Aggregation and Oligomerization Characterization of ß-lactoglobulin Protein by a Solid State Nanopore Sensor

Mitu Acharjee[1], Brad Ledden[2], Brian Thomas[2], Xianglan He[3], Jason Giurleo[3], Troy Messina[3], David Talaga[3], and Jiali Li[2]

[1]Affiliation not available
[2]University of Arkansas Fayetteville
[3]Rutgers The State University of New Jersey

March 23, 2023

Abstract

This work demonstrates protein aggregation and oligomerization can be evaluated by solid-state nanopore method. A silicon nitride nanopore sensor is used to characterize a model protein ß-lactoglobulin variant A (βLGa) amyloid formation and native-state oligomerization in close to biological solution condition at single molecule level. To verify the results obtained from nanopore measurements, atomic force microscopy (AFM) and dynamic light scattering (DLS) techniques are used to measure and calibrate the same βLGa protein samples incubated at different stages. Using the parameters measured by DLS, AFM, and by measuring linear and circular dsDNA molecules in the same nanopore, we estimate the length and diameter of amyloid fibrils, and the number of βLGa aggregation and the distribution of these species. Furthermore, as a demonstration of the nanopore technique, βLGa self-association and aggregation at pH 4.6 as a function of temperature are measured in 2M and 0.1M salt. Protein aggregation has been linked to many chronic and devastating neurodegenerative human diseases and is also strongly associated with aging. This study shows the advantages and limitations of evaluating protein aggregation by solid-state nanopore technology.

Hosted file

Aggregate-2023+BLG_JLi.docx available at https://authorea.com/users/598653/articles/631143-aggregation-and-oligomerization-characterization-of-%C3%9F-lactoglobulin-protein-by-a-solid-state-nanopore-sensor