Abstract

Bismuth is not a common element to use in the chemical world. It is present in a small amount in nature, but can be easy obtained with the refining process of metals. Bismuth has some interesting features, like non-toxicity and good stability. This makes bismuth interesting for green chemistry.

There are already some organobismuth compounds known like alkylbismuth compounds and arylbismuth compounds. For this project the focus laid on the use of triarylbismuth compounds. Triarylbismuth compounds come in two ways: triarylbismuth(III) and triaryl(V)bismuth compounds. In the last two decade these compounds were used for some important synthetic organic reactions, like arylation and cross-coupling reactions.

Peptides are the building block of proteins. Proteins have important roles in living organism, but also in the medicinal chemistry. They can be used to make medicines. To create a peptide chain, several aminoacids are coupled together. This process comes with a problem: epimerisation. This problem was solved with the Cu(II) catalysed Chan-Lam reaction.

The aim of this project was to apply triarylbismuth(III) compounds as reagents in the Cu(II) catalysed Chan-Lam reaction for esterification of peptide esters with the main focus on avoiding epimerisation.

The first part was to synthesize different triarylbismuth(III) compounds. Only one had succeeded: triphenylbismuth with a yield of 69%. This synthesis was done by doing a transmetallation of phenylmagnesium bromide with bismuthchloride. The other triarylbismuth(III) compounds were tris(4-nitrophenyl)bismuth and tris(pentafluorophenyl)bismuth. These compounds couldn’t be synthesized. Tris(4-nitrophenyl)bismuth was tried with two different routes. The first one was, making 4-nitrophenylmagnesium bromide and then transmetallation with bismuth chloride. The second, was lithiation of 4-nitrophenyl bromide with n-BuLi and then transmetallation with bismuthchloride. There was only one attempt to make tris(pentafluorophenyl)bismuth: transmetallation of pentafluoromagnesium bromide with bismuthchloride.

The second part of the project was to apply triphenylbismuth as reagent in the Cu(II) catalysed Chan-Lam reaction. This reaction was a success. Five different dipeptide phenylesters could be made and without epimerisation. The yield were between 58%-73%.

The conclusion of this project was: triarylbismuth(III) compounds can be used as reagents in the Cu(II) catalyzed Chan-Lam for esterification of peptides esters. These reactions could be done without epimerisation.

For further research, the Cu(II) catalyzed Chan-Lam reaction must be further optimized for triarylbismuth(III) compounds as reagents.
An another try must be done to synthesize tris(4-nitrophenyl)bismuth and tris(pentafluorophenyl)bismuth. It is also interesting to make other triarylbismuth(III) bismuth compounds.
For the synthetic organic chemistry, it is maybe interesting to apply triarylbismuth compounds for other reactions, like the Ullman reaction.