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Stability of the D-Ribose-Na^+Montmorillonite and DL-Glyceraldehyde-Na^+Montmorillonite Systems in Aqueous Suspension Under Gamma Radiation Fields at pH 7 and 92°C: Implications in Chemical Evolution

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In chemical evolution, the stability of bio-organic compounds in the surrounding geological environment is as important as their syntheses, especially in the presence of an external energy source (e.g. ionizing radiation, thermal energy, etc.). Therefore, there must be a balance between the synthesis and the decomposition of these molecules to have them for other prebiotic processes[1]. Aldoses, in addition to their biochemical interest as energetic molecules or as structural molecules in biological systems, are also of paramount importance in the context of chemical evolution. The synthesis and preservation of aldoses under prebiotic conditions is a fundamental step for the abiotic formation of the nucleotides that make up the nucleic acids (e.g. RNA where the ribose is the structural aldose)[2]. A more plausible geological scenario should involve the participation of a multiphase system, formed by the presence solids/liquids or liquid/ gases interphases[3, 4]. Several solid surfaces may have been relevant in this context: sulfides, carbonates, and clays. In this work, we highlight the possible role of clay minerals due to their physicochemical properties, their broad geological distribution. The primary objective of this work is focused in studying the stability of two aldoses adsorbed in a clay mineral: D-Ribose-Na^+Montmorillonite and DL-Gliceraldehide-Na^+Montmorillonite suspensions at pH 7 and 92°C under a high radiation field. To this end, the radiolysis of both systems was carried out by exposing them to a different irradiation dose and ratios aldose-clay. The analysis of these systems was performed by UV spectroscopy and liquid chromatography (HPLC) and HPLC-coupled to a mass spectroscopy.

Our results indicate that the aldose-clay systems are relatively stable under irradiation and the radiation-induced or thermal-induced reactions in these systems yield compounds of pre-biological importance.

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