J. Indian Chem. Soc.,
Vol. 96, January 2019, pp. 111-112

Triphala incorporated PCL nanomembrane as wound dressing material for infection control

Rajalakshmi Ramamoorthy, Swetha Andra and Murugesan Muthalagu*

Department of Textile Technology, Anna University, Chennai-600 025, India

E-mail: mmurugesan@annauniv.edu

Manuscript received online 28 August 2018, accepted 10 October 2018

In this study, we have made an attempt to incorporate triphala into PCL to develop nanofiber for sustained drug release for infection control. The electrospun mat was characterized by SEM, FTIR and TGA. Further, the nanomembrane shows broad spectrum antimicrobial activity and good blood compatibility. The burst and sustained release of drug helps to control infection throughout the healing process. These results obtained shows the promising effect of triphala PCL as wound dressing material to control infection and to enhance wound healing with antioxidant property.

Keywords: Triphala, polycaprolactone, composite, nanofibrous mat, antimicrobial.

Introduction

Triphala, an ancient ayurvedic drug with balancing and rejuvenating effect of three dosas – vata, pita and kapha. It is composed of three myrobalans, Amalaki (*Embilica officinalis*), Haritaki (*Terminalia chebula*) and Bibhataki (*Terminalia bellerica*)[1]. The medicinal property of triphala is due to the presence of constituents like tannins, quinines, flavones, flavonoids, flavonols, gallic acid and vitamin C[2,3]. Recent days, electrospun nanofibers are famous for its high surface to volume ratio, surface functionalization, ability to mimic extra cellular matrix and drug delivery applications[4]. Herbal incorporated polymer with controlled drug release is of recent interest. In the present study, we have incorporated triphala with PCL to prepare electrospun mat. Further, the antimicrobial activity, biocompatibility and drug release study was done for analyzing the triphala PCL mat for wound dressing applications.

Experimental

10% PCL solution prepared with methanol:chloroform (50:50) was used to develop nanomembrane. Triphala extract prepared by maceration (solvents same as PCL) was used to develop 5% triphala incorporated PCL. The electrospinning was done at a flow rate of 1 ml/h with 15 kV high voltages at a distance of 15 cm from needle to collector.

Results and discussion

The morphology of PCL and triphala PCL was shown in Fig. 1. The PCL produces flattened fiber but the triphala PCL was smooth and there is an increase in the diameter of the fiber these changes may be due to the incorporation of triphala extract. The FTIR result shows the presence of OH stretching at 3352 cm^{-1} and N=H vibrations at 1613 cm^{-1} which indicates the incorporation of triphala with PCL (Fig. 2). The incorporation of triphala do not influence the thermal stability but it has the ability to withstand sterilization processes (Fig. 3).

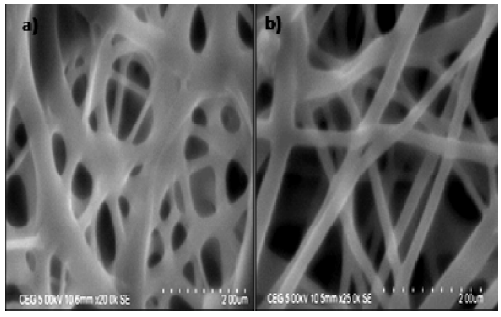

Fig. 1. SEM images of (a) PCL and (b) triphala PCL.

The tiphala PCL shows higher activity towards *S. aureus* followed by *P. aeruginosa, K. pneumoniae* and *E. coli* which shows broad spectrum of antibacterial activity of the

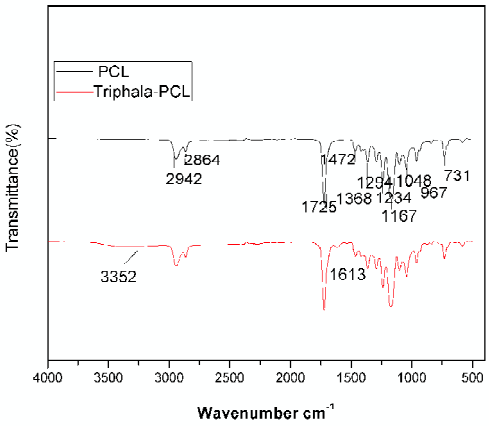

Fig. 2. FTIR analysis of PCL and triphala PCL.

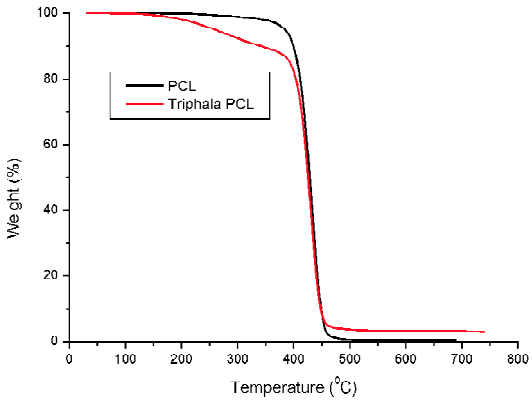

Fig. 3. Thermal degradation of PCL and triphala PCL.

nanomembrane as shown in Table 1. The lysis of blood cells above 5% was considered cytotoxic to blood cells. But, lysis of PCL was 0.47% and triphala PCL was 0.84% (>1%) which shows good biocompatibility towards blood cells. The initial burst release followed by sustained release of drug was identified for 8 h and the continuous release was observed for 3 days (Fig. 4). The release of gallic acid, the primary phenolics of triphala was identified by standard gallic acid with the λ_{max} at 274 nm and confirmed with Folin ciocalteu reagent.

Table 1. Antimicrobial activity study

Pathogens	PCL	Triphala PCL
S. aureus	0	15
E. coli	0	9
K. pneumoniae	0	13
P. aeruginosa	0	14

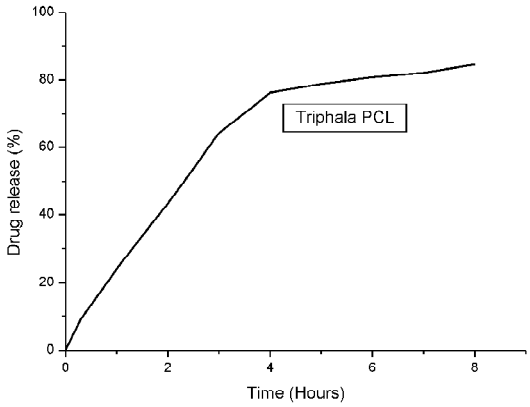

Fig. 4. Drug release of triphala PCL.

Conclusions

In this study, the triphala incorporated PCL nanofiber was prepared and characterized. The triphala PCL shows good broad spectrum of antimicrobial activity and biocompatibility. The drug released at initial burst rate followed by sustained release helps control wound infection and enhanced healing due to antioxidants of triphala.

References

1. C. T. Peterson, K. Denniston and D. Chopra, *J. Altern. Complementary Med*., 2017, **23**, 607.
2. S. Prakash and A. U. Shelke, *J. Indian Soc. Periodontol.,* 2014, **18**, 132.
3. V. D. Tripathi and R. Tiwari, *Int. J. Adv. Res.,* 2015, **3**, 608.
4. M. Zamani, M. P. Prabhakaran and S. Ramakrishna, *Int. J. Nanomedicine*, 2013, **8**, 2997.