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Production of alpha-aminophosphonates

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Abstract
The production of alpha-aminophosphonate compounds was carried out by homogeneous catalysis using acetic acid, aldehydes, benzyl carbamate and trimethylphosphite or triphenylphosphite. This synthesis process provided alpha-aminophosphonates 2a-f in chemical yields of 50-60%.

Key words:
alpha-aminophosphonate, benzyl carbamate, homogeneous catalysis.

Introduction

Alpha-aminophosphonates and alpha-aminophosphonic acids, Image 1, have a vast application in pharmaceuticals and agrochemicals since they are analogous to amino acids and have a wide range of biological activities, such as enzymatic inhibitors, antibiotics, antivirals, anticancer agents, antifungals, herbicides, insecticides, among others[1].

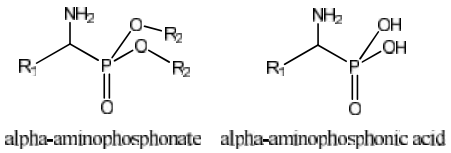

Image 1. Alpha-aminophosphonate and alpha-aminophosphonic acid structures.

Methodologies described in the literature usually use high temperatures, long reaction times and provide low chemical yields. Thus, it is necessary to develop a methodology which provides a simplified process with better chemical yields.
In this work, we report preliminary results of the synthesis of these compounds, using homogeneous catalysis via acetic acid, in which the reactive intermediate is generated in situ, for the production of alpha-aminophosphonates **2a-f** compounds with 50-60% yields.

Results and Discussion

The alpha-aminophosphonate compounds **2a-f**, Image 2, were synthesized from the mixture of the corresponding aldehyde - benzaldehyde (**1a**), 4-chlorobenzaldehyde (**1b**) and 2-methoxybenzaldehyde (**1c**) - by reacting with benzyl carbamate trimethyl- or triphenylphosphite, 5 equivalent of acetic acid, 0.2 g anhydrous magnesium at 80ºC for 4 hours, achieving 50-60% yields after purification, Chart 1.

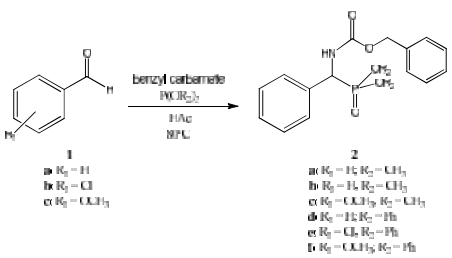

Image 2. Production process of alpha-aminophosphonates **2a-f**.

Chart 1. Production of alpha-aminophosphonates **2a-f** using acetic acid in homogeneous catalysis.

Aldehyde	Product	Isolated yield (%)
1a	**2a**	56
1b	**2b**	51
1c	**2c**	50
1a	**2d**	60
1b	**2e**	56
1c	**2f**	59

The chemical structures of the synthesized compounds were confirmed by ^{1}H and ^{31}P NMR and GC-MS analysis and compared with the literature[3]. To obtain the alpha-aminophosphonic acids, hydrolysis with concentrated hydrochloric acid under reflux is necessary.

Conclusions

The use of acetic acid as a catalyst promoted the synthesis of alpha-aminophosphonate compounds **2a-f** in yields of 50-60%, however, further studies for a better understanding of the process as well as amplification of the number of compounds will be performed to optimize the alpha-aminophosphonates and will be reported in the future.

Acknowledgement

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