# Enhancing the bioavailability of hydrophobic drugs using hot melt extrusion

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## Abstract

Many existing drugs (as well as new revelations) in the pharmaceutical industry bear a distinct disadvantage in the sense that they are not water soluble, displaying low bioavailability values and consequently a reduced in-vitro effect. Hot melt extrusion (HME) is one technique currently being used to increase the solubility of hydrophobic compounds.

The current study examined the feasibility of enhancing the bioavailability of poorly soluble veterinary anthelmintics using melt extrusion. It was demonstrated that melt extrusion changed the morphology of the API, converting it from a crystalline (insoluble) to an amorphous (soluble) state. Subsequent dissolution trials demonstrated the concept dosage forms to greatly enhance the solubility of the API

## Introduction

Bioavailability can be defined as the portion of the drug that becomes available to the target tissue upon contact [1]. Within the general pharmaceutics industry, almost 40% of new drug discoveries, and approximately 30% of existing drugs are practically insoluble in water and display low levels of bioavailability[2]. Low bioavailability results in a large majority of the drug being excreted without conferring its therapeutic effect on the host. [2]

Table 1: Methods currently employed to increase the solubility of hydrophobic pharmaceutical compounds.

| Methods of increasing the solubility of hydrophilic API | Details |
|---|---|
| Micronization | Physical reduction in drug particle size by mechanical means. May reduce the efficacy of the drug through stress imposed. |
| Homogenization | Physical reduction in drug particle size by high pressure. May reduced the efficacy of the drug through stress imposed. |
| Hot Melt Extrusion | The process converts the drug from a crystalline to an amorphous form which is soluble in water. The process is continuous and has potential for high output. |

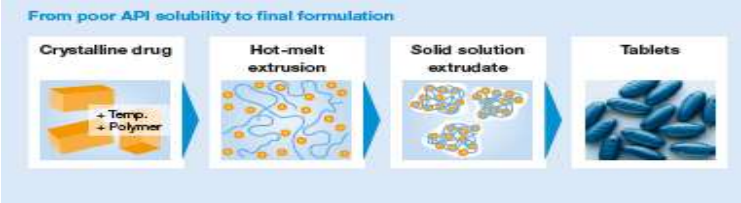


Figure 1: The incorporation of API into polymer blends using melt extrusion [3]

## Methods

Table 2: Techniques used in the current study

| Technique | Details |
|---|---|
| Hot melt extrusion | Method of manufacturing concept dosage form |
| DSC | Investigation of thermal characteristics of polymer/API/dosage form |
| TGA | Investigation of thermal degradation of polymer/API/dosage form |
| XRD | Investigation of morphology of API/API encapsulated in dosage form |
| Dissolution | Investigation of solubility of API/API encapsulated in dosage form |

## Results and Discussion

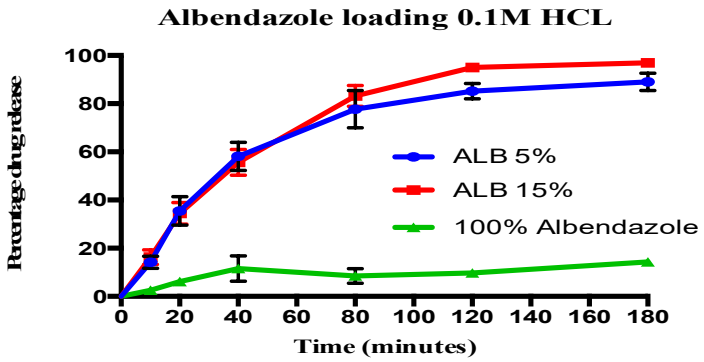


Figure 2: Solubility of virgin API (100% albendazole) and API encapsulated in dosage form (5 and 15%) in 0.1m HCL

## Conclusion and Future Work

The results of this study illustrate the suitability of a variety of polymers for the melt extrusion process, the enhancement in solubility of hydrophobic veterinary anthelmintics, and a potential continuous manufacturing process of a water soluble dosage form. Given the increasing need for the farming community to become more efficient, and expiration of patents-loss of revenue channels encountered by pharmaceutical companies, the results of this study illustrate a robust pharmaceutical grade solution of creating a novel, easy to administer dosage form of hydrophilic veterinary anthelmintic to both cattle and small animals.

## References

[1] Ketan T. Savjani, Anuradha K. Gajjar, and Jignasa K. Savjani, (2012) Drug Solubility: Importance and Enhancement Techniques. ISRN Pharmaceutics

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[3] Kolter, K., Karl, M., Nalawade, S. and Rottmann, N., (2010). Hot melt extrusion with BASF Pharma polymers, Extrusion Compendium

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