Development of biphasic drug delivery PVA/propolis electrospun nanofibres

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Introduction

The integration of nanotechnology into biomedical applications is called "nanomedicine". Nanomedicine has the ability to change properties of materials at the molecular and atomic level [1]. Numerous methods have been employed to generate biomaterials in nanoscales. One such method is electrospinning which is regarded as a versatile, inexpensive and simple methodology to fabricate materials with sizes in the nanometre range [2]. Different drug release profiles: fast release, sustainable release, biphasic release (i.e. quick/slow system, slow/quick system), triphasic release can be tailored using electrospun nanofibres. This study aims to fabricate polyvinyl alcohol (PVA) hydrogel nanofibres encapsulated with propolis extract which can introduce a biphasic drug delivery system.

Methods

- Propolis extract is prepared by grounding the raw propolis to a fine powder and dissolved in 70% ethanol at 70 °C using an ultrasonic bath [3].

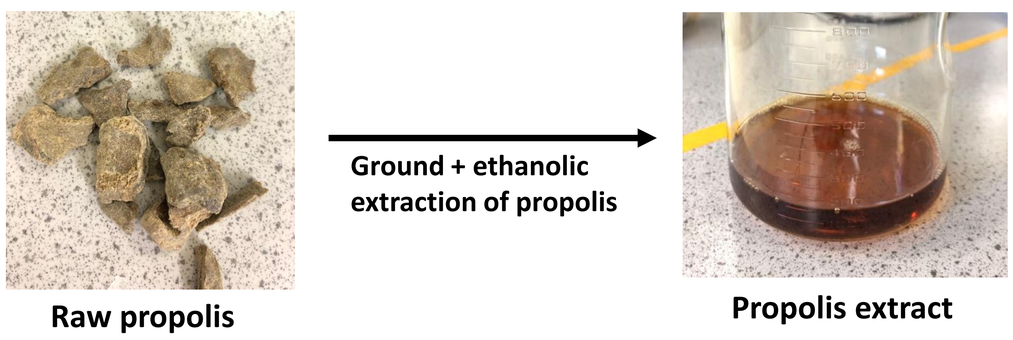

Figure 1: *Ethanolic extraction of propolis*

- The PVA/propolis nanofibres were prepared using electrospinning technique. The nanofibres membrane was collected after 8 hours of electrospinning.

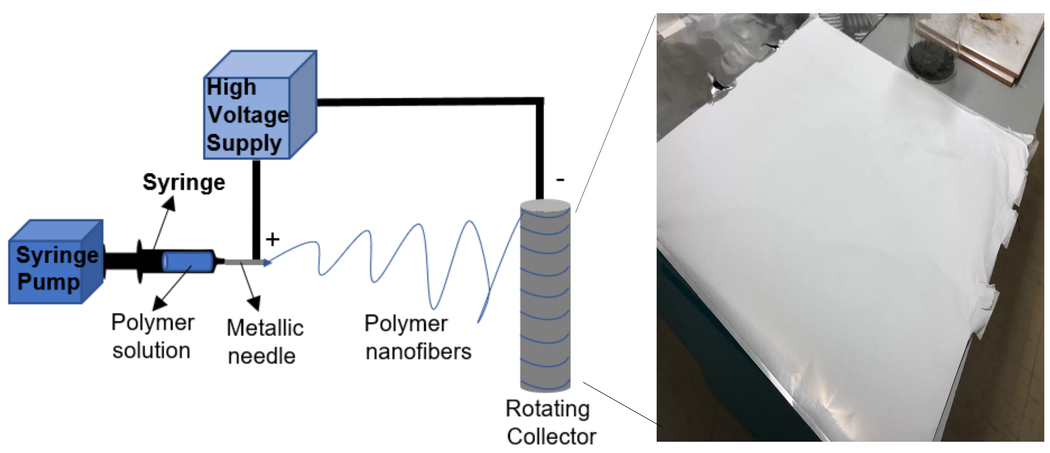

Figure 2: *Schematic diagram of the electrospinning*

Discussion

- The PVA/propolis nanofibres were randomly aligned and the diameter of nanofibres were not uniform **(Figure 3)**. A decrease in average diameter of nanofibres occurred with increased propolis concentration.

- The PVA/propolis nanofibres were very hydrophilic as seen in **Figure 4**. The reduced water contact angle, indicated an increase of hydrophilicity in the PVA/propolis nanofibres and good wettability.

- The amount of PVA crystallites decreased as the hydrophilicity increased **(Figure 4)**. This resulted in a decrease of tensile strength with the increase of propolis concentration.

- A biphasic drug delivery profile was obtained **(Figure 5)**. The nanofibre membranes have an initial burst release in 30 minutes and followed by a constant drug release up to 2-6 hours.

- The drug encapsulation efficacy was in the range of 80%-91%.

Results

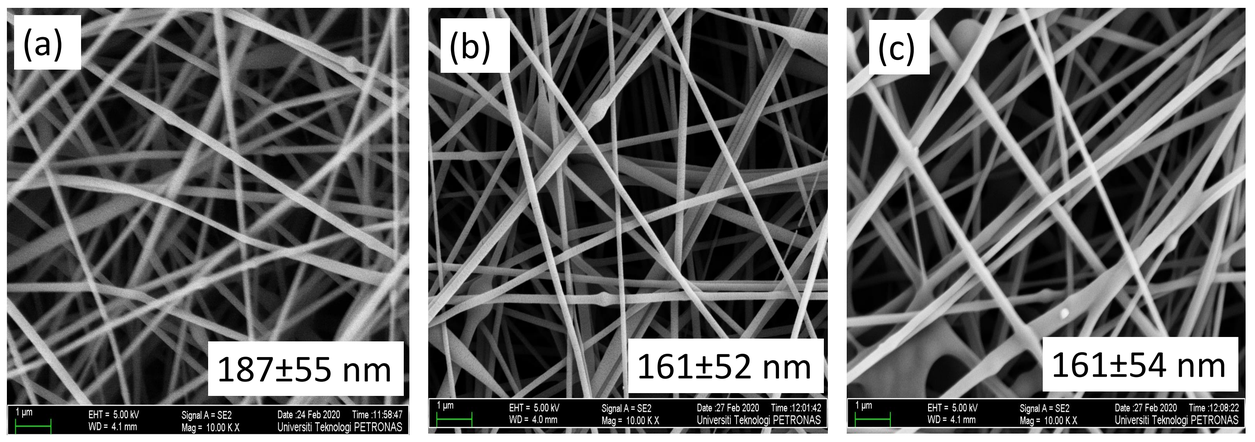

Figure 3: *SEM micrographs of (a) 5%, (b) 10%, (c) 15% propolis contained PVA nanofibres.*

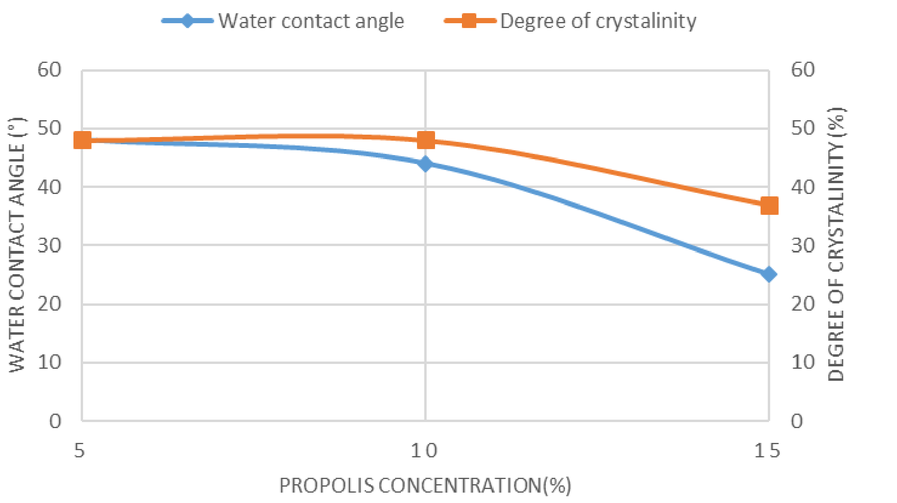

Figure 4: *Water contact angle of PVA/propolis nanofibres.*

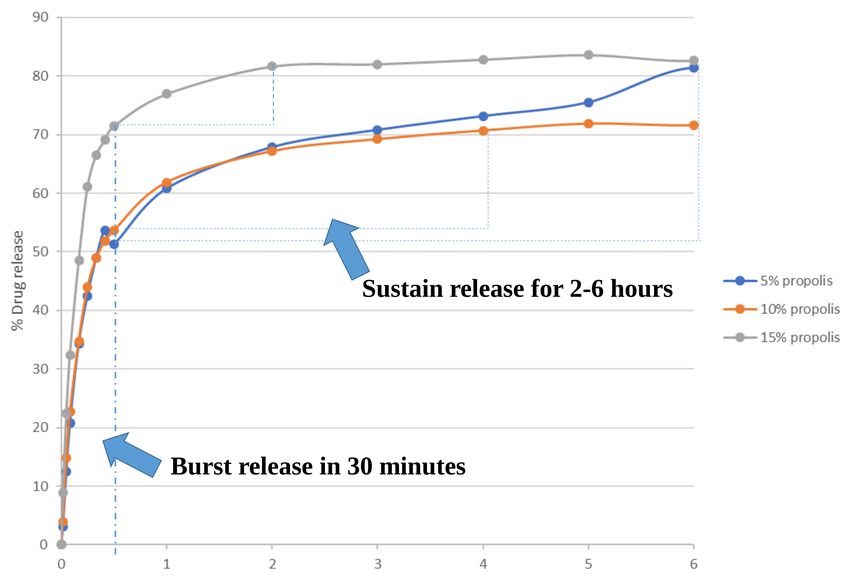

Figure 5: Drug delivery profile *of PVA/propolis nanofibres.*

Conclusion

- The PVA/propolis nanofibres viability as a biphasic drug delivery system.

- These quick/slow release system is of potential to use in therapeutic applicationsn, providing the shortest time possible to delivery the drug to the target area.

References

1. Ramakrishna *et. al.*, An Introduction to Electrospinning and nanofibres. New Jersey: World Scientific, 2005.
2. Chee *et al.*, Electrospun hydrogels composites for bone tissue engineering. Elsevier Inc., 2018.
3. De lima et al., J of Pharm. Sci., 105(3):pp. 1248-1257, 2016.