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Curcumin loaded microspheres for the management of inflammatory bowel disease

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Inflammatory bowel disease (IBD) is a chronic relapsing condition, comprised of Crohn's disease and ulcerative colitis and affects approximately 6.8 million people globally [(1)]. Nutraceuticals such as curcumin have been documented as having antioxidant, and anti-inflammatory properties, and may potentially be beneficial in the management of IBD [(2)]. However, there are limited *in vivo* studies with mixed results, which may be due to challenges related to the poor systemic bioavailability [(3,4)]. Research has shown that microspheres have the potential to act as a carrier for drugs and other compounds and their unique properties may help alleviate challenges such as bioavailability and solubility in addition to delivering these compounds to targeted sites [(5)]. Therefore, the aim of this study was to initially load curcumin into a suitable microsphere and determine its release. It is anticipated that this smart delivery system may be useful for the management of IBD. Poly lactic acid (PLA) / polyethylene glycol (PEG) microspheres were prepared by emulsion and solvent evaporation technique. Briefly, a solution of curcumin and PLA/PEG polymer in dichloromethane were steadily poured into a 2 wt% polyvinyl alcohol solution. The mixture was mechanically stirred using a magnetic flea for 6 hours (until organic solvent evaporated). The microspheres were then filtered from solution, dried and characterised. Curcumin release rate from microspheres was determined using phosphate buffer solution (PBS) and UV spectroscopy. Curcumin microspheres ranged in size from 45μm to greater than 180μm.

Polymer ratio affected the size and yield of microspheres, with 51% (75% PLA) and 15% (50% PLA) yield reported. Higher PEG concentration decreased the total yield of microspheres. The microspheres were optically viewed under light microscope at 10x magnification to determine the surface morphology. PLA/PEG microspheres were smooth, and elongated, whereas PLA microspheres were smooth and spherical. Average cumulative release of curcumin from 75% PLA and 50% PLA microspheres after 48 hours was 16% and 8%, respectively. The challenge with this research was incorporating the curcumin into a compatible carrier that would also allow for its subsequent release. PLA/PEG microspheres have the potential as a carrier for curcumin, thereby mitigating the poor solubility issue. PEG is a hydrophilic polymer which increases the degradation rate of the microspheres, thereby increasing the release of curcumin. Future work involving 'smart' hydrogel drug and nutrient delivery system when combined with the PLA/PEG microspheres has the potential to improve the treatment and management of IBD.

References

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