

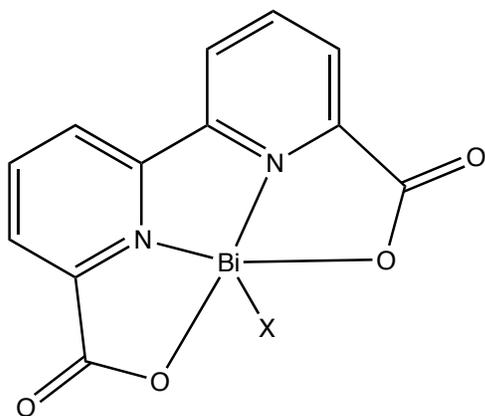
New Bismuth Catalysts for Organic Reactions in Aqueous solution

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Most reactions in organic chemistry are performed in organic solvents. Organic reactants are soluble in organic solvents. Many reagents used to promote these reactions are themselves only stable in organic solvents. Unfortunately, many widely used organic solvents are toxic and harmful for the environment. Developing “green” synthetic methodology, methodology that avoids the use of these toxic solvents is a valuable goal. This project will be a step toward that goal. We will explore the use of bismuth compounds as Lewis acids that catalyze the reactions of organic molecules in aqueous solution. Lewis acids are powerful tools to promote and direct the reactivity of organic molecules. Most Lewis acids, however, react with water and are thus not effective in an aqueous environment.

Some compounds containing bismuth, have been shown to be stable enough in aqueous environments to be used as catalysts in a limited range of organic reactions. Bismuth(III) precursors, in the presence of a tetradentate amino alcohol ligand, can catalyze some nucleophilic addition reactions. These known catalyst is limited for a variety of reasons. The ligands are not readily available and require a long and challenging synthesis to make. They have low solubility in water. They also have structural features that make them unsuitable for use in promoting the reactions of more complex organic molecules (like most drug candidates).



We hope to develop a new class of bismuth compounds, based on the structure shown, that will be stable in water, soluble in water, non-toxic, and yet also Lewis acidic enough to be effective catalysts. While the heavy elements surrounding bismuth on the periodic chart are quite toxic (lead, tin, antimony), bismuth itself is not at all toxic. In fact, it is the active ingredient in the over the counter medication for upset stomach known as Pepto-Bismol.