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Molecular reactions of PAH fragments in astronomical environments irradiated by soft X-rays

Comprehending the origins of life in the universe has always been a matter of study. Therefore, offering valuable insights into the mechanisms driving the formation of precursors of prebiotic molecules could serve as a roadmap for guiding laboratory experiments aimed at synthesizing them under conditions that simulate those found in space. PAHs and its building blocks commonly act as precursors for complex organic molecules (COMs), as well as playing a significant role in the energy balance of the interstellar medium (ISM) and comprising approximately 10% of the elemental carbon found in the universe. Because the PAHs and its building blocks are ubiquitous and abundant in astronomical environments, this study aimed to investigate the impact of soft X-rays on the physicochemical properties of 2-methylanthracene, benzene, and deuterated benzene. To determine them, Time-Of-Flight Mass Spectrometry (MS-TOF) spectra were taken for each molecule in laboratory simulated astronomical conditions, using soft X-rays photons from a synchrotron radiation source in the Brazilian Synchrotron Light Laboratory (LNLS) and changing its irradiation energy around the inner-shell C1S resonance. The spectra were analyzed to establish the chemically active fragments of every molecule by using mathematical fittings and thermodynamical properties. Many of the fragments were classified as not active but the ones who were classified as chemically active showed potential involvement in the genesis of prebiotic molecules precursors. Now the study is being focused on finding applications for the protection of storage devices by proposing interactions with other species that have been found in astronomical environments.

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