

This article was downloaded by:

On: 28 January 2011

Access details: *Access Details: Free Access*

Publisher *Taylor & Francis*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: Mortimer House, 37-41 Mortimer Street, London W1T 3JH, UK



## Phosphorus, Sulfur, and Silicon and the Related Elements

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713618290>

### Studies on the Condensation of Highly Hindered $\alpha$ -Amino Methylphosphonates with $\beta$ -Triphenylgermyl Propionic Acid

Li-Juan Mao<sup>a</sup>; Ru-Yu Chen<sup>a</sup>

<sup>a</sup> Institute of Elemento—Organic Chemistry, Nankai University, Tianjin, P. R. China

**To cite this Article** Mao, Li-Juan and Chen, Ru-Yu(1996) 'Studies on the Condensation of Highly Hindered  $\alpha$ -Amino Methylphosphonates with  $\beta$ -Triphenylgermyl Propionic Acid', *Phosphorus, Sulfur, and Silicon and the Related Elements*, 111: 1, 166

**To link to this Article:** DOI: 10.1080/10426509608054795

**URL:** <http://dx.doi.org/10.1080/10426509608054795>

PLEASE SCROLL DOWN FOR ARTICLE

Full terms and conditions of use: <http://www.informaworld.com/terms-and-conditions-of-access.pdf>

This article may be used for research, teaching and private study purposes. Any substantial or systematic reproduction, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The accuracy of any instructions, formulae and drug doses should be independently verified with primary sources. The publisher shall not be liable for any loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## STUDIES ON THE CONDENSATION OF HIGHLY HINDERED $\alpha$ -AMINO METHYLPHOSPHONATES WITH $\beta$ -TRIPHENYLGERMANYL PROPIONIC ACID

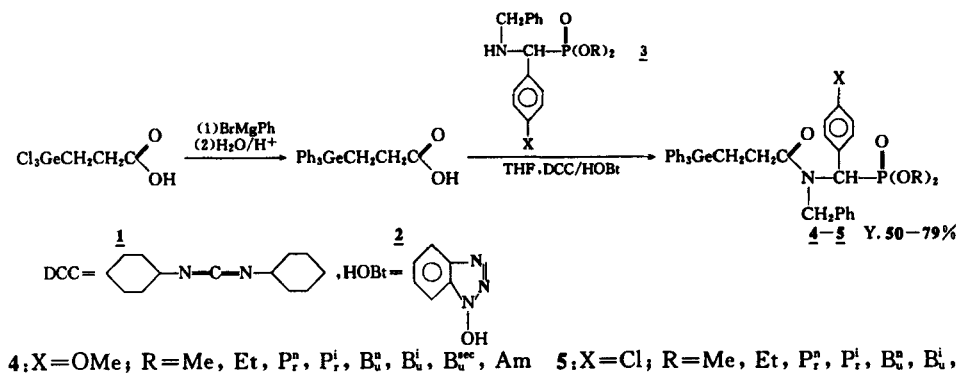
LI-JUAN MAO\* AND RU-YU CHEN

Institute of Elemento—Organic Chemistry, Nankai University Tianjin 300071, P. R. China

**Abstract** The condensation reaction of highly hindered  $\alpha$ -amino methylphosphonates with  $\beta$ -triphenylgermyl propionic acid was studied. The two novel series 4–5 were designed and synthesized in good yields. Preliminary bioassays showed that the compounds 4–5 exhibited significant antitumor activities both in vivo and in vitro.

**Key Words** Condensation reaction,  $\alpha$ -Amino methylphosphonate,  $\beta$ -Triphenylgermyl propionic acid, Antitumor activity

It has been previously reported that  $\alpha$ -Amino phosphonic acids and their derivatives show anticancer properties<sup>[1]</sup>. In order to look for novel antitumor drugs with high activities and low toxicities, two novel series 4 and 5 were designed and synthesized by the direct condensation of highly sterically hindered  $\alpha$ -aminophosphonates 3 with triphenylgermyl propionic acid 2 in good yields (see scheme 1).



Scheme 1

For synthesizing the compounds 4 and 5, different routes were attempted. Firstly, the conventional ways were tried, but they all failed. Only did the way shown in scheme I be quite successful for the hindered condensation due to both the effective catalysis of HOBt and the irreversible dehydration of DCC. The reaction rate of the condensation has much to do with R groups. The bulkier the R group, the slower the reaction rate was. When R group varied from Me to Am, the condensation would last from 6 to 15 days at room temperature. The preliminary bioassays indicated that most of 4 and 5 exhibited significant antitumor activities both in vivo and in vitro. One of them was indeed effective against sarcoma-180 in rats even compared to 5-fluorouracil (5-FU). It has been also found that the series 4 and 5 showed much higher antitumor activities than the corresponding aminophosphonates 3.  
[1] Wysocka-Skrzela B., Polish J. Chem. 56, 1573(1982).