

The Bipolar Nature of Charge Resident on a Variety of Pharmaceutical Aerosols

Mark O'Leary, Wamadeva Balachandran and Frank Chambers

School of Engineering and Design

Brunel University

Uxbridge, Middlesex UB8 3PH United Kingdom

Abstract:

The bipolar nature of the charge resident on a variety of pharmaceutical aerosols has been demonstrated. The implications of electrostatic deposition driven by charge resident on pharmaceutical aerosols within both the human airway and any plume generation and conditioning devices can only be explored with knowledge of the levels of individual droplet charges. Unless an aerosol has been deliberately charged it is unlikely to possess a unipolar charge distribution. Net charge measurement systems which are only capable of resolving the summed charge over an aerosol population should not be relied upon to provide data used to calculate levels of droplet charge as any aerosol bipolarity is lost as under-estimation. Electrostatic particle capture techniques have been used to obtain simultaneous positive and negative polarity electrical-mobility distributions from aerodynamically split aerosol streams. This data can be combined with a suitable size distribution to provide a true bipolar charge distribution, facilitating calculations regarding the level of charge on individual aerosol droplets. Both nebulised aerosols and pMDIs have been subject to this measurement technique and most have been shown to possess a significant level of bipolar charge. Utilising this methodology, the true contribution of electrostatic mechanisms to overall aerosol deposition can begin to be appreciated.