equipment used must always take into account the ingredients being processed and downstream operations. The influence of particle size distribution on the flavour of chocolate suggests that deagglomeration occurring during conching may be as important to flavour development as it is to viscosity reduction.

References

- Afoakwa, E.O., Paterson, A., Fowler, M. (2007) Factors influencing rheological and textural qualities in chocolate a review. *Trends in Food Science and Technology* **18**, 290–298.
- Afoakwa, E.O., Paterson, A., Fowler, M. (2008) Effects of particle size distribution and composition on rheological properties of dark chocolate. *European Food Research and Technology* **226**, 1259–1268.
- Afoakwa, E.O., Paterson, A., Fowler, M., Ryan, A. (2009) Matrix effects on flavor volatiles release in dark chocolates varying in particle size distribution and fat content using GC-mass spectrometry and GC-olfactometry. *Food Chemistry* **113**, 208–215.
- Afoakwa, E.O., Paterson, A., Fowler, M., Vieira, J. (2008) Particle size distribution and compositional effects on textural properties and appearance of dark chocolates. *Journal of Food Engineering* 87, 181–190.
- Aguilar, C.A., Ziegler, G.R. (1992) Spray-dried whole milk powders and the processing of chocolate. 25th Anniversary Scanning Microscopy Meeting, Food Structure Program, Chicago, pp. 9–12.
- Alamprese, C., Datei, L., Semeraro, Q. (2007) Optimization of processing parameters of a ball mill refiner for chocolate. *Journal of Food Engineering* **83**, 629–636.
- Beckett, S.T. (1994) Control of particle size reduction during chocolate grinding. *Manufacturing Confectioner* **74**(5), 90–97.
- Blanshard, J.M.V. (1995) The glass transition, its nature and significance in food processing. In: *Physico-Chemical Aspects of Food Processing* (ed. Beckett, S.T.), Blackie, Glasgow, pp. 17–48.
- Bolenz, S., Holm, M., Langkrär, C. (2014) Improving particle size distribution and flow properties of milk chocolate produced by ball mill and blending. *European Food Research and Technology* **238**, 139–147.
- Bolenz, S, Manske, A. (2013) Impact of fat content during grinding on particle size distribution and flow properties of milk chocolate. *European Food Research and Technology* **236**, 863–872.
- Bond, F.C. (1960) Crushing and grinding calculations. *British Chemical Engineer* **6**, 378–391, 543–548.
- Bouzas, J., Brown, B.D. (1995) Interactions affecting microstructure, texture, and rheology of chocolate confectionery products. In: *Ingredient Interactions: Effects on Food Quality* (ed. Gaonkar, A.G.), Marcel Dekker, New York, pp. 451–528.
- Fischer, B.J. (1994) Particle Size Distribution Effects on Rheology of Molten Dark Chocolate. MS thesis, Pennsylvania State University, University Park.
- Fritzsche, T. (1994) Optimization of influencing variables in the chocolate rolling process. *Proceedings Chocolate Technology*, **1994**, 7–9.
- Hogenbirk, G. (1985) Glucose and lactose influence on characteristics of chocolate flavored coatings. *Manufacturing Confectioner* **65**(10), 27–34.
- Jackson, K. (1994) Recipes. In: Industrial Chocolate Manufacture and Use (ed. Beckett, S.T.), Chapman and Hall, London, pp. 258–280.
- Kaya, E., Cho, H.,, Hogg, R. (1997) Reagglomeration phenomena in fine grinding of coal. Minerals and Metallurgical Processing 14, 37–42.
- Klimpel, R.R., Manfroy, W. (1978) Chemical grinding aids for increasing throughput in the wet grinding of ores. *Industrial Engineering Chemical Process Design and Development* 17, 518–523.

- Kuster, W. (1980) Technological aspects of liquor grinding. Proceedings of the 34th Pennsylvania Manufacturing Confectioners' Association Production Conference, April 22–24, Lancaster, pp. 78–86.
- Kuster, W. (1984) Liquor grinding. Manufacturing Confectioner 64(8), 47-55.
- Kuster, W. (1991) Particle size. Manufacturing Confectioner 71(8), 57-60.
- Martin, R.A., Stumpf, D.M. (1992) Process of Refining Saccharide Crystals during Food Processing. United States Patent 5 080 923.
- McGeary, R.K. (1961) Mechanical packing of spherical particles. *Journal of the American Ceramic Society* **44**(10), 513–522.
- Mongia, G. (1997) Particle Size Distribution Affects the Rheology and Sensory Attributes of Milk Chocolate, PhD thesis, Pennsylvania State University, University Park.
- Mongia, G., Ziegler, G.R. 2000. The role of particle size distribution of suspended solids in defining the flow properties of milk chocolate. *International Journal of Food Properties* **3**(1), 137–147.
- Niediek, E.A. (1994) Particle size reduction. In: *Industrial Chocolate Manufacture and Use* (ed. Beckett, S.T.), Chapman and Hall, London, pp. 83–101.
- Olinger, P.M. (1994) New options for sucrose-free chocolate. *Manufacturing Confectioner* **74**(5), 77–84.
- Pangborn, R.M., Kayasako, A. (1981) Time-course of viscosity, sweetness and flavor in chocolate desserts. *Journal of Texture Studies* 12, 141–150.
- Peter, T. (1994) Particle size reduction with the two-stage refining system. *Proceedings Chocolate Technology* 1994, Cologne, pp. 7–9.
- Rumpf, H. (1962) The strength of granules and agglomerates. In: *Agglomeration* (ed. Knepper, W.A.), John Wiley & Sons, Inc., New York, pp. 379–418.
- Schmieder, R.L., Keeney, P.G. (1980) Characterization and quantification of starch in cocoa beans and chocolate products. *Journal of Food Science* **45**(3), 555–563.
- St. John, J.F., Fetterhoff, J.G., Carpenter, J.R., Brown, B.D., Azzara, C.D., Tarka, S.M., Rank, C., Strohmaier, G.K. (1995) *Reduced Fat Confectionery Products and Process*. United States Patent 5 464 649.
- Sudduth, R.D. (1993a) A generalized model to predict the maximum packing fraction and the viscosity of solutions with suspended particles. *I. Journal of Applied Polymer Science* **48**, 25–36.
- Sudduth, R.D. (1993b) A new method to predict the maximum packing fraction and the viscosity of solutions with a size distribution of suspended particles. II. *Journal of Applied Polymer Science* **48**, 37–51.
- Sudduth, R.D. (1993c) A generalized model to predict the viscosity of solutions with suspended particles. III. Effects of particle interaction and particle size distribution. *Journal of Applied Polymer Science* **50**, 123–147.
- Tangsripongkul, S. (1993) *Breakage Mechanisms in Autogenous Grinding*. PhD thesis, Pennsylvania State University, University Park.
- Windhab, E.J. (1995) Rheology in food processing. In: *Physico-Chemical Aspects of Food Processing* (ed. Beckett, S.T.), Chapman and Hall, London, pp. 80–115.
- Windhab, E.J. (1997) Structure–rheology relationships in chocolate processing. *Proceedings of an International Symposium on Confectionery Science*, University Park, pp. 104–126.
- Ziegleder, G (2006) Premium Chocolate Conching, ZDS Schoko-Technik, Cologne.
- Ziegler, G.R., Mongia, G., Hollender, R. (2001) The role of particle size distribution of suspended solids in defining the sensory properties of milk chocolate. *International Journal of Food Properties* **4**(2),175–192.