

In many countries, therefore, SMB is still used in wafer and cracker production although it causes a sulphurous off-taste. Enzymes as an alternative to SMB improve the taste and have definite technical advantages, namely constant dough properties once the reaction is accomplished, including similar texture of return dough and fresh dough, the reduction of water addition to wafer batters and control of wafer density and stability (Fig. 189).

When tested in the Farinograph, both SMB and enzymes show a decline in kneading resistance (Fig. 190). The reaction of SMB occurs much faster, but probably due to the presence of atmospheric oxygen, some of the resistance is restored upon continued mixing, when disulphide bonds broken by SMB recover (upper right). The slower but persistent reaction of the enzymes results in minimum resistance, when all the substrate of the enzymes has been degraded.

18.14 References

- Ahrenholz SH and Neumeister CE, 1987. Development and use of a sampling and analytical method for azodicarbonamide. *Am Ind Hyg. Assoc. J.* 48:442-446.
- Bauer N, Koehler P, Wieser H and Schieberle P, 2003. Studies on the effects of microbial transglutaminase on gluten proteins of wheat. In: *Recent Advances in Enzymes in Grain Processing*. Courtin CM, Veraverbeke WS and Delcour J, (eds.), Laboratory of Food Chemistry Katholieke Universiteit Leuven, Leuven, Belgium, p 107-113.
- Bechtel WG, Meisner DF and Bradley WB, 1953. The effect of the crust on the staling of bread. *Cereal Chem.* 30:160-168.
- Chung OK and Pomeranz Y, 1977. Wheat flour lipids, shortening and surfactants. *Baker's Dig.* 5:32-44; 153.
- Diderichsen BK and Christiansen L, 1986. Preparation of a maltogenic amylase enzyme. *US Patent Application* 4,598,048.
- Dirndorfer M, 2000. Personal communication.
- Freund W, 1995. *Bäckerei Konditorei Management 5 – Verfahrenstechnik Brot & Kleingebäck*. Gildebuchverlag GmbH & Co. KG, Alfeld, Germany.
- Frisbæk J, 2003. Novel tailor-made xylanases: Their characteristics, performance in cereal processing and use as a tool to understand xylanase functionality in baking. In: *Recent advances in enzymes in grain processing*. Courtin CM, Veraverbeke WS, Delcour JA (eds.), Lab. of Food Chem., Katholieke Univ. Leuven, Belgium. 241-245.
- Gebruers K, Courtin CM, Goesaert H, Van Campenhout S and Delcour JA, 2002. Endoxylanase inhibition activity in different European wheat cultivars and milling fractions. *Cereal Chem.* 79(5):613-616.
- Geissmann T and Neukom H, 1973. On the composition of the water soluble wheat flour pentosans and their oxidative gelation. *Lebensm.-Wiss. Technol.* 6(2):59-61.
- Gonzalez P, 2001. *Sunn Pest – Unlocking the Mysteries of an Ancient Problem*. Int. Center for Agric. Res.
- Gray JA and Bemiller JN, 2003. Bread staling: molecular basis and control. *Compreh. Rev. Food Sci. Food Safety* 2:1-21.
- Grosch W and Wieser H., 1999. Redox reactions in wheat dough as affected by ascorbic acid. *J. Cereal. Sci.* 29:1-16.
- Hedwig A, 1996. Personal communication.
- Höfer M, Ghyczy M and Popper L, 1996. Yeast interaction with lecithin fractions. *Food Technol. Int.* 86-88.
- Hosney RC and Faubion JM, 1981. A mechanism for the oxidative gelation of wheat flour water-soluble pentosans. *Cereal Chem.* 58(5):421-424.
- Jörgensen H, 1935. Ein Beitrag zur Beleuchtung der hemmenden Wirkung von Oxidationsmitteln auf proteolytische Enzymaktivität: Über die Natur der Einwirkung von Kaliumbromat und analogen Stoffen auf die Backfähigkeit der Weizenmehle. *Biochem. Z.* 280:1-37; 283:134-145.
- Kieffer R, 2003. Die Elastizität von Weizenteig – ein häufig überschätztes Qualitätsmerkmal. *Getreide Mehl Brot* 57(6):335-339.
- Kieffer R, Kim JJ, Walther C, Laskawy G and Grosch W, 1990. Influence of glutathione and cysteine on the improver effect of ascorbic acid stereoisomers. *J. Cereal Sci.* 11:143-152.
- Köhler P, 1999. Untersuchungen zur Backwirksamkeit von DATEM und seinen Komponenten. *Getreide Mehl Brot* 53(4):224-233.
- Kragh KM, Larsen B, Rasmussen P, Duedahl-Olesen L and Zimmermann W, 1999. Non-maltogenic exoamylase and their use in retarding retrogradation of starch. *WO 99/50399*.
- Krog N, 1971. Amylose complexing effects of food-grade emulsifiers. *Stärke.* 23:206-210.

- Kulp K, 1979. Staling of bread. *Am. Inst. Baking Tech. Bull.* 1(8).
- Kulp K, Olewnik M and Bachofer C, 1985. Functional effects of chlorinated flour on cookie spread and quality of sugar snap cookies. *AIB Technical Bulletin* 7(5):1-9.
- Linko YY, Javanainen P and Linko S, 1997. Biotechnology of bread baking. *Trends Food Sci. & Technol.* (8):339-344.
- Lösche K, 1996. Erfahrungen mit modifizierten Knetverfahren. *Getreide Mehl Brot* 50(2):72-82.
- Lösche K, 2002. Beeinflussung der plastischen bzw. elastischen Eigenschaften bei der Teigbereitung. *Getreide Mehl Brot* 56(2):81-91.
- Ludwig DS, 2000. Dietary glycemic index and obesity. *J. Nutr.* 130:280S-283S.
- Maltha PRA, 1950. Über den Einfluss von l-Ascorbinsäure und Verbindungen mit verwandter Struktur auf die Backfähigkeit des Mehles. *Getreide Mehl* 3(9): 65-69.
- MacRitchie F and Gras PW, 1973. The role of flour lipids in baking. *Cereal Chem.* 50:292-302.
- Molan PC, 1992. The antibacterial activity of honey. 1. The nature of the antibacterial activity. *Bee World* 73(1):5-28.
- Neukom H and Markwalder HU, 1978. Oxidation gelation of wheat flour pentosans: a new way of cross-linking polymers. *Am. Assoc. of Cereal Chem.* 23(7):374-367.
- Pomeranz Y, 1984. *Functional properties of food components.* Academic Press.
- Pomeranz Y, 1988. *Wheat chemistry and technology.* AACC, St. Paul, MN, USA.
- Popper L, 2002. Backvorprodukt und Verfahren zur Herstellung von Backwaren. DP 10 209 629.
- Sandstedt RM, Kneen E and Blish MJ, 1939. A standardized Wohlgemuth procedure for α -amylase activity. *Cereal Chem.* 16:712-723.
- Schünemann C and Treu G, 2002. *Technologie der Backwarenherstellung.* Gildebuchverlag GmbH & Co. KG, Alfeld, Germany.
- Seibel W, Seiler K and Elsner G, 1984. Wirkung von extrudierten Weizenmehlen auf die Qualitätseigenschaften von Feinen Backwaren. *Getreide Mehl Brot* 38(6):182-187.
- Si JQ, 1995. New developments of enzymes for the baking industry. *AIQS Congress, Spain, Nov. 1995.*
- Stauffer CE, 2000. Emulsifiers as antistaling agents. *Cereal Foods World* 45(3):106-110.
- Tegge G, 1984. *Stärke und Stärkederivate.* Behr's Verlag, Hamburg.
- Van Eijk JH and Hille JDR, 1995. Nonamylolytic enzymes. In: Hebeda RE and Zobel HF (eds.), *Baked goods freshness: technology, evaluation and inhibition of staling.* Marcel Dekker, New York, p 131-150.
- Van Nieuwenhuyzen W, 1998. Lecithins open doors to baked goods. *Int. Food Ingred.* (2): 32-36.
- Van Nieuwenhuyzen W, 1999. Amylose complexation by hydrolysed lecithins. *Eur. Food Drink Rev.* (6):43-47.
- Van Nieuwenhuyzen, W, 2001. Personal communication.
- Willett WC, 2001. *Eat, drink and be healthy: the Harvard Medical School guide to healthy eating.* Simon & Schuster, New York.
- Wrigley C, 2004. Sprouted grain: Detection and aberrant results. *Cereal Foods World* 49(3):169-171.
- Yin Y and Walker CE, 1992. Pentosans from gluten-washing wastewater: Isolation, characterization, and role in baking. *Cereal Chem.* 69(6):592-596.
- Zobel H and Kulp K, 1996. The staling mechanisms. In: Hebeda RE and Zobel H (eds.), *Baked goods freshness – technology, evaluation and inhibition of staling,* Marcel Dekker, New York, p 1-64.