

roasting and/or nib treatment; both of which can also kill any *Salmonella* present. Besides validated processes it is also advisable to have robust sampling and analysis schemes on the final product for *Salmonella* (see Chapter 25). Unfortunately, when cocoa powder is contaminated with *Salmonella* it is not homogeneously distributed, therefore a sampling scheme such as is proposed by the FDA is recommended. Details about *Salmonella* contaminated products have been published (Gill *et al.*, 1983; Craven *et al.*, 1975; D'Aoust *et al.*, 1975) and it is known that *Salmonella* may survive for many months in chocolate. Additionally, when consumed in chocolate, *Salmonella* is protected by the fat in chocolate against the acidity of gastric juice and consequently relatively low levels of *Salmonella* may cause salmonellosis.

For specific applications (i.e. sterilised dairy products), other microbiological parameters such as thermoresistant spores are important to be determined. The shell content of cocoa powder (as well of cocoa mass) is another important quality aspect. The shell, being the outer layer of the cocoa bean, can be contaminated with sand, pesticides and so on. The shell is very hard and causes wear to grinding equipment. It is technically impossible to produce a completely shell-free cocoa but it should obviously be reduced to an acceptable level.

Cocoa powder is very sensitive to high temperature and to temperature fluctuations which may result in the melting and re-crystallisation of the cocoa butter. This is visible as fat bloom, changing the “external” colour of the powder. Melting and re-crystallisation will also lead to lump formation, a common problem that causes difficulties in processing cocoa powder. Due to the hygroscopicity of cocoa powder absorbance of moisture from its environment should also be avoided and appropriate packaging used. Multiply paper bags (with an inner polyethylene coating, liner or its equivalent) of 25 kg or 50 lbs are most commonly used to pack cocoa powder. Besides this supersacks/big bags (up to 1000 kg, 2204 lbs) and loose bulk deliveries in silo trucks (up to 20 000 kg) are used. Special skills and equipment are necessary when using this type of transport.

When cocoa powder is stored under proper conditions a shelf life of three years can be guaranteed. These conditions are:

- Dry and clean warehouse, free from any foreign odours, rodents, insects and so on.
- The relative humidity of the air should preferably not exceed 50%.
- The temperature in the warehouse should consistently be 18–22 °C (64–72 °F). Sharp fluctuations in temperature should be avoided.
- Exposure to heat sources such as sunlight, lamps and heating systems should be avoided.

Conclusion

The use of good raw material is essential for the production of high quality cocoa products. Many processes can be applied but experience and optimisation of the process conditions are needed to obtain a consistent final quality of the cocoa

mass, cocoa butter and cocoa powder. Today cocoa products are available in a wide variety of flavours, colours and other important characteristics, which are then able to be used to produce unique cocoa- and chocolate-containing products.

Appendix: Manufacturers of cocoa processing equipment

There are several manufacturers and many brands of cocoa processing equipment and inclusion/exclusion on this list does not imply any recommendation or otherwise.

Bühler Barth GmbH, Freiberg am Neckar, Germany.

Hamburg Dresdner Maschinenfabriken GmbH, Dresden, Germany (Probat, Petzholdt, Bauermeister and MacIntyre brands).

JND Technologies Limited, Retford, UK.

Micronising Company (UK), (1998) Framlingham, Suffolk IP13 9PT, UK.

Royal Duyvis Wiener B.V. (incorporating FB Lehmann) Koog ann de Zann, The Netherlands.

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