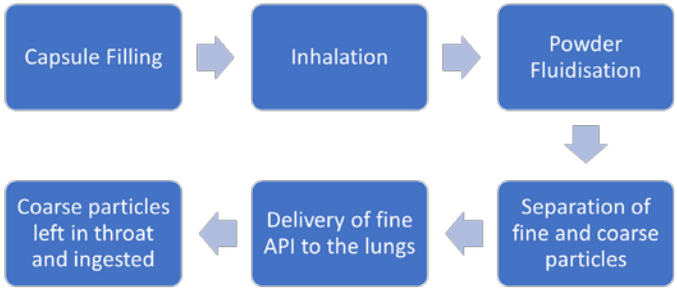
Dry Powder Inhalers (DPIs) are used to deliver a controlled dose of active pharmaceutical ingredient (API) to the deep lung. An excipient transfers the fine particles of the API from the capsule before being trapped in the throat and subsequently swallowed as the API continues to the lungs.

DPI performance will be dependent on several powder properties, including the response to air, permeability, inter-particular mechanical locking and friction. By measuring the rheological properties of DPI formulations, the properties of generic products can be matched to their branded counterparts.



It is also important that the capsule filling method, and the inhaler geometry and mechanism are similar as any changes to the production or operation techniques could result in variation in performance and efficacy.

PROCESS RELEVANT POWDER CHARACTERISATION

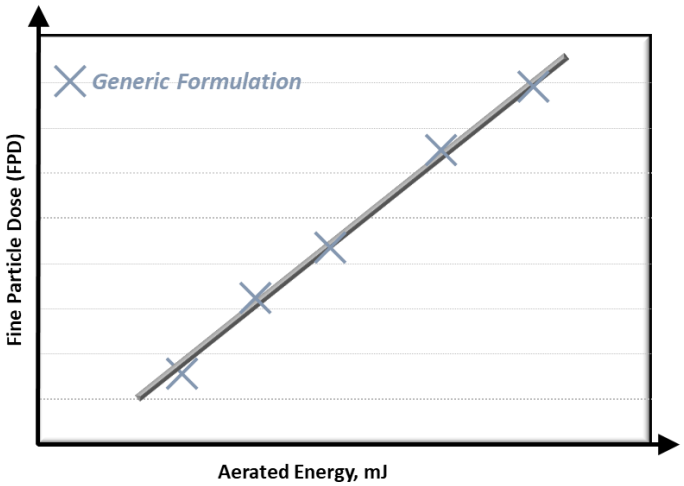


Figure 1: Fine Particle Dose (FPD) correlates with Aerated Energy.

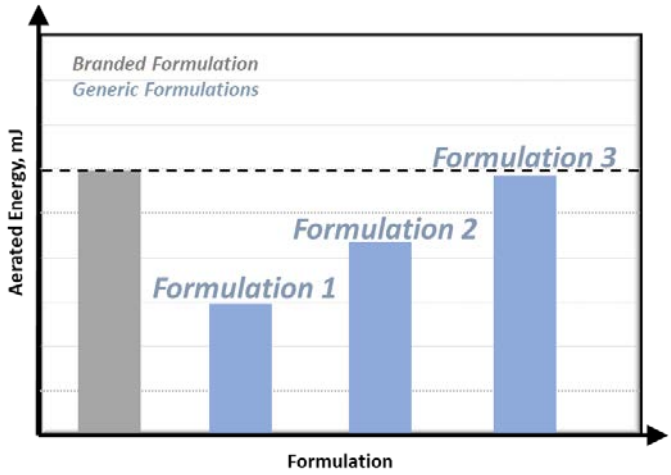


Figure 2: Matching Generic Formulation properties to Branded Formulation.

For DPIs, the quantity of powder that reaches the deep lung, the delivered dose, must be controlled. For effective transport of the API into the deep lung it is necessary that the powder disperses in the inhaled air stream. Aeration properties of the formulation, such as the powder's response to the introduction to air, the ability of the powder to fluidise and the cohesive forces between powder particles, are therefore vital.

In order to determine the Fine Particle Dose (FPD), i.e. mass of particles smaller than 5µm, it is typically necessary to conduct a range of extensive laboratory testing. However, in previous studies, FPD has been shown to exhibit a strong correlation with properties such as Aerated Energy (AE), Compressibility and Permeability [1,2]. AE is shown in Figure 1 shows an example of this for AE.

Therefore, when a new Generic Formulation is produced, the AE can be compared to that of the Branded Formulation, as shown in Figure 2. By adjusting the formulation as necessary, for example increasing fines content, the AE of the Generic Formulation can be matched to the Branded Formulation to ensure similar performance in the application.

By matching generic DPI formulations to branded products, manufacturers can be more confident of producing formulations which will have properties that are conducive to comparable performance, e.g. uniform dosage and efficient transport of API to the lungs.

For further information, please contact the Applications team on +44 (0)1684 851 551 or via support@freemantech.co.uk.

[1] Kinnunen *et al.*, AAPS PharmSciTec, 2014.
[2] Pitchayajittipong *et al.*, Int. J. Pharm., 2010.