

# The holistic approach to temper

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**It is interesting to look at the individual processes that chocolate goes through and try to define the common perceptions (and, in some cases, misconceptions) of what each of these is meant to do and on what parameters they depend.**

**R**efining, for example, is meant to reduce particle size and conching is meant to remove moisture from the chocolate and to alter the flavour profile by eliminating unwanted volatiles. But is that all they do? Or do they have an effect downstream on the performance of the chocolate as it is tempered? Indeed, what is the tempering process dependent on? Many people would say that it is dependent on the fat phase of the chocolate, and, certainly, that does play a big part. But is that the only thing that tempering performance is dependent on? Clearly not because Talbot et al (2007) showed that the non-fat solids in chocolate also have an effect on tempering.

What about viscosity? There are many factors controlling viscosity – total fat content, particle size, emulsifier content, moisture content and so on. The question that all of this raises is ‘are these things independent of each other or are they all linked together?’ Work that we have done looking at the effect of refining and conching in different ways on tempering and viscosity of chocolate suggests that the way the chocolate is made has more of an effect on the way it performs than many people think.

Take tempering for instance. We tempered a milk chocolate that had been refined and conched in different ways. One batch had gone through a conventional multi-roll refiner and conche; a second batch had been processed for 30 minutes under light pressure in a Lloveras refiner-conche; a third batch had been processed for 5 hours under heavy pressure in the Lloveras refiner-conche (see also Talbot et al, 2008). The time taken to achieve temper in a seeded tempering kettle was measured. We carried out a similar experiment on a milk chocolate that contained 3% Creamelt™ 900 (a multi-purpose vegetable fat from Loders Croklaan) in place of 3% cocoa butter. In this case we looked at four chocolates, all processed in a ball-mill. Two were processed in a full ball-mill (10kg load) and sampled after 6 and 24 hours processing and in a half-

loaded ball-mill (5kg load) sampled after the same processing times.

If the only thing that affected temper was the nature of the fat phase then we would expect each sample of the same chocolate to perform identically and not correlate with any aspect of the way the chocolate had been made. In fact, we found a correlation between time to achieve temper and the mean particle size of the chocolate (Figure 1). The smaller the particle size, the longer is the tempering time. Generally speaking, particle size decreases with extended processing and so crystallisation modifiers may be playing a role here. The more processing, particularly the more conching at elevated temperatures, the greater is the likelihood of minor components such as partial or oxidised glycerides being produced. Many of these can act as crystallisation retarders and could be a reason for longer tempering times in those chocolates that have

been processed for a longer time.

Tempering also depends, to a large extent, on the number and surface area of seed nuclei and how well these seeds intermix with the molten chocolate. Each of the different particle sizes and shapes resulting from the different refining/conching processes can have an effect on the degree of intermixing of seed and molten chocolate as well as on the surface area available for heterogeneous nucleation.

On the other hand, viscosity of the chocolate may be playing a part in all of this. The different production (refining/conching) methods gave chocolates with different viscosities. When these were tempered there was a strong correlation between viscosity at 50°C and the tempering time (Figure 2). At lower viscosities there was a difference between the two chocolates with the chocolate containing Creamelt™ 900 taking longer to temper. At higher viscosities, however, this difference was much less.

Decreasing the tempering temperature would have the effect of reducing tempering time and increasing viscosity thus bringing the Creamelt™ 900-containing chocolate into line with the standard milk chocolate. It was also interesting that, irrespective of the process method and irrespective of the viscosity at 50°C, the viscosity at temper was always about 2.7 times higher than that at 50°C.

Clearly then, we need to treat chocolate production, chocolate recipes and chocolate processing holistically rather than segregating them and assuming that each can be considered independent of the other. The production methods will have an effect on processing parameters such as tempering and viscosity. The recipe, particularly in terms of the fat phase will also have an effect on tempering and viscosity. Differences attributed to the use of vegetable fat can be reduced by making changes to tempering temperatures bringing both temper times and viscosity in line with those seen with a vegetable fat-free chocolate.

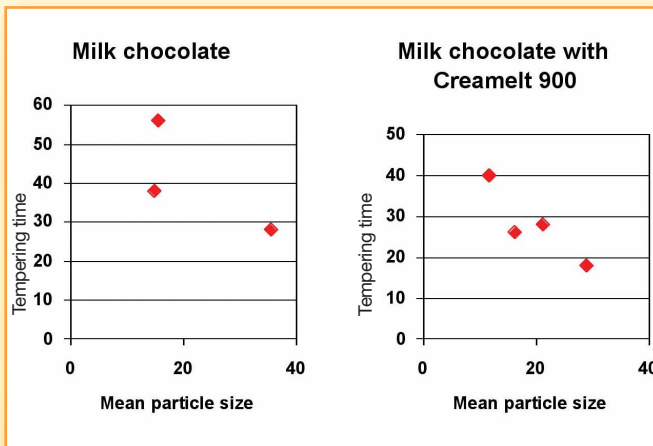


Figure 1: Effect of particle size on tempering

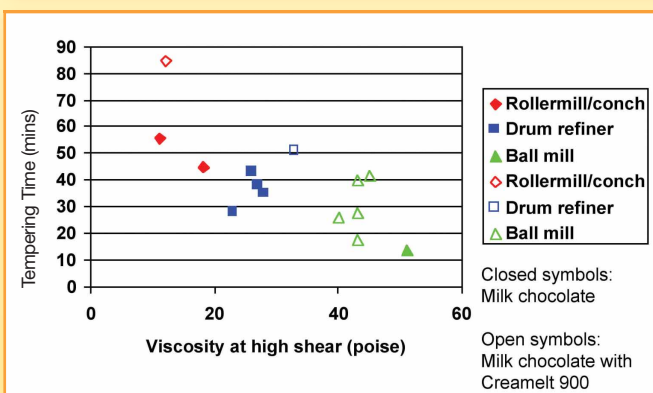


Figure 2: Effect of process-induced viscosity on tempering time

**References**

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