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# The Reactivity of Metal Phosphites: Oxidative Rate Analysis

Abstract:

Phosphorous compounds are involved in many of the biomolecular processes deemed fundamental for life. DNA, ATP, and phospholipids are a few of the molecules where phosphates can be found in the body. Phosphates are geochemically characterized by their low solubility and poor reactivity. This has led to the investigation of reaction mechanisms that could lead to the formation of the phosphorous compounds found in organisms. The oxidation of phosphite into phosphate could be how phosphates were introduced to life, due to phosphites being more soluble and more reactive than phosphates. We will present the synthesis and oxidation reactivity of four metal phosphite compounds: calcium phosphite, magnesium phosphite, iron (II) phosphite, and iron (III) phosphite. Thermogravimetric analysis coupled with Fourier transform infrared spectroscopy, also known as TGIR, measures the thermal decomposition products of metal phosphite samples, and when performed with a slow ramp rate (~1°C/min) can be used to determine the activation energy of metal phosphite oxidation. This is performed to characterize the reactivity of the metal phosphites. Additionally, a tube furnace is used for the oxidative heat treatment of larger samples of metal phosphites for their analysis using different methods. FTIR and $^{31}$P NMR analysis confirm the structure and, indirectly, the oxidative state of the phosphorous compound. Characterizing the oxidative reactivity of metal phosphites will improve the parameters used in geochemical models of the early Earth and can help determine their plausibility as a source of phosphorus for prebiotic chemistry and the origin of life.

Keywords: oxidation, metal phosphites, TGIR, NMR, FTIR, organophosphates, reactivity