A dielectrophoresis-impedance method for protein detection and analysis

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Abstract

Dielectrophoresis (DEP) has increasingly been used for the assessment of the electrical properties of molecular scale objects including proteins, DNA, nanotubes and nanowires. However, whilst techniques have been developed for the electrical characterisation of frequency-dependent DEP response, biomolecular study is usually limited to observation using fluorescent markers, limiting its applicability as a characterisation tool. In this paper we present a label-free, impedance-based method of characterisation applied to the determination of the electrical properties of colloidal protein molecules, specifically Bovine Serum Albumin (BSA). By monitoring the impedance between electrodes as proteins collect, it is shown to be possible to observe multi-dispersion behaviour. A DEP dispersion exhibited at 400 kHz is attributable to the orientational dispersion of the molecule, whilst a second, higher-frequency dispersion is attributed to a Maxwell-Wagner type dispersion; changes in behaviour with medium conductivity suggest that this is strongly influenced by the electrical double layer surrounding the molecule. © 2017 Author(s).

Indexed keywords

Engineering controlled terms: Body fluids; Characterization; Dispersions; Electrophoresis; Molecules; Yarn

Bovine serum albumins; Electrical characterisation; Electrical double layers; Fluorescent markers; Frequency dependent; Higher frequencies; Impedance based methods; Protein molecules

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