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Control the aggregation of model amyloid insulin protein under ac-electric fields ZHONGLI ZHENG, BENXIN JING, Y. ELAINE ZHU, University of Notre Dame — In vitro experiments have been widely used to characterize the misfolding/unfolding pathway characteristic of amylodogenic proteins. Conversion from natively folded amyloidogenic proteins to oligomers via nucleation is the accepted path to fibril formation upon heating over a certain lag time period. In an alternative engineering approach to manipulate and control protein aggregation, we have investigated the aggregation kinetics of insulin, a well-established amyloid model protein, under applied ac-electric fields of varied ac-frequency and voltage at room temperature. Using fluorescence correlation spectroscopy and fluorescence imaging, we have observed that the insulin aggregation can occur at much shortened lag time under applied ac-electric fields, when a critical ac-voltage is exceeded. The strong dependence of lag time on ac-frequency over a narrow range of 500 Hz-5 kHz indicates the effect of ac-electroosmosis on the diffusion controlled process of insulin nucleation. Yet, no difference of conformational structure is detected with insulin under applied ac-fields, suggesting the equivalence of ac-polarization to the conventional thermal activation process for insulin aggregation.

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