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Interactions and reactivity of nucleic acids and nucleotides with alumino-silicate nanotubular-structure

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Studies on the adsorption of nucleic acids and nucleotides by natural minerals such as clay minerals address a wide range of issues from the biochemical evolution of the earth and the origin of life, anti-bioresistance, gene transfer in ecosystems, etc (Yu et al., 2013). The interest of these studies lies in the high surface area and reactivity of these clay minerals. More recently, many works focused on other types of fine and reactive particles, namely nanoparticles, in particular with regard to the vectorisation of active principles. Indeed, quantum confinement, structural defects, and sub-coordination of surface atoms exacerbate or generate new physical and chemical properties at such a nanoscale. Nevertheless, the impacts of these surface properties in interaction with nucleic acids and nucleotides is still poorly understood.

There is a family of nanoparticles of natural origin, with a chemical composition close to that of clays, but with a tubular structure. Those alumino-silicate found mainly in volcanic soils are formed by a layer of aluminium oxyhydroxide on the outside of the tube and silicates in the inner layer.

The project addressed the mechanisms of nucleotide and nucleoside adsorption onto the nano-tubular alumino-silicate particles. A combination of chemical, separation techniques and spectroscopic tools was used to quantify the amount of adsorbed monomers and to determine the atomic structure of the surface complexes. The results enabled to decipher the role of the phosphate groups and to compare DNA and RNA series related to their adsorption mechanisms.

References:

Yu W. H., Li N., Tong D. S., Zhou C. H., Lin C. X. and Xu C. Y. (2013) Adsorption of proteins and nucleic acids on clay minerals and their interactions: A review. Appl. Clay Sci. 80–81, 443–452.

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