# EVALUATION OF WATER/HYDROPHOBIC POWDER CONTACT ANGLE

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The wetting of a powdered material by water is fundamental in many processes in pharmacy. The classical measure of wettability is the cosine of the contact angle, $\theta$, which, for solid surfaces, can be measured geometrically. This approach is obviously not possible with fine particles unless they are agglomerated e.g. by compaction (Kossen & Heertjes, 1965). However, the surface formed may have properties different from those possessed by a single crystal of the material. Established methods in which the powder form is retained, involve measurement either of the rate of penetration of a fluid into a bed of the powder (Studebaker & Snow, 1955) or of the pressure required to prevent entry of fluid into the powder bed (Bartell & Osterhof, 1927). If water will not penetrate the bed, neither of these methods is applicable. The present work describes an adaptation of this type of technique, in which the penetration rates of mixtures of water and a miscible liquid, capable of wetting the powder, are measured. The derived values for the contact angles are then extrapolated to zero concentration of the wetting liquid.

To test the principle, initial experiments were undertaken with powder beds of lactose which could be wetted by both solvent (ethanol) and water. Contact angles for water and water/ethanol mixtures were derived from the rates of penetration relative to perfectly wetting solvents (e.g. hexane, toluene). The values of cos $\theta$ (0.810) obtained by extrapolation to zero ethanol concentration are the same order of magnitude as the experimentally determined value (0.840) and as the literature value (0.866) (Lerk & others, 1976).

This technique was then applied to a hydrophobic powder, griseofulvin, into a bed of which, water alone will not spontaneously penetrate. The extrapolated value of cos $\theta$ was dependent on the particle size, being -0.205 for particles of a volumetric mean diameter $d_{vm}$ = 8.35 μm and -0.167 for $d_{vm}$ = 57.7 μm. Neither of these values agree with that of 0.545 determined by geometric observations of drops on compacted griseofulvin surfaces (Zografi & Tam, 1976). This disagreement could arise from the inadequacy of the Washburn (1921) equation on which penetration methods are based, yet the negative value determined by solvent/water penetration is more in keeping with the observed hydrophobic properties of powdered griseofulvin.

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The authors wish to express their thanks to the I.C.I. (Pharmaceuticals) Ltd. for the research grant to D.T.C. and the sample of griseofulvin.