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Effect of Nanodiamond Surfaces on tRNA Dynamics Studied by Neutron Scattering and MD Simulations GURPREET DHINDSA, DEBSINDHU BHOWMIK, Wayne State University, PANCHAPAKESAN GANESH, MONOJOY GOSWAMI, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, VADYM N. MOCHALIN, Drexel University, HUGH O'NEILL, Biology and Soft Matter Division, Oak Ridge National Laboratory, USA, YURY GOGOTSI, Drexel University, EUGENE MAMONTOV, SNS OakRidge National Laboratory, USA, XIANG QIANG CHU, Wayne State University — Nanodiamond (ND) inherits most of the superior properties of bulk diamond and delivers them at the nanoscale. ND is non-toxic and possesses excellent mechanical and optical properties with large surface area and surface functionality. ND mixed with biomolecules can be a good platform for drug delivery. Here we demonstrate the adsorption of tRNA on the ND surface and investigate the change in the tRNA dynamics using neutron scattering technique and molecular dynamics (MD) Simulations. We compare the dynamics of hydrated tRNA on ND surfaces with that of freestanding hydrated tRNA molecules and dry tRNA on ND surfaces. Both experiments and simulations show that the relaxational dynamics of tRNA on ND surface is faster than that of the freestanding tRNA molecules and dry tRNA on ND surfaces. Our results suggest that the tRNA on the ND surfaces has fewer hydration water molecules on it due to the water adsorption on the ND hydrophilic surface. Therefore fewer hydrogen bonds formed on its surface results in the tRNA faster motion. The MD simulations also show a "caged" dynamics of the water molecules adsorbed on the ND surfaces.

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