J. Pharm. Pharmacol. 1998, 50 (Supplement): 55

Electrostatic charge accumulation and decay in pharmaceutical polymer materials used in metered dose inhalers

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The electrostatic charge generated on pharmaceutical polymer materials during the manufacture and use of pharmaceutical pressurised metered dose inhalers (MDIs) may significantly affect the performance of such devices. Characterisation of the polymers by measurement of electrostatic charge and discharge properties would provide useful information for MDI manufacture and use, however such techniques have not been widely explored.

An experimental investigation has been undertaken of charge accumulation and decay on discs of selected device (actuator) materials used in MDIs using a modification of the technique described previously (Carter et al 1995).

Polymer discs (4.8mm diameter, mass 14-30mg) were cut from selected actuator devices and PVC powder (Corvic, ICI) samples (approximately 35mg) were compressed to produce flat faced compacts of 4.8mm diameter. All samples were cleaned and stored in closed containers (r.h. 0.8%) before electrostatic charging. Each sample was placed on an earthed steel substrate under a corona charging needle at a separation of 300μm and charged for 3 min at -1.1kV under ambient conditions. The charge on the sample was measured before and at selected time intervals after charging by transferring with an earthed instrument to a Faraday well connected to an electrometer (Keithley 610C).

The discs were categorised (Table 1) according to the magnitude of charge acquired from the corona and time taken to decay on an earthed substrate, to the charge before corona exposure. Category A discs acquired a low charge and showed rapid decay. Category B discs acquired an intermediate charge and showed rapid decay. Category C discs acquired a low charge and showed a slow decay. Category D discs acquired a low/intermediate charge and showed an intermediate charge decay time and Category E discs acquired an intermediate/high charge and showed slow decay.

Table 1. Mean charge values (% coefficient of variation) for discs (n=10)

Disc Sample	charge before corona (nC g^{-1})	charge after corona (nC g^{-1})	Time to decay (hours)	Category
Grey	-0.03 (131)	-4.6 (79)	1	A
PVC	-1.21 (91)	-13.2 (30)	2	B
Type 7	-0.06 (235)	-11.2 (82)	1	B
Black	-0.65 (27)	-6.9 (24)	24	C
White	-0.35 (67)	-7.4 (51)	24	C
Type 9	-0.98 (54)	-6.9 (26)	24	C
Red	-0.71 (59)	-4.8 (65)	4	D
Type 1	-1.73 (144)	-9.9 (18)	6	D
Blue	-0.99 (101)	-21.6 (18)	24	E
Brown	-0.86 (34)	-10.7 (28)	25	E
Type 3	-1.49 (35)	-10.4 (31)	40	E
Type 8	-1.33 (60)	-11.2 (36)	27	E

Generally these results demonstrate that the different polymer discs have different charge accumulation and decay properties. An increased understanding of the role of electrostatic charging in MDI technology may improve manufacture and use.

References

Carter, P.A. et al (1995) J. Pharm. Pharmacol. 47: 1066