

Solar UV synthesis of heterocyclic nitrogen compounds from N₂O and CO

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Abiotic process to synthesize building blocks of life (e.g., amino acids, nucleobases) is crucial for the origin of life and its early evolution. In the current knowledge of prebiotic chemistry, amino acids and nucleobases are considered to be produced through Strecker type reaction, that requires hydrogen cyanide (HCN). Alternative to HCN, nitrous oxide (N₂O) could be a second abundant nitrogen species next to N₂ in the primitive atmosphere [1], and could be converted into NH₃ and amino acids in a weakly reducing atmosphere [2]. In this work, we report further analysis of photochemical experiment by using Orbitrap MSMS coupled with UHPLC. The results demonstrated that UV irradiation to N₂O and CO atmosphere provided not only amino acids formation, but also heterocyclic nitrogen compounds such as hexamethylenetetramine (HMT), imidazole as well as pyrimidine including uracil. HMT is the most abundant product in the unhydrolyzed sample of UV irradiation of N₂O and CO, could be produced from formaldehyde and NH₃, and could be further converted into amino acids. We will also report the ongoing experiments that explore the role of HMT, as well as NH₃ - involving formose-type reaction in photochemical synthesis of amino acids

Reference

[1] Airapetian, V., Glöckner, A., Gronoff, G. et al. *Nature Geosci* 9, 452–455 (2016).

[2] Zang et al. *Astrobiology*. Apr 2022.387-398.