Microorganisms that utilize inositol phosphates in the environment

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Phytic acid – *myo* inositol hexa*kis*phosphate – is the main storage form of P in plants, accounting for between 70 and 80% of the total P in the seeds of cereal and legume crops. Intensive agricultural operations, such as pig and poultry feedlots, use grain as the primary source of macro and micronutrients. Monogastric animals however, are unable to degrade phytate and 95% is excreted directly into the manure. Additionally, passage through the animal's gastrointestinal tract leads directly to a number of nutritional problems; for example, complexation of the compound with metals such as iron can lead to anemia, while complexation with proteins can inhibit protein digestion.

Manure from intensive agricultural operations is commonly composted and then used as a crop fertilizer. Over-application of P is typical and the phytate in the manure is not bioavailable to most plants directly. Excess P loading from these non-point pollution sources into freshwater bodies via erosion and surface runoff causes eutrophication. Algal blooms (some harmful), anoxia, and catastrophic fish kills are all hallmarks of such excess nutrient addition.

The hydrolysis of phytate to phosphate and inositol (or to inositol monophosphate) is achieved enzymatically by phytase. Organisms producing phytase have been obtained from such diverse locations as soil, cattle rumen, cattle shed floors, soybean mash, seawater, culture collection repositories, and plant seeds, which suggests that the ability to degrade phytate might be widely distributed in a variety of ecosystems. The described organisms range from common soil (for example, *Pseudomonas* spp., *Bacillus subtilis*, and *Klebsiella* spp.) and anaerobic (for example, *Escherichia coli* and *Mitsuokella* spp.) bacteria, to fungi (for example, *Aspergillus* spp. and *Penicillium* spp.) and plants (for example, barley and wheat). No study, however, has investigated the prevalence of phytate-degrading organisms across an ecological gradient, and monogastric farms, which produce an abundance of manure-derived phytate, have not been used as a potential source of microbes that can degrade the compound.

Soil and water strata extend through several redox conditions, which give rise to unique ecological societies. In this study, a spatial transect of a poultry manure-enriched region in the Chesapeake Bay, provides samples from which concurrent degradation of phytate and thiosulfate occurs. Organisms from each sampling site were able to degrade phytate. *Pseudomonad*, *Arthrobacter*, *Staphylococcus*, and *Bacillus* species were identified and their phytate-degrading activity assessed. An exploration of the potential advantages exhibited by bacteria living in a thiosulfate lifestyle will be shared, along with preliminary characterization data from the phytase enzyme of a novel *Pseudomonad*, *Staphylococcus*, and *Arthrobacter*.