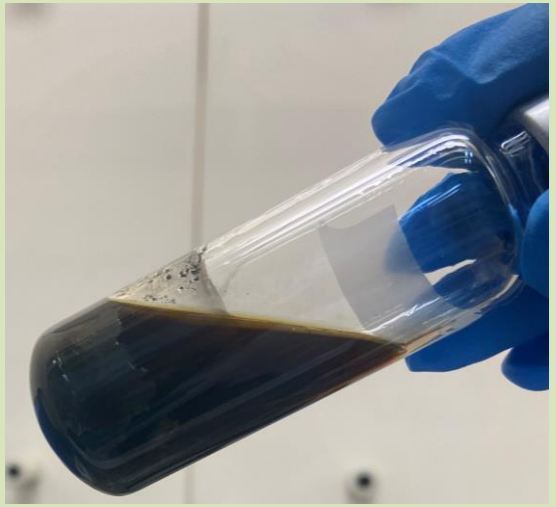
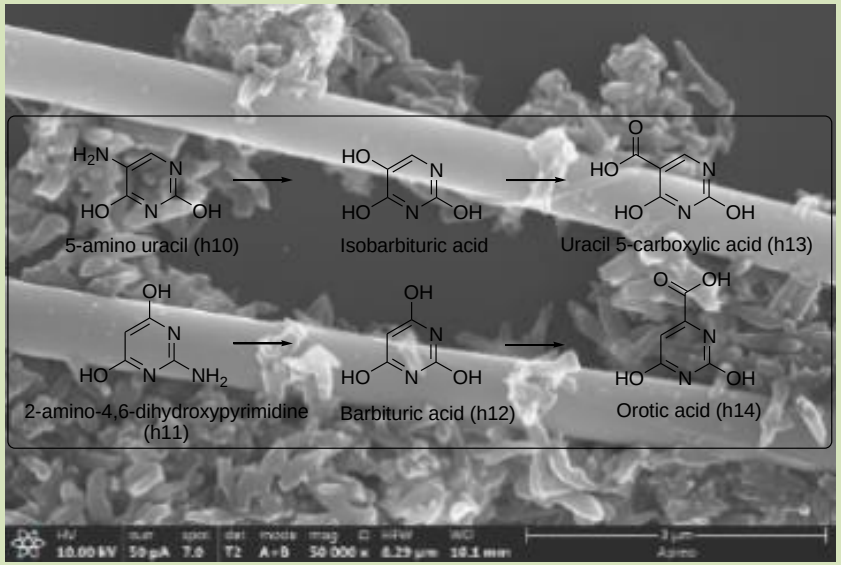
A dual perspective on the microwave-assisted synthesis of HCN polymers towards the chemical evolution and design of functional materials





In this paper, the first study on NH_4CN polymerization induced by microwave radiation is described, where a singular kinetic behaviour, especially when this reaction is conducted in the absence of air, is found. As a result, a complex conjugated N-heterocyclic polymer system is obtained, whose properties are very different, and even improved according to morphological features, characterized by their X-ray diffraction patterns and scanning electron microscopy analysis, with respect to those produced under conventional thermal treatment. In addition, a wide variety of relevant bioorganics have been identified, such as amino acids, nucleobases, co-factors, etc., from the synthetized NH_4CN polymers. These particular families of polymers are of high interest in the fields of astrobiology and prebiotic chemistry and, more recently, in the development of smart multifunctional materials. From an astrobiological perspective, microwave-driven syntheses may simulate hydrothermal environments, which are considered ideal niches for increasing organic molecular complexity, and eventually as scenarios for an origin of life. From an industrial point of view and for potential applications, a microwave irradiation process leads to a notable decrease in the reaction times, and tune the properties of these new series macromolecular systems. The characteristics found for these materials encourage the development of further systematic research on this alternative HCN polymerization.

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