Effect of Type and Ratio of Solubilizing Polymer on Characteristics of Hot-Melt Extruded Orally Dissolving Films

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Purpose
This study investigated the effect of two solubilising polymers independently combined with a film-forming polymer on the mechanical properties and drug release rates of orally dissolving films (ODFs) prepared by hot melt extrusion.

Methods
A 2^3 factorial design was employed to study the effects of solubilising polymers, namely Kollidon® VA 64 or Soluplus®, on mechanical properties and drug release rates of chlorpheniramine (CHL) or indomethacin (IDM) loaded ODFs, by varying their ratios to a film-forming polymer (hydroxypropyl cellulose (HPC)), respectively. The polymer powder blends with 10%w/w drug load and 14%w/w triethyl citrate as plasticiser were extruded using hot-melt extrusion. The film extrudates were cut into appropriate sizes and shapes for post-extrusion analysis. The mechanical properties (tensile strength, Young’s modulus and percent elongation) were studied employing a texture analyser. The drug release rates were studied using a USP Apparatus 1 and HPLC analysis. Solid state characterisations were done utilizing thermal analysis, X-ray diffraction and polarising light microscopy techniques. Drug-polymer interactions were investigated using FT-IR spectroscopy.

Results
The factors impacting mechanical properties were the drug and the two-way interactions between drug and solubilising polymer. The factors impacting drug release rates were the drug, solubilising polymer and the two-way interactions between solubilising polymer and the ratio of solubilising polymer to film forming polymer. Both drugs exhibited plasticising effects on the polymer matrix and had higher film ductility and lower film stiffness than placebos. Kollidon® VA 64-containing films performed better in terms of drug release whereas Soluplus®-containing films had better mechanical properties. Infra-red spectroscopy suggests possible polymer-drug interaction between IDM and Soluplus® resulting in lower drug release rates. The drug release rate could be improved upon reduction in film thickness as well as by addition of sodium carbonate as an excipient.

No crystalline drug was detected in freshly-extruded films.

Conclusion
Mechanical properties were influenced by the drug and the two-way interactions between drug and solubilising polymer. Release rates were impacted by the drug and solubilising polymer. The drug release rates could be improved by decreasing film thickness as well addition of sodium carbonate in case of IDM films.