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Nanoparticles production from microfluidics: The Elixir?

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INTRODUCTION
- Nanoparticles offer improved performance of active ingredients, stability, controlled delivery, increase comfort and reduce the overall drug content and cost.
- Nanoparticles are helpful in drug delivery in cases where drugs have poor water solubility.
- Drugs such as Hydrocortisone (HC) pose a problem, because the right amount of unchanged drug needs to reach the targeted cells.

AIM:
- Produce hydrocortisone nanoparticles using laboratory-fabricated microfluidic devices and investigate a variety of device parameters on nanoparticle properties.
- Study the effect of stabilisers and polymer on the produced nanoparticles.

EXPERIMENTAL SET UP
Experiments were carried out in fabricated glass capillary co-flow microfluidic devices, to synthesise hydrocortisone nanoparticles. Figures 1 and 2 are the schematic diagrams of the co-flow microfluidic device and the experimental set-up of the synthesis of the hydrocortisone nanoparticles respectively while Figure 3 is the flow diagram of the steps taken in producing the nanoparticles.

CHARACTERISATION
DSC thermal profile of processed and unpreserved HC were analysed, to show the changes in the crystallinity of the drug. A sharp peak observed in Figure 7 corresponds to the melting point of the pure unpreserved sample. This peak shifted for the processed drug, which indicates the encapsulation of the drug in the polymer and stabilisers. This was corroborated by the XRPD analysis carried out on the processed and unpreserved samples (Figure 8A and 8B).

CONCLUSION
- Nozzle diameter affects the size of nanoparticles produced.
- HPMC (and other stabilisers) has a major effect on the size and stability of nanoparticles produced.

FUTURE WORK
- Production and encapsulation of nanoparticles using counter-current devices and other types of nanoparticles and study of the release rates of drugs encapsulated.
- Synthesis of Liposomes and Niosomes using both Dispersion Cell and 3D-printed Microfluidic devices to encapsulate drugs.

REFERENCES

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