EFFECT OF COCOA BUTTER ON THE COMPATIBILITY OF SPECIALTY FATS

Keywords: cocoa butter equivalent (CBE); interaction between fats

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Selected commercial samples of vegetable specialty fats, i.e. *palm mid-fraction (PMF), Borneo tallow (IP) and sal stearin (SLs), were blended with cocoa butter (CB) in multi-component systems. The compatibility of the blends was monitored from the changes of solid fat content (SFC). With the addition of 50% CB to the systems, the eutectic effect among the specialty fats was no longer detected. The maximum amount of PMF that can be used in the formulation of a final product may not be directly correlated with its performance in the formulation of cocoa butter equivalent (CBE). In order to comply with the requirement of 50% SFC at 30°C in blends of 50% CBE and 50% CB, the maximum level of PMF in the CBE formulation itself was 50 percent.*

INTRODUCTION

In a previous study (Md. Ali *et al.*, 1992), it was reported that palm mid-fraction (PMF), Borneo tallow (IP) and sal stearin (SLs) showed eutectic interaction in ternary blends. The eutectic mixture formed on the addition of between 50% and 90% PMF, giving curves close to the binary line of PMF: SLs. The presence of eutectic interaction in the fat system of chocolate products may cause undesirable results such as softening and bloom formation. In confectionery formulations such as couverture and supercoatings however, cocoa butter (CB) is normally added, or is present within the cocoa mass at a significantly high level (Rossell, 1991). The objective of the present study was to determine whether the presence of cocoa butter (at the 50% level) in the system of PMF, SLs and IP would interact as a eutectic. The addition of cocoa butter at the 50% level in CBE compatibility studies has also been carried out by previous researchers (Balinga and Shitole, 1981; Wethrall, 1959; Traitler and Dieffenbacher, 1985).

EXPERIMENTAL

The commercial samples of PMF, IP, SLs and cocoa butter mentioned in our previous report (Md. Ali *et al.*, 1992) were used in this study. They were kept at -18°C in airtight jars when not in use. The specialty fats (PMF, IP and SLs) were blended with each other in binary and ternary systems (*Figures 1-3*), and also with 50% CB in ternary and quaternary systems (*Figures 4-6*). The interaction between the component fats was monitored by determining solid fat content (SFC) (Md. Ali *et al.*, 1992) with a Newport Analyser Mark II continuous wave NMR spectrometer. The sample in the NMR tube was melted at 70°C for 30 minutes before being chilled at 0°C for 90 minutes. The tube was then transferred to a 26°C bath and kept for 40±0.5 hours for stabilization. The stabilized sample was again chilled at 0°C for 90 minutes before being held at the measuring temperature for 60 minutes prior to measurement.

RESULTS AND DISCUSSION

Figures 4-6 show that when the amount of specialty fats in the systems was limited to 50% (*Figures 4-6*), no minimum point of SFC could be found at 30°C, by contrast with the results from blends without CB (*Figures 1-3*). However, the addition of CB had only a small effect on SFC at 35°C. Hogenbirk (1984) noted that incompatibility between fats can usually be detected between 27.5°C and 30°C.

The results of the present study showed that the component fats were more compatible with each other in the presence of 50% CB. The change was probably due to the increased content in the systems of POS (palmito-oleostearin: one of the main triglycerides in CB). This moved the triglyceride composition away from the eutectic valley shown in the Anderssen's POP/POS/SOS phase diagram (Kheiri, 1982).

Figure 7 shows the isosolid diagram of the quaternary component system at 30°C, which was drawn from values obtained from the curves shown in *Figures 4* to *6*. The addition of PMF reduces the SFC of the final blend. The reduction of SFC (resulting from the addition of PMF) is greater with increasing SLs content than with increasing IP content. The maximum level of PMF that can be added in a CBE formulation depends upon the SFC specification of the final blend. If the blend needs to have about 50% SFC at 30°C, an important characteristic of Ghanian CB (Shukla,1990), then the maximum level of PMF in a PMF: IP binary blend is about 50% (point A in *Figure 7*), while in a PMF: SLs binary blend it is about 20% (point B). A higher maximum level of PMF can be used in a PMF: IP blend than in a PMF: SLs blend because of the greater compatibility of PMF with IP than with SLs. Similar findings were reported by Kalanithi (1985).

The usage of a high level of IP is not recommended since this fat is relatively more expensive and less readily available (Kheiri, 1982; Anon, 1983). To formulate a CBE with lower IP and higher PMF content, both IP and SLs should be used. However as shown in *Figure 4*, the addition of SLs to a PMF: IP blend reduces the PMF usage. For the maximum level of PMF (in order to obtain not less than 50% SFC at 30°C in the final blend), the amounts of both SLs and IP in the CBE formulation should be 25% (point C). PMF is then 50% of the CBE formulation. It is important to note here that, even though the SFC at 30°C of PMF:IP:SLs (50:25:25) (*Figure 3*) is somewhat inferior to that of PMF:IP (50:50) (*Figure 1*), this was not the case when PMF:IP:SLs (50:25:25) was blended with an equal weight of CB.

From this study it can be concluded that the compatibility between the CBE component fats (PMF, IP and SLs) will increase as cocoa butter is added into the system. The maximum amount of PMF that can be used in the formulation of the final product may not be directly correlated with its performance in the formulation of CBE.

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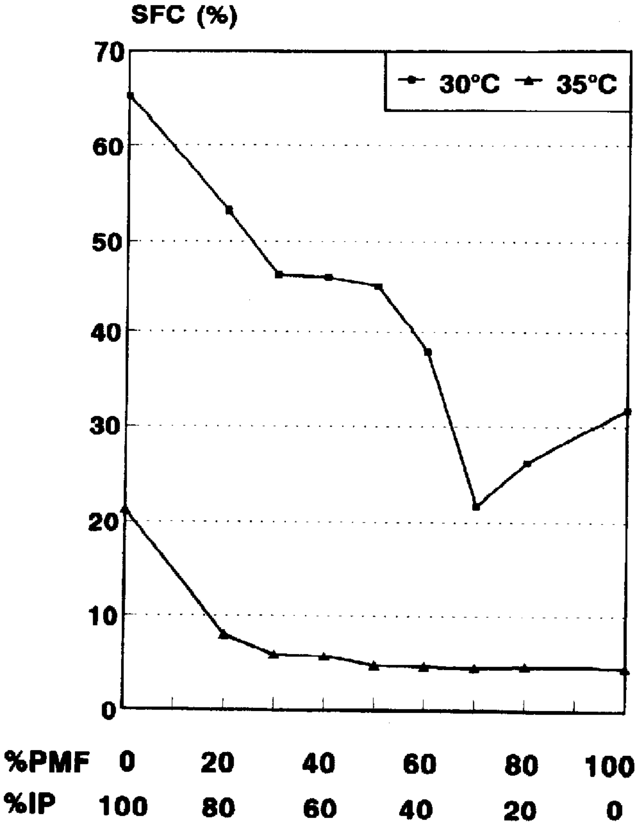

Figure 1. Solid Fat Content of PMF:IP Blends

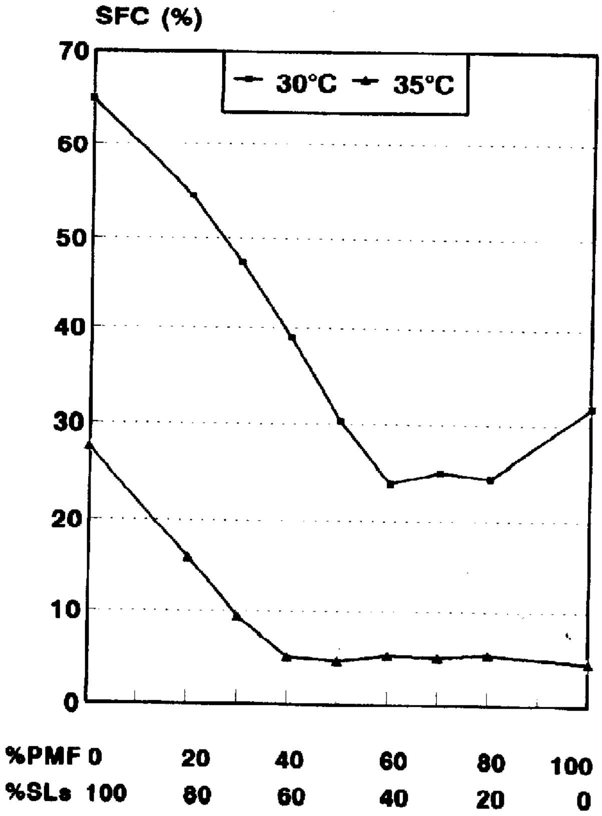

Figure 2. Solid Fat Content of PMF:SLs Blends.

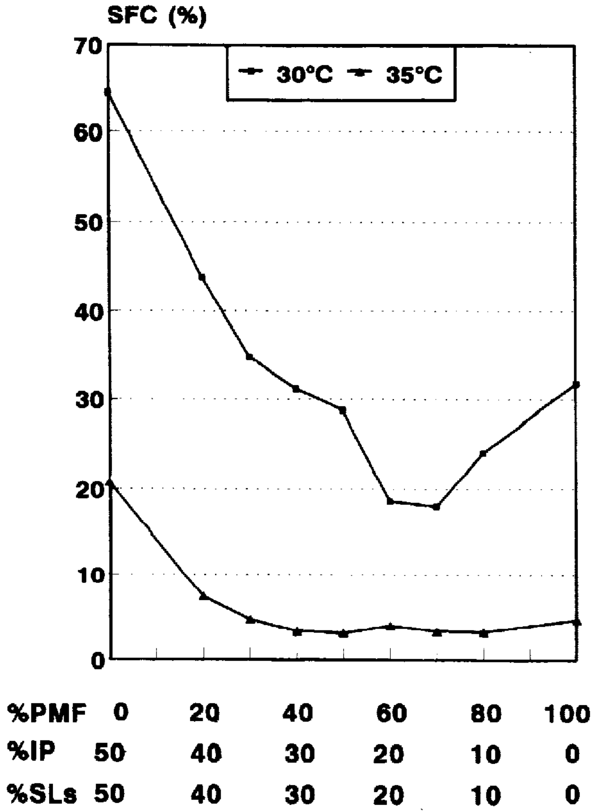

Figure 3. Solid Fat Content of PMF:IP:SLs Blends

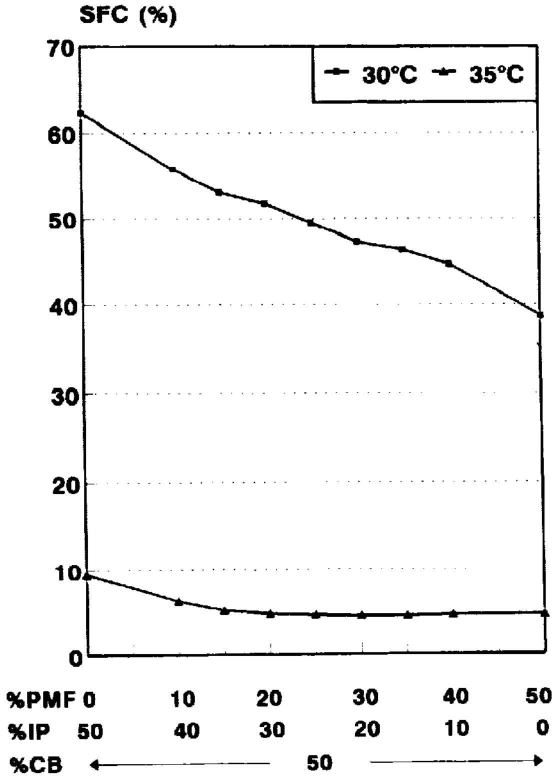

Figure 4. Solid Fat Content of PMF:IP:CB Blends

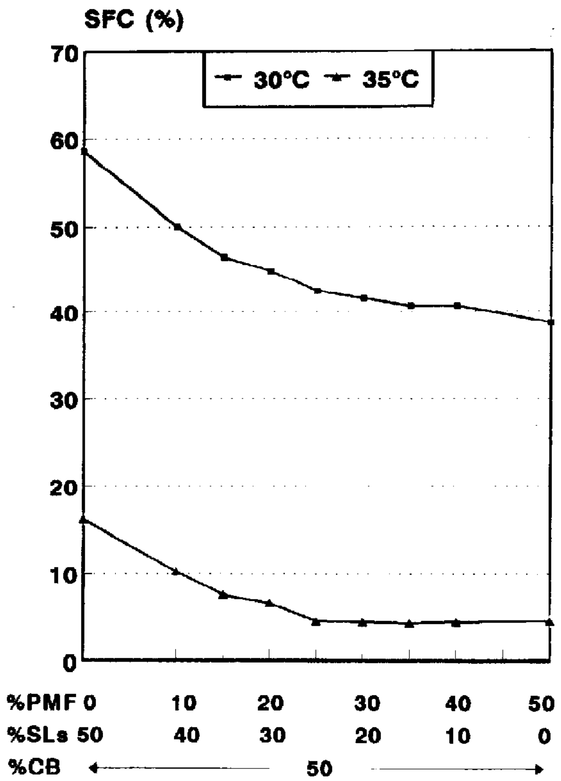

Figure 5. Solid Fat Content of PMF:SLs:CB Blends

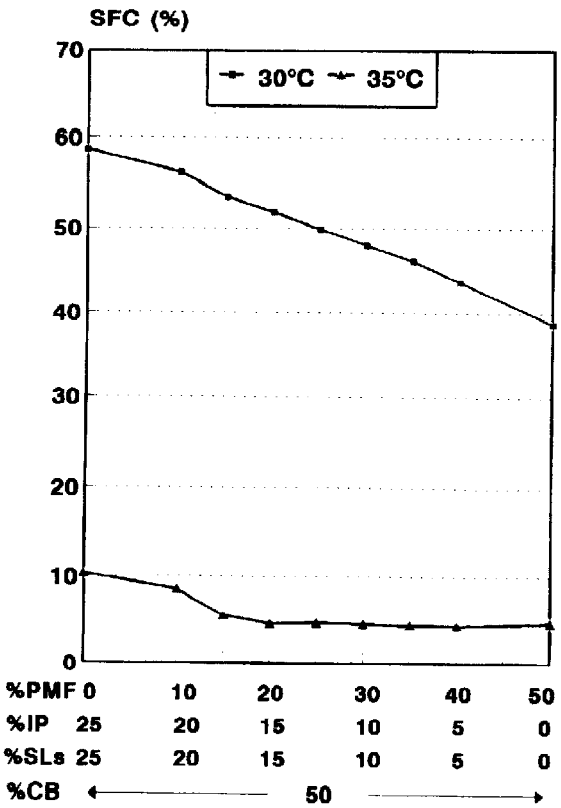

Figure 6. Solid Fat Content of PMF:IP:SLs:CB Blends

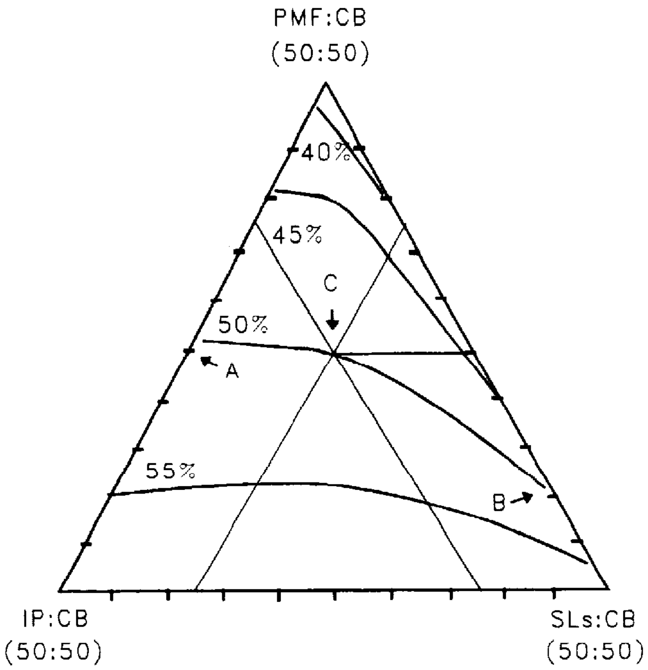

Figure 7. Isosolid Diagram at 30°C for Blends of PMF:IP:SLs with 50% Cocoa Butter

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