Novel technologies in proofing wheat dough – the impact of $C0_2$ on process – and product - qualities

K. Lösche ; NFT GmbH

Equilibrium-humidity

A simple wheat dough is characterized by a water activity of around a_w = 0,96. To avoid desorption effects during processing and to keep heat - conductivity high, it is necessary to take an appropriate equilibrium –humidity on that level (around 96 % rel. humidity). The use of electro –steamer even in proofers are not able to fulfill these requirements. In addition, the use of steam very often leads to pass over the dew-point, that induces mold grow a lot. The use of water-aerosols together with a specific and laminar air -flow on the other hand, will unable the baker to meet the wanted conditions. At the same time energy consumption is decreased (> 30%), the quality of baked goods is increased as well and hygienic problems could be controlled better. Many novel equipment and processing are established in case of proofers, retarders and others. Some backgrounds, examples and practical applications will be given.

Impact of the ambient atmosphere during fermentation in proofers on dough- properties, hygiene-situations and baked good -quality

Fermentation of wheat dough is mainly done by baker `s yeast. Around 1/3 of the produced $C0_2$ will go out of the dough piece into the ambient air. Depending on the procedure of proofing and on the design of technical systems, the $C0_2$ -concentration will arise. In many cases the $C0_2$ -concentrations reaches levels during proofing up to 2000 ppm, 5000 ppm or more than 10.000 ppm. These higher levels of $C0_2$ will e.g. dilute the oxygen in the air and dough will change into more sticky and viscous properties and less browning reactivities during baking.

Very often proofers are defined as a critical control point according HACCP -concepts, because the conditions during dough-fermentation (e.g. temperature like 35°C, humidity like 80%, dew point depends on) will induce the growth of molds as well as the production of mycotoxins and more. In general, the hygienic situations in proofers are not always well controlled until today.

Novel data´s indicates, that the combination of high $C0_2$ with other environmental stressors produces a compounding effect on mold growth compared to that of individual stressors. Novel technologies are able today to decrease the temperature in proofers a lot (example: instead 35 °C only 26 / 27°C), because the heat -conductivity can be kept high. This is one important variable to decrease mold grow (at constant fermentation time in comparison). At the same time the rel. humidity can increase up to around > 90 % by using water-aerosols (avoiding dew point) , because the $C0_2$ -concentration is controlled on a level of around 1500 ppm. Considering the important process- parameters like humidity, temperature **and** $C0_2$ (others like dew point, oxygen) during proofing, is done by monitoring these data `s and by specific plant - controlled systems at the first time.

Finally a novel and controlled process in proofing or retarding of dough is described, which in comparison is less in energy -consumption, more save in hygienic aspects and better for health and safety at work, leading to constant and improved quality data ´s of baked goods. The final products are expected to be characterized by lower mold and mycotoxin levels, which can increase shelf life and decrease health risks.

NFT GmbH
Am Holzhafen 11 A
D-27570 Bremerhaven
www.northernfoodtec.com

Sources

- Bedard M (2019): Using Carbon Dioxide ($C0_2$) Sensors to Detect Food Spoilage ; cereal technology 01 , 30-32
- USDA (2016): Stored Product Insect and Engineering ; Research : Manhattan KS , 10 (7)
- Gilbert MK, Medina A, Mock BM, Lebor MD, Rodriguez A, Bhatangar D, Magan N, Obrian G , Payne G (2018) : Carbon Dioxide Mediates the Response to Temperature and Water Activity Levels in *Aspergillus flavus* during Infection of Maize Kernels ; J. Toxins (Basel) , 10 81) : 5 , 1-20
- Zhao HC, Zhang SH,Huang SI, Cai JP (2015) : Prevention of toxigenic fungal growth in stored grain by carbon dioxide detection; Food Addit. Contam. Part A Chem. Anal. Control, Expo Risk Assess, 32 (4) , 596-603
- Cummins EP, Selfridge AC, Sprin PH , Sznajdes JI, Taylor CT (2014) : Carbon dioxide - sensing in organisms and its implications for human disease ; Cell Mol Life Sci. 71 (5) , 831-845
- Maier DE, Hulasare R, Qiang B, Armstrong P (2006) : Monitoring carbon dioxide levels for early detection of spoilage and pests in stored grain ; 9th International Working Conference on Stored Product Protection , Sao Paulo , Brazil , 1174-1181

Bremerhaven, March the 22nd, 2019