

## Effects of Temperature and Organic Acids on The Formation of Struvite via Wet Precipitation

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Struvite is an important mineral in different fields of sciences and industries. Struvite precipitation is commonly used for one of solutions for a treatment of wastewater contaminated by phosphate and nitrate. In addition, struvite is of great interest in a medical science because it is often found in kidneys related to urinary systems including many organics. Nevertheless, physicochemical properties such as crystallinity, morphology, and solubility of struvite formed under different conditions are not clearly understood yet. Therefore, it is important to understand effects of different factors such as temperature and organics on the formation and behavior of struvite under different environments.

A series of magnesium phosphates was synthesized under different conditions with a wide range of synthetic and drying temperature 7–60 °C, and in the presence of organic acids such as citric, glutamic, and aspartic acids. Changes in the formation of struvite were investigated using microscopic and spectroscopic analyses. From XRD and FTIR, it is found that struvite is only formed below 30 °C regardless of the presence of organic acids. It is also found that there is a reverse relationship between crystallinity of the synthesized struvite and temperature. TGA results show that struvite is transformed to other magnesium phosphates at a range of 60–150 °C with the heating rate, 10 °C/min. This phase transformation is also observed when struvite is dried at various temperatures for 24 hrs in oven, indicative of kinetically thermal decomposition of struvite. In SEM, rod-like and prismatic shapes are dominantly shown as struvite morphology under all experimental conditions. The aspect ratios of the struvite crystals in size are changed in presence of organic acids significantly. For struvite crystals formed in the presence of organic acids, crystal size increases dramatically two to three times with 30–60 µm in length. The aspect ratio of the crystals formed in presence of glutamic or aspartic acids does not change, but in presence of citric acid the ratio decreases dramatically. Our results demonstrate that struvite is significantly sensitive to temperature and the presence of organics.