

Incorporation of WPI solution in cocoa butter matrix improves the viability of the probiotics

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Abstract

Probiotics have recently emerged as effective therapeutic agents to improve intestinal health. In this research work, we have developed cocoa butter (CB) and Whey protein isolate (WPI) based emulgels through hot-emulsification technique. The formulations were thoroughly characterized. Microscopic evaluation confirmed the formation of biphasic systems. X-ray diffraction studies illustrated WPI solution improved the crystallinity of the emulgels. The IR spectroscopic studies suggested a considerable increment in the hydrogen bonding between the components of the formulations containing WPI. The thermograms the formation of stable polymorphs, Form IV (β') and Form V (β), in the presence of WPI. Incorporation of WPI solution increased the viscous component of the emulgels (increased %SR) in a concentration-dependent manner. Furthermore, the survivability of model probiotic *L. planatarum* was found to be more prominent in the emulgels contrarily to the control. Based on the observations, we firmly suggest that the prepared emulgels can serve as efficient encapsulating matrices for the delivery of probiotics.

Objectives

- To understand the effect of incorporation of WPI solution on the physico-chemical properties of the cocoa butter matrices.
- To study the effect of composition of the formulations on the viability of the probiotics.

Materials and Methods

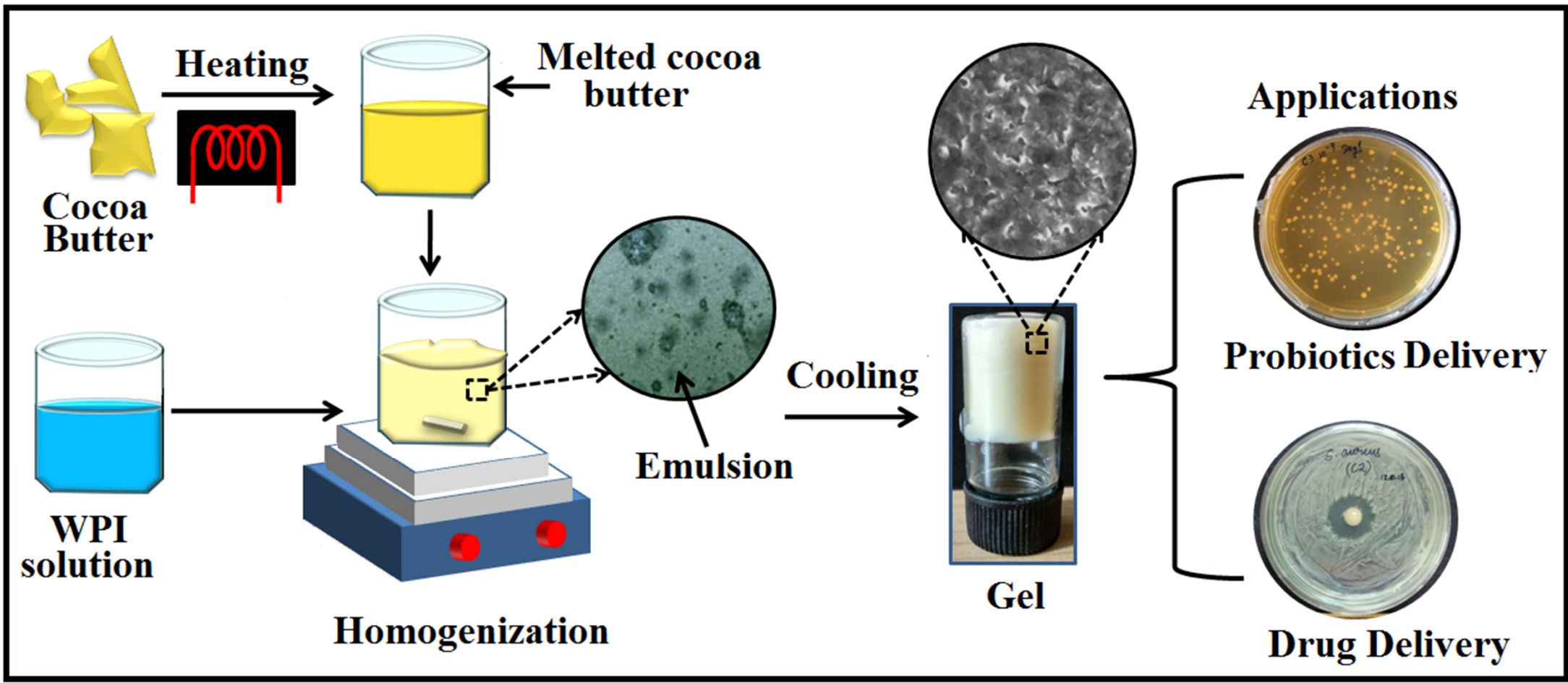


Figure 1. Schematic diagram summarizing the method of preparation of the formulations.

Table 1: Composition of the prepared emulgels

Samples	Composition (g)	
	Cocoa butter	WPI solution (11%, w/v)
C1	10.00	0.00
C2	9.00	1.00
C3	8.00	2.00
C4	7.00	3.00
C5	6.00	4.00

Results

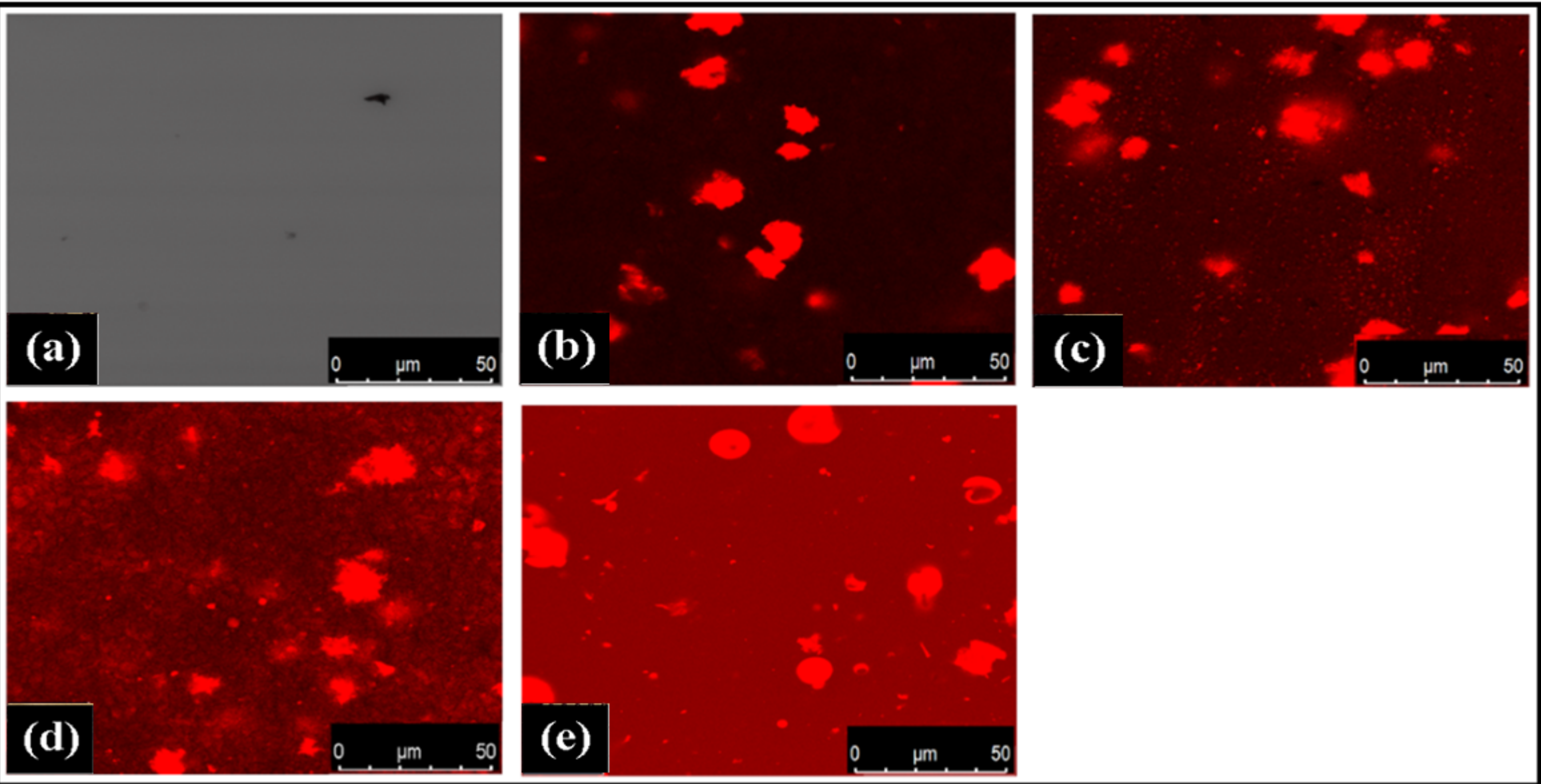


Figure 2. Confocal micrographs of the samples. (a) C1, (b) C2, (c) C3, (d) C4 and (e) C5.

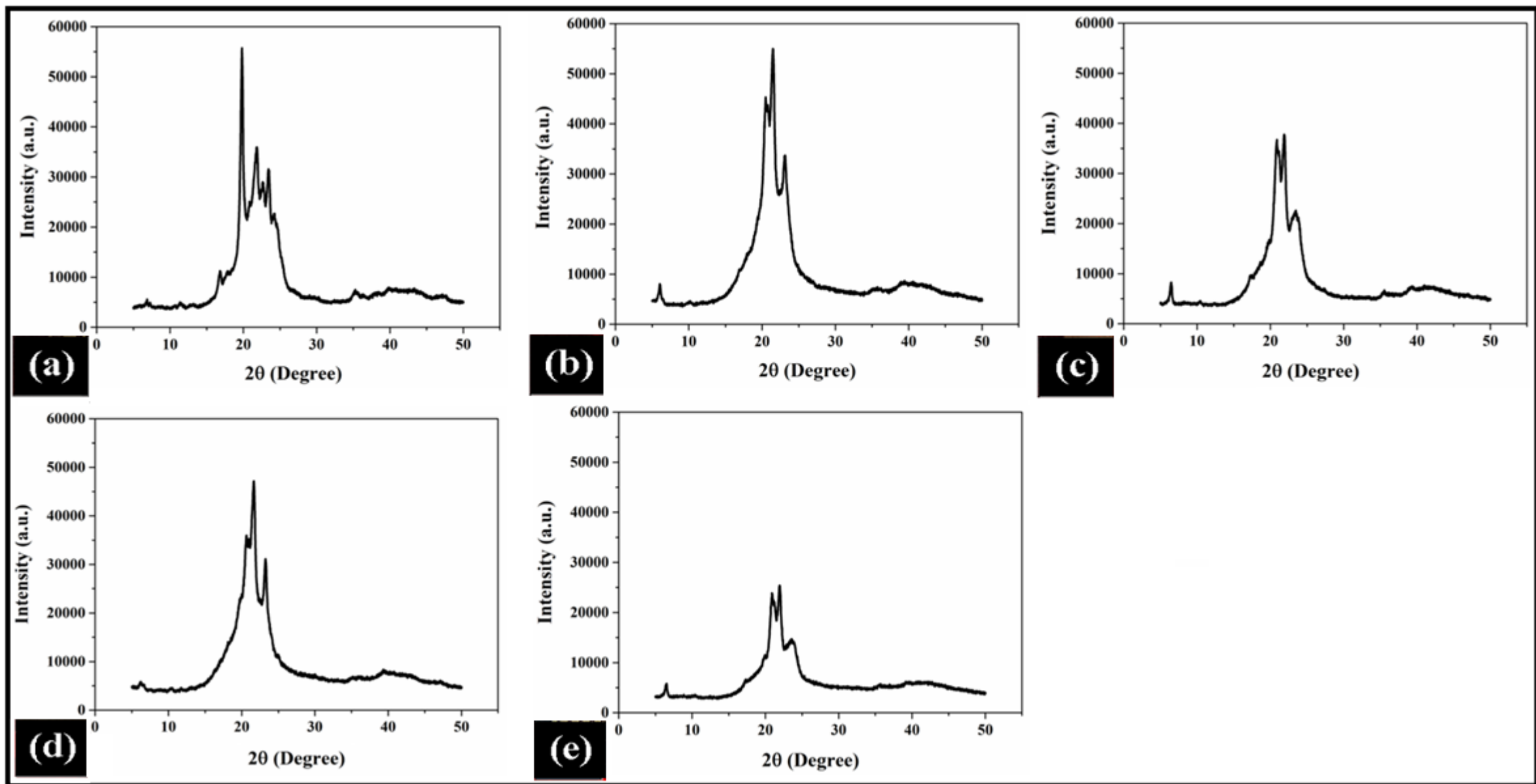


Figure 3. XRD profiles of the samples: (a) C1, (b) C2, (c) C3, (d) C4, and (e) C5.

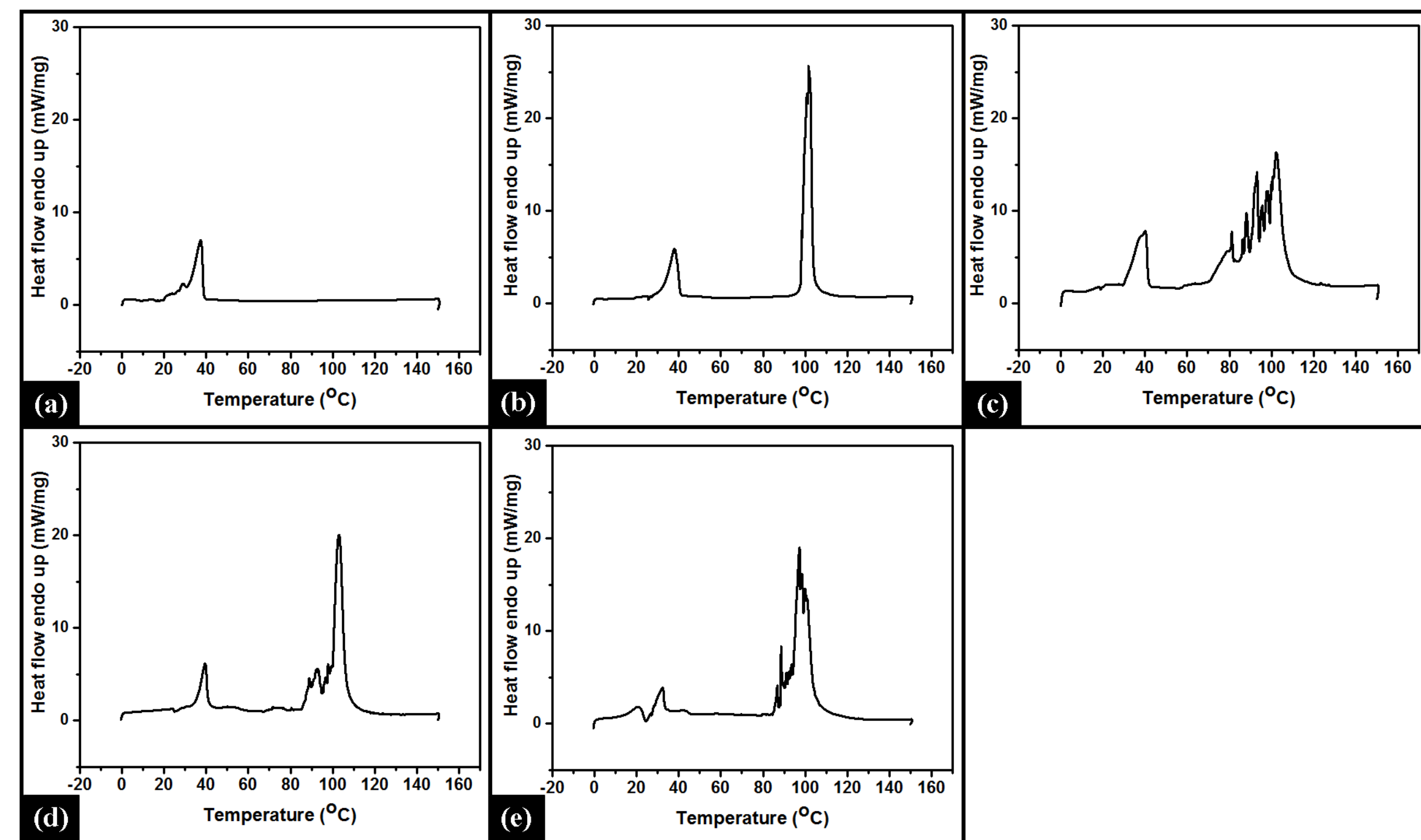


Figure 4: Thermal analysis of the samples: (a) C1, (b) C2, (c) C3, (d) C4, and (e) C5.

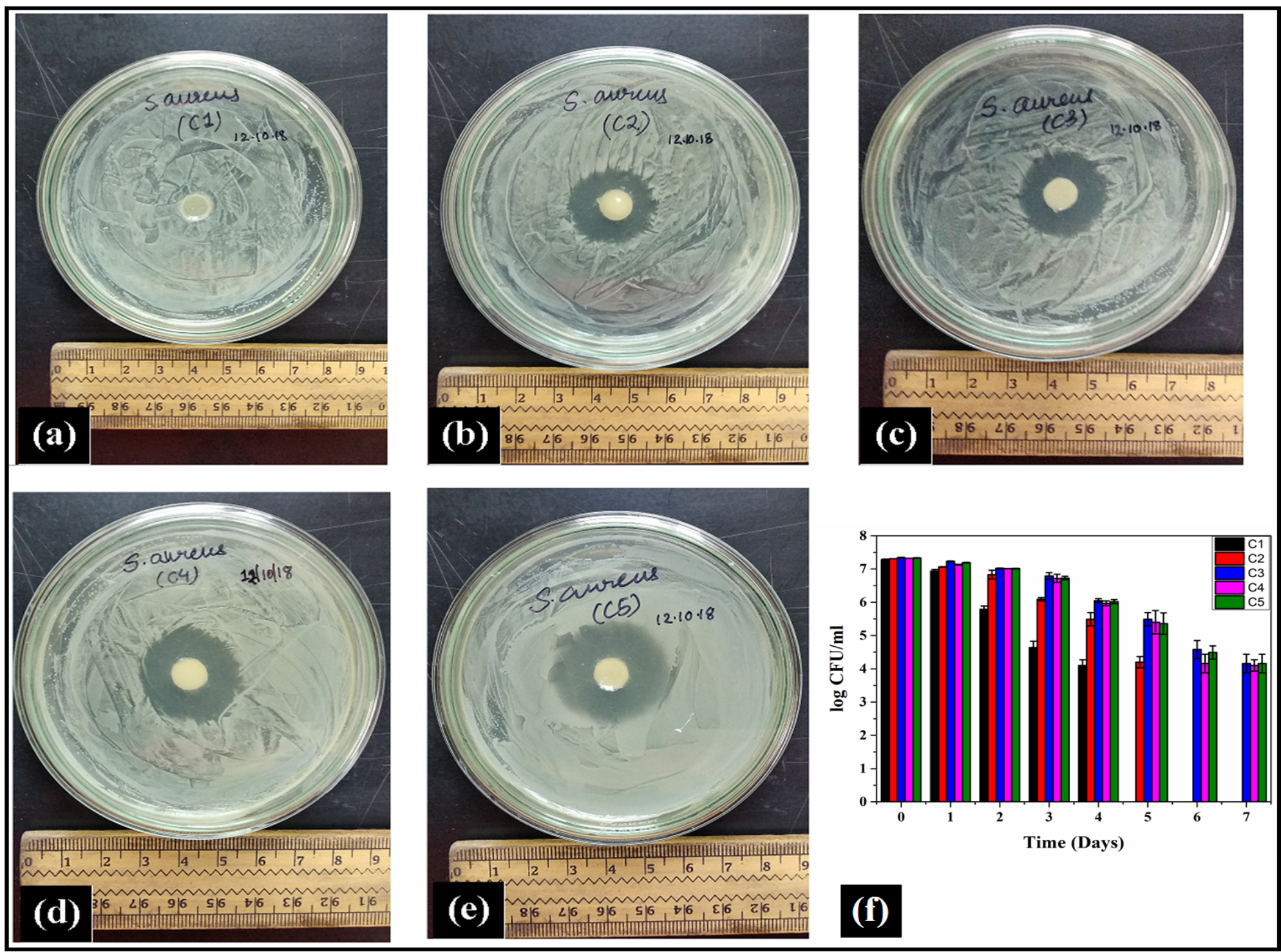


Figure 5. Antimicrobial activity against *S. aureus*. (a) C1D, (b) C2D, (c) C3D, (d) C4D, and (e) C5D; (f) Probiotics viability study.

Conclusion

- ❖ Formation of emulgels was confirmed by the confocal microscopy.
- ❖ Water-in-fat type of emulgels was obtained.
- ❖ At higher proportions of WPI percolation of the aqueous phase into the cocoa butter phase was observed.
- ❖ The XRD study suggested the presence of Form IV (β') and Form V (β) polymorphs of CB.
- ❖ The crystallite size of the formulations was highest in the C4 emugel.
- ❖ Form V (β) polymorph was predominant at lower proportions of WPI solution.
- ❖ When the WPI proportion was highest, the presence of an additional Form IV (β') polymorphs was also present.
- ❖ An increase in the zone of inhibition with the increase in the WPI phase was observed.
- ❖ A higher proportion of WPI solution better supported the probiotics viability.

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