Study of Pendant Drop in Electric Field Generated by Electron Beam-Irradiated Hydroxyapatite

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Abstract. Electrostatic interactions play an important role in adsorption of proteins or bacteria on biomaterials. Thus, modification of surface potential can be used to regulate their adsorption. However, a proper understanding of this phenomenon is still lacking. Here we propose a method that can be used to evaluate the effect of modified surface potential on liquids and solutions. It is based on a droplet hanging from a needle (so called Pendant Drop) at a known distance from the modified surface. As the drop approaches the charged biomaterial surface, the electric field generated by the surface charge increases. Free charges or inner dipoles naturally present in the droplet are displaced or oriented, respectively, in the direction of the field. As a result, the upper droplet hemisphere is repelled from the charged surface, lower hemisphere is attracted to it, thus, the drop elongates. In sufficiently high homogeneous or non-homogeneous electric filed, the drop can be eventually torn into two equal subdroplets or detached from the needle, respectively. Moreover, thanks to the modified Laplace equation we can use the modified shape to calculate the value of the charge trapped in the dielectric sample. We demonstrate this measurement using dielectric biomaterial named hydroxyapatite. The pellets of hydroxyapatite were irradiated by electron beam of 30 kV and with electron dosages between 0.01uC/cm2 and 1.0uC/cm2. Behavior of deionized water droplet in proximity of the charged hydroxyapatite was studied and compared with electrowetting phenomena.

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