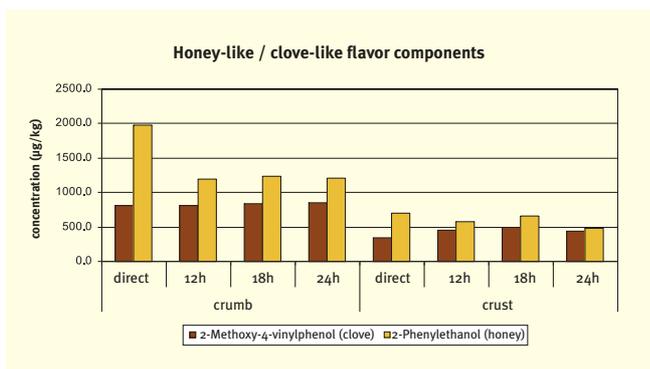
As expected, the analysis showed that starch-degrading enzymes are still active at temperatures of minus 2°C. The maltose content increases with increasing storage time with a significant rise starting after 12 hours storage time while the glucose content decreases during the proofing phase (because the yeast consumes glucose) but still remains relative-ly constant during storage.

The substances detected during GC analysis of the different rolls were classified into odor groups:

- + fruity/flowery flavor components
- + honey-like and clove-like flavor components
- + green and potato-like flavor components
- + malty flavor components



++ figure 4
Fruity/flowery flavor components in the products tested

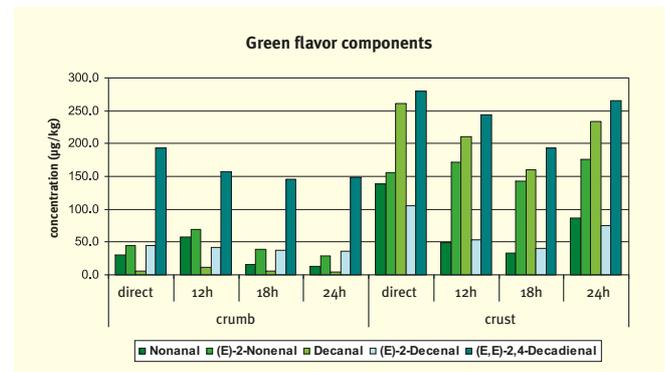


++ figure 6
Honey-like / clove-like flavor components in the products tested

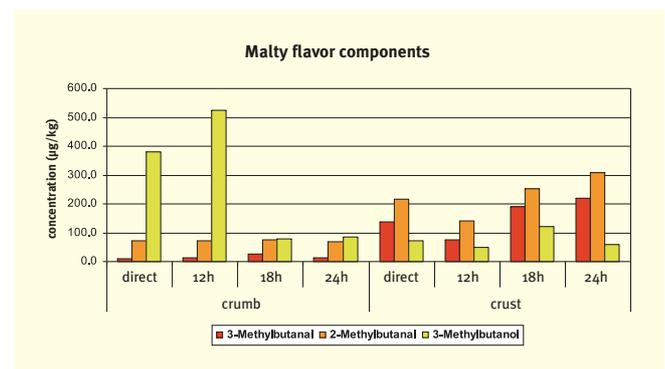
Fruity or flowery aroma components are mainly found in the crumb. These are higher in PATT products with prolonged storage time than in directly prepared rolls. The honey-like and clove-like flavor components are also more likely to be found in the crumb than in the crust. Their content increases slightly with increasing storage time. However, the differences between the traditional production and the PATT process are not very distinct except for 2-phenylethanol. The green and potato-like aroma components are mainly produced by aldehydes. They are responsible for the fatty or stale character and mainly present in the crust. During the entire storage period, PATT rolls first experienced a reduction in these flavor components. The lowest level is reached after a storage period of 18 h. After 24 h storage time, the level of these undesired substances is significantly higher and almost reaches the level found in traditionally made rolls. Since the PATT rolls with increasing storage time display a higher degree of browning, the level of malty flavor components increases in the crust as well.

In total the flavor comparison of the different rolls shows that products made with the PATT process display a clearly broader and more balanced aroma spectrum than conventionally made rolls. The comparison of the different GC approaches gives reason to believe that a storage period of 18 hours would be optimal.

Further information on the experiment and its results are available from **University of Wädenswil, Michael Kleinert Head of the Food Technology department, Grüental CH-8820 Wädenswil, E-mail: m.kleinert@hsw.ch +++**



++ figure 5
Green flavor components in the products tested



++ figure 7
Malty flavor components in the products tested



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