

Abstract

In this work, innovative electrospun nanofibers were engineered using polycaprolactone (PCL), polyethylene oxide (PEO), whey protein (WP), and lyophilized apricot powder (LAP). SEM images revealed well-defined, continuous fibers at both nano- and microscale, confirming successful fabrication. DSC analysis demonstrated that the inclusion of PEO and LAP disrupted crystallinity and promoted amorphous structures, improving the thermal profile of the fibers. Notably, surface hydrophilicity was greatly enhanced: the water contact angle of neat PCL (97%) decreased dramatically to 30–40% with WP and LAP incorporation. These synergistic modifications not only tailored fiber morphology and thermal properties but also introduced significant functional improvements. Overall, PCL-PEO-WP-LAP nanofibers represent a promising platform for advanced biomedical and functional applications, bridging natural bioactive components with synthetic polymers to create next-generation materials.

Introduction

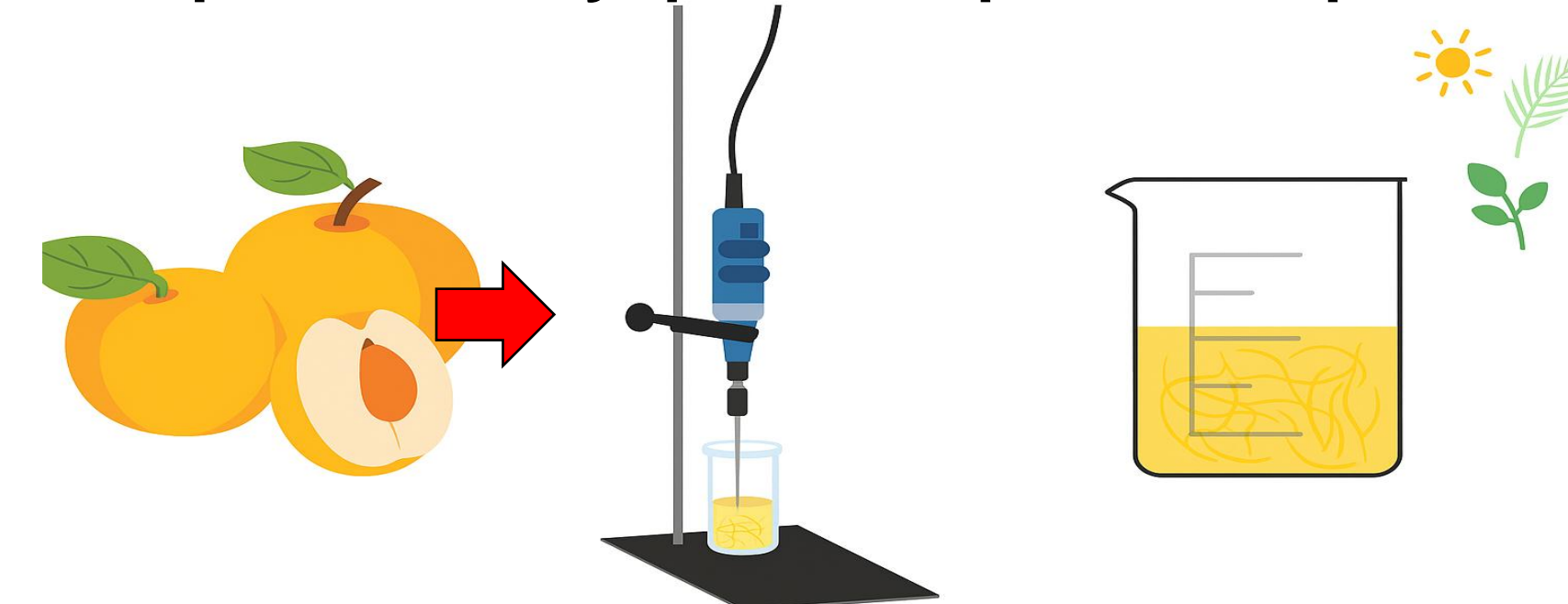
A sedentary lifestyle and insufficient fiber and fluid intake have made constipation one of the most common health problems today. Although this problem is often treated with laxatives, long-term use can lead to adverse effects such as bowel laziness, electrolyte imbalances, and dependence. Therefore, the need for natural and safe alternatives is increasing.

Functional foods are attracting attention not only for supporting nutrition but also for their health-protective effects. In this context, apricots stand out as a natural laxative that supports bowel movements thanks to their high dietary fiber, phenolic compounds, and sorbitol content, which is a natural sugar alcohol.

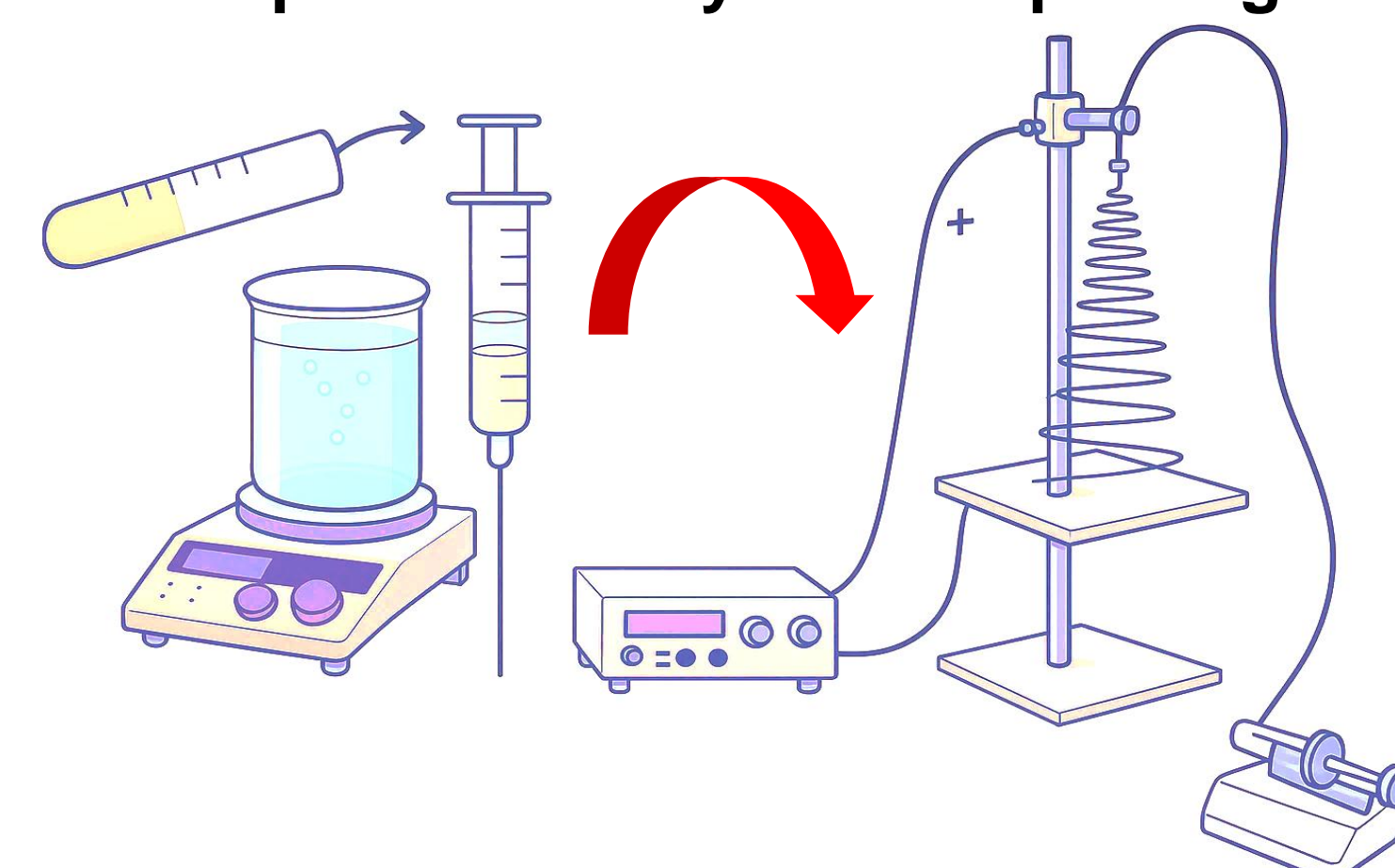
This study aims to develop a functional nanofiber mat incorporating Hacıhaliloğlu apricot through the electrospinning technique. The objective is to obtain an innovative dietary supplement that preserves the bioactive components of apricots while providing a high surface area and controlled release properties. This approach provides a natural solution that supports digestive health while transforming the potential of local apricots into a value-added product.

Materials and Methods

Preparation of lyophilized apricot samples



Fiber production by electrospinning method



Nanofibers

Figure.1 Schematic illustration of the fiber production process.

Results

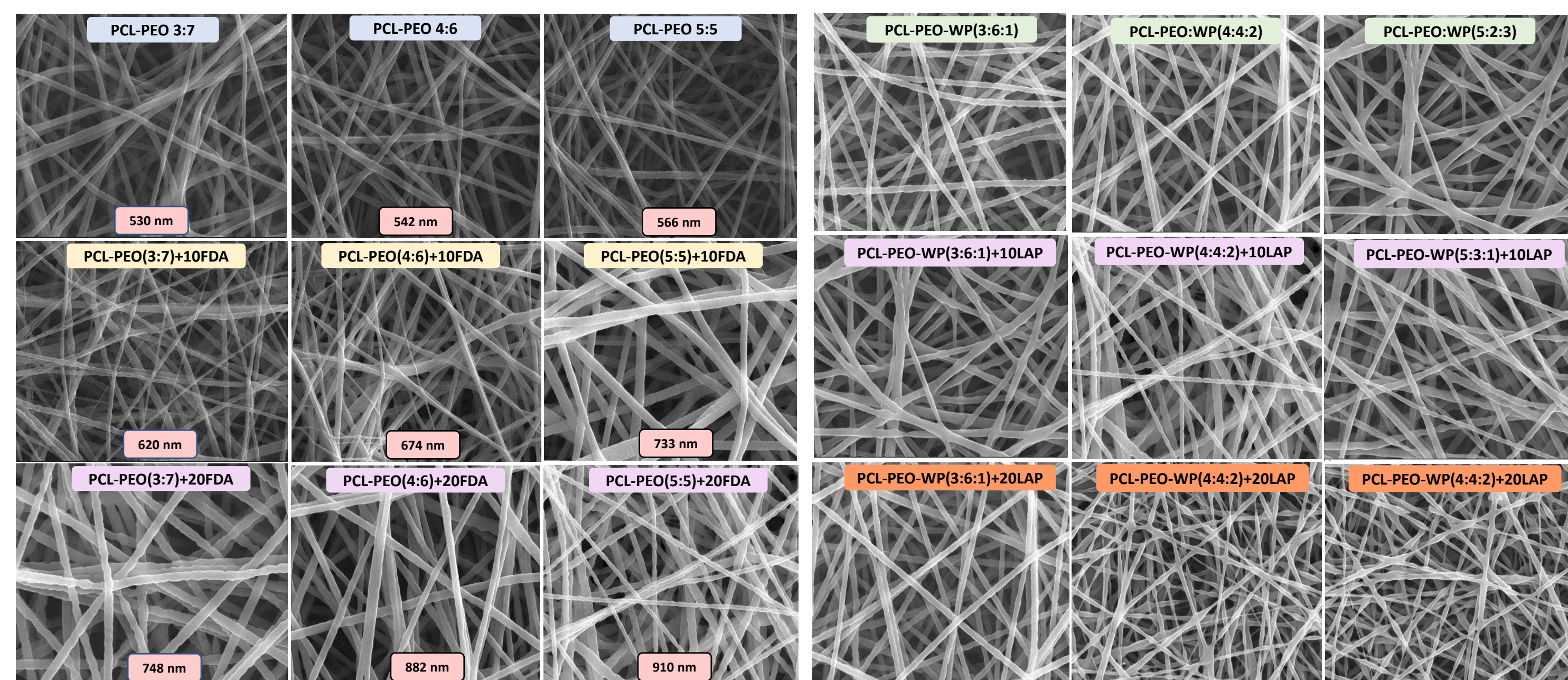


Figure.2 SEM images of fibers with different compositions and conditions.

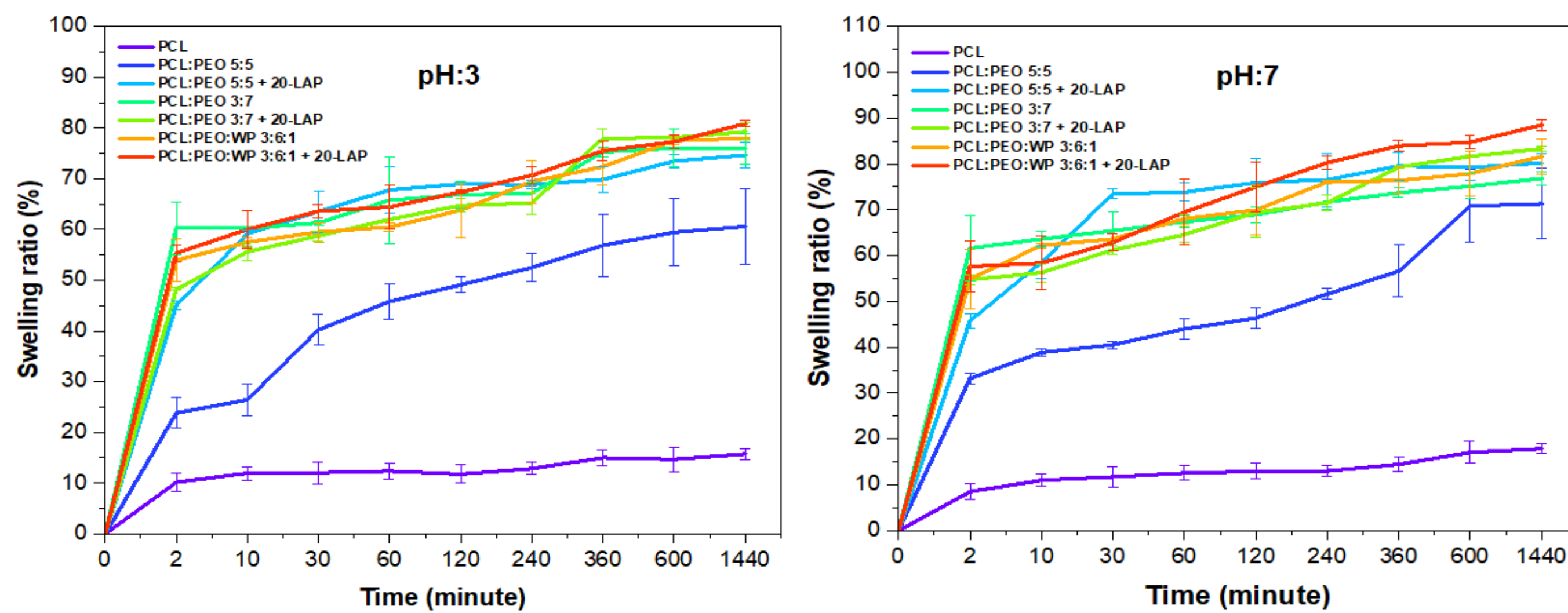


Figure.3 Swelling behavior of various electrospun fibers under different pH conditions (pH 3 and pH 7).

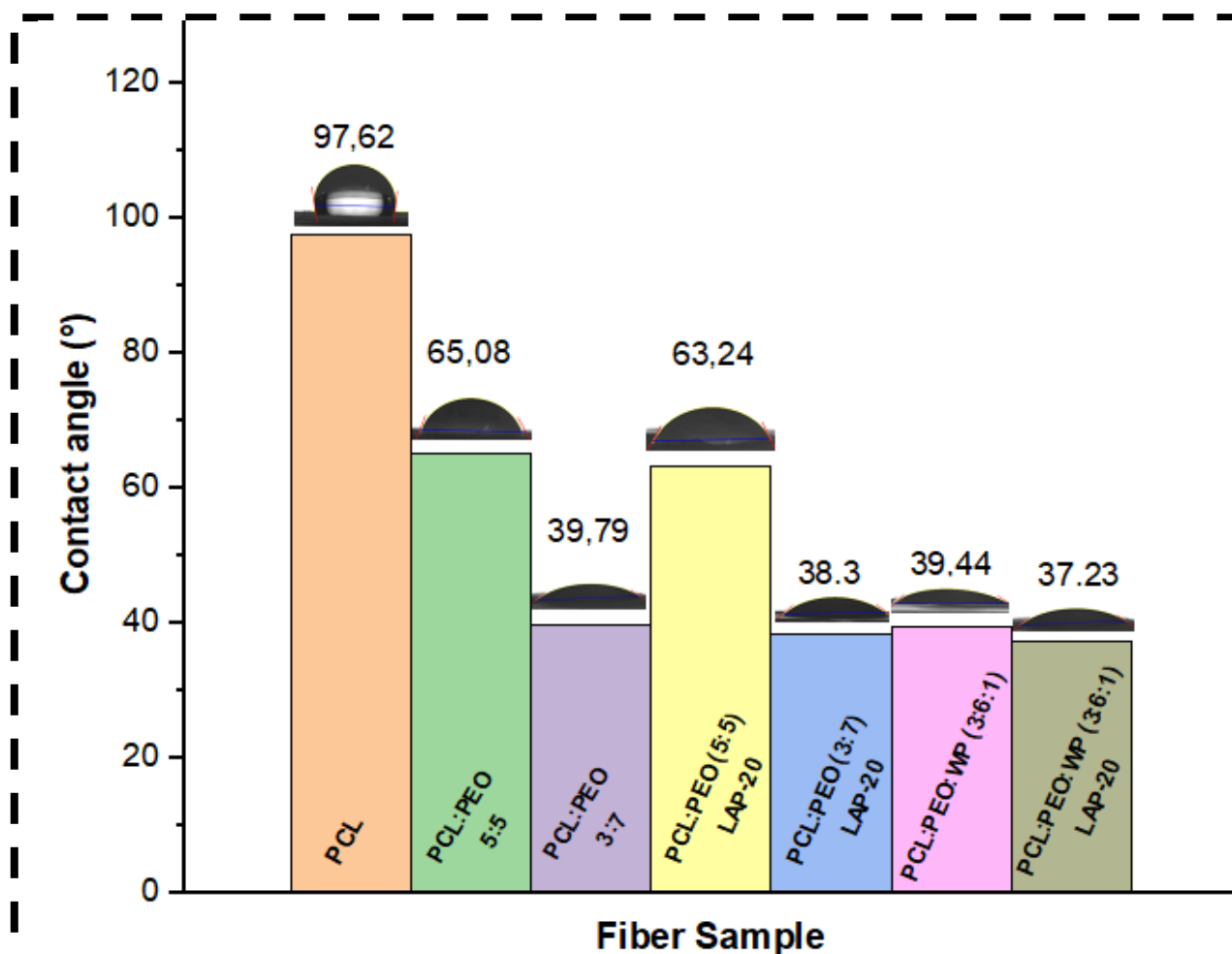


Figure.4 Water contact angle of electrospun fibers.

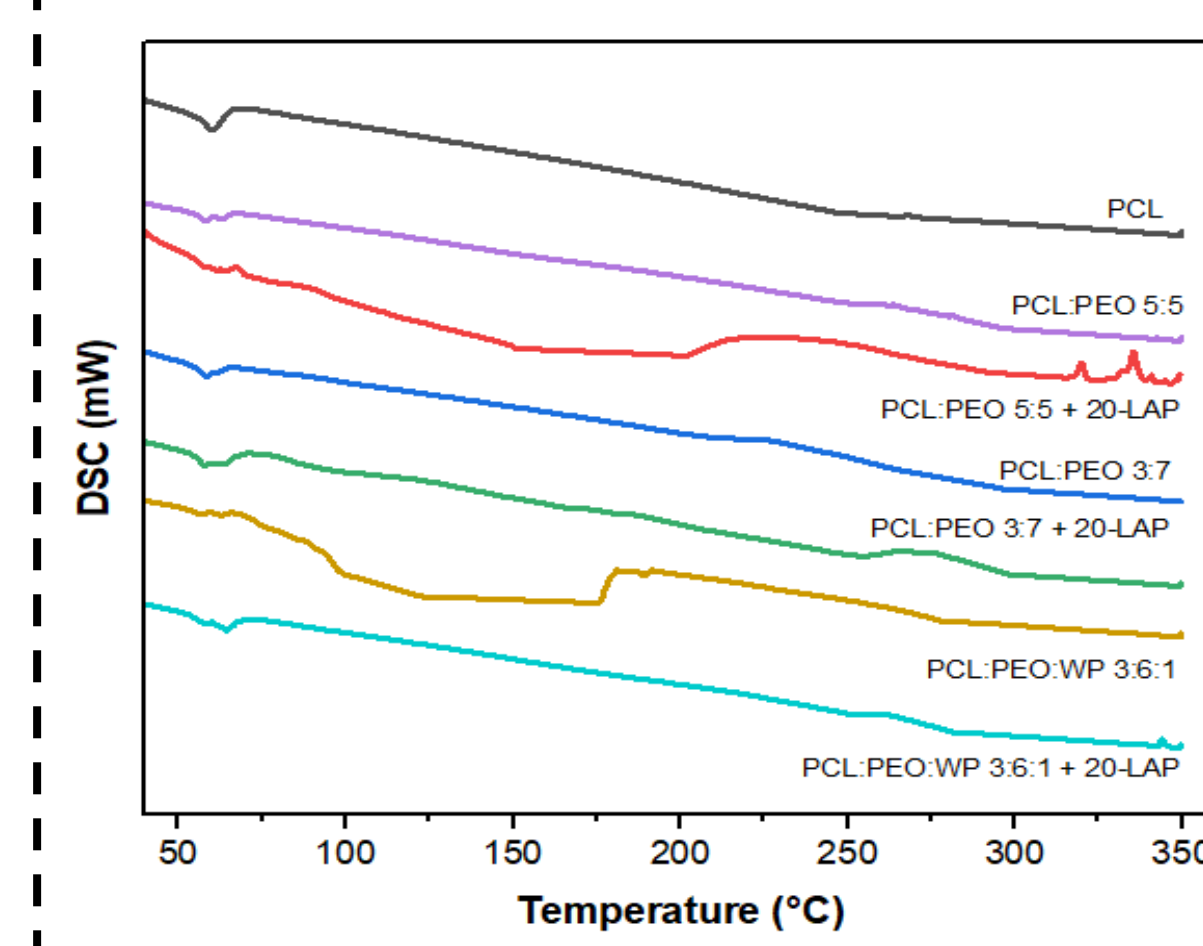


Figure.5 DSC results of electrospun fibers.

Conclusions

- ✓ SEM analysis revealed that randomly oriented fibers were morphologically smooth and bead-free, with diameters ranging between 300–600 nm and 1–1.5 μm.
- ✓ Swelling tests showed that PCL fibers exhibited the lowest swelling ratios in all fibers, with approximately 15% and 17% in pH:3 and pH:7 environments, respectively. In contrast, LAP-loaded fibers displayed markedly higher swelling values, reaching 82% at pH:3 and 88% at pH:7.
- ✓ The water contact angle of pure PCL fibers was measured at 97%. However, with the addition of PEO, LAP, and WP, the value decreased significantly to ~37%, confirming a remarkable improvement in surface hydrophilicity.
- ✓ DSC analysis indicated that the incorporation of PEO and LAP into PCL fibers reduced crystallinity, decreased the melting temperature, and promoted the formation of a more amorphous structural configuration.

References

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