

This article was downloaded by:

On: 30 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



Spectroscopy Letters

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title~content=t713597299>

LASER RAMAN AND INFRARED SPECTRA OF L-(-)-ETHYL LACTATE

Hao Su-E^a; Jin Chan^a

^a Department of Applied Chemistry, Harbin Institute of Technology, Harbin, P.R. China

Online publication date: 31 May 2001

To cite this Article Su-E, Hao and Chan, Jin(2001) 'LASER RAMAN AND INFRARED SPECTRA OF L-(-)-ETHYL LACTATE', *Spectroscopy Letters*, 34: 3, 371 — 374

To link to this Article: DOI: 10.1081/SL-100002292

URL: <http://dx.doi.org/10.1081/SL-100002292>

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.

LASER RAMAN AND INFRARED SPECTRA OF L-(-)-ETHYL LACTATE

Hao Su-E and Jin Chan

Department of Applied Chemistry, Harbin Institute of
Technology, Harbin, 150001, P.R. China

ABSTRACT

A new method for synthesizing L-(-)-ethyl lactate which is an important intermediates of R-phenoxypropionate herbicides catalyzed by AlCl_3 is described. The structure of the synthetic L-(-)-ethyl lactate is studied by using Raman and infrared spectra.

Key Words: L-(-)-Ethyl lactate; Raman spectra; Infrared spectra.

INTRODUCTION

Phenoxypropionate herbicides have the advantages of efficient, lower toxicity, wide-weeding, good choice, long service life and safe to crops, so to develop the phenoxypropionate herbicides is the important issue in nowadays. In the process of experiments, people discovered that there is a chirl carbon in the molecule structure of herbicides, there is optical rotation isomer. The activities of R-herbicides are hundreds times higher than the S-herbicides. If we use only R-herbicides, we not only can lower the amount of the herbicides, but also can lower the operating costs and reduce the pollution to environment. L-(-)-Ethyl lactate is the important intermediates of R-phenoxypropionate herbicides (1).

Ethyl lactate was always produced with the method catalyzed by H_2SO_4 , this method has the disadvantages of rotting to the equipments and having many

subsidiary reactions and complicated aftertreatments (2,3). Recently the synthetic methods of ethyl lactate with the strong acid resin as catalyst were reported, these methods had many advantages compared with the method catalyzed by H_2SO_4 , but the reactive time was long, the best reactive time was also 5~6 h (4,5).

A new synthetic method of L-(-)-Ethyl lactate with L-(-)-lactic acid as raw material and with $AlCl_3$ as catalyst is described here, and the influencing factors of the amount of catalyst, the reactive temperature and the reactive time was studied through orthogonal experiments. The result shows that this new method has the advantages of not rotting to the equipments and having few subsidiary reactions and simple aftertreatments, and the best reactive time was reduced to 3 h, the yield of L-(-)-Ethyl lactate was up to 88.5% (6), and the ratio of optical rotation was determined to be $[\alpha]_D^{20} = 8.93^\circ$ with the WXG-4 polarimeter, thus the optical purity was confirmed to be 96%.

In this paper, Raman spectra and Infrared spectra of the synthetic L-(-)-Ethyl lactate catalyzed by $AlCl_3$ are presented. The result shows that the synthetic products of L-(-)-Ethyl lactate catalyzed by $AlCl_3$ have few foreign substance and high quality.

EXPERIMENTAL

L-(-)-Ethyl lactate was synthesized with L-(-)-lactic acid as raw material and with $AlCl_3$ as catalyst, the amount of $AlCl_3$ was 1%. Ethanol was used as solvent, the ratio of ethanol and L-(-)-lactic acid was 2.5:1, benzene was used to remove water, the reactive temperature was 75°C, rectification was used to refine the product after reaction, the obtained L-(-)-Ethyl lactate was to be determined by Raman spectra and Infrared spectra.

In Raman spectra measurement, the 514.5 nm line of argon ion laser (Innova 70) was used as the excitation source, the power of incident light was 100 mw. The scattered light was split by a double grid monochromator (Tokin Yvon HRD 1), setting of various slit widths, so that the resolution of the monochromator was no less than 2 cm^{-1} . The signal from monochromator was detected by an optical multichannel analyzer (OMA) with Reticon detector. By accumulating mult-scans and substrating background, high quality spectra were obtained. The measurements were the repeated for three times, the results were the same. In Infrared spectra measurements, a 5DXC-FTIR Fourier transforming Infrared spectrometer of Nicolet company was used. The scan range was 4000~400 cm^{-1} .

RESULTS AND DISCUSSION

Some Raman spectra of the synthetic L-(-)-Ethyl lactate are presented in Fig. 1, they can be assigned as follow: 636 cm^{-1} was C-H bending vibration, 863 cm^{-1} was C-O stretching vibration, 1115 cm^{-1} was C-C symmetrical



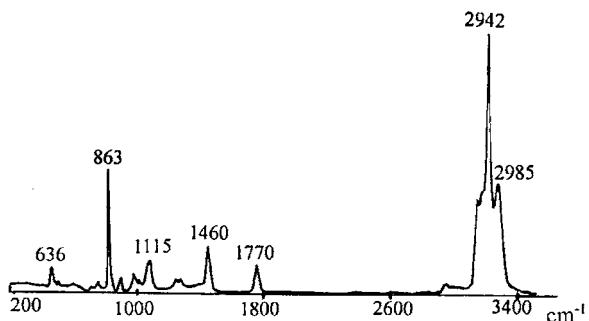


Figure 1. Raman spectra of the synthetic L-(-)- Ethyl lactate catalyzed by AlCl_3 at 300 K.

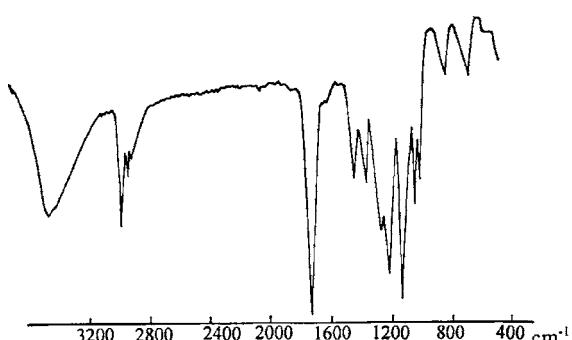


Figure 2. Infrared spectra of the synthetic L-(-)-Ethyl lactate catalyzed by AlCl_3 at 300 K.

stretching vibration, 1460 cm^{-1} was $-\text{CH}_3$ nonsymmetrical stretching vibration, 1770 cm^{-1} was $\text{C}=\text{O}$ stretching vibration, 2942 cm^{-1} was $\text{C}-\text{H}$ stretching vibration and 2985 cm^{-1} was $\text{O}-\text{H}$ stretching vibration. The Infrared spectra of the synthetic L-(-)- Ethyl lactate are presented in Fig. 2, and the Infrared spectra of the standard L-(-)- Ethyl lactate are presented in Fig. 3. It can be seen that in Figs. 2 and Figs. 3 there are $\text{C}-\text{O}-$ absorption peak at 1140 cm^{-1} , $\text{C}=\text{O}$ absorption peak at

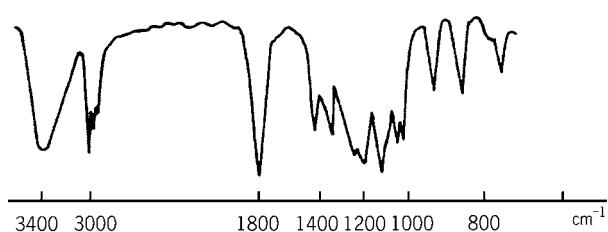


Figure 3. Infrared spectra of the standard L-(-)-Ethyl lactate at 300 K.



1740 cm^{-1} , H–O synthetic absorption peak at 2990 cm^{-1} and H–O free absorption peak at 3460 cm^{-1} . Comparing Figs. 2 with Figs. 3, it is seen that they are very similar in figure shape.

Sum up the analytic result of the Raman spectra and Infrared spectra, it shows that the synthetic L-(-)-Ethyl lactate catalyzed by AlCl_3 was as pure as the standard L-(-)-Ethyl lactate. The new synthetic method of L-(-)-Ethyl lactate with L-(-)-lactic acid as raw material and with AlCl_3 as catalyst was feasible, and it has the advantages of simple producing technology, short reactive time, higher yield and pure products.

REFERENCES

1. Yu-Ling Huang, *GuangXi Chemistry* (in Chinese), 15 (2), 1994.
2. Song-Pei Zhang, *JiangXi Chemistry* (in Chinese), 32(5), 1996.
3. Si-Gui Cheng, *Handbook of Fine Organic Chemicals* (in Chinese), 1992: 687–695.
4. Rong-Bao Wei, *Fine Chemistry* (in Chinese), 12(2), 1995.
5. Hui-Rong Yang, *Journal of Synthetic Communications*, 24(22), 1994.
6. Su-E Hao, *Journal of Harbin Institute of Technology*, 31(1), 1999.

Received November 3, 1999

Accepted February 11, 2001



Request Permission or Order Reprints Instantly!

Interested in copying and sharing this article? In most cases, U.S. Copyright Law requires that you get permission from the article's rightsholder before using copyrighted content.

All information and materials found in this article, including but not limited to text, trademarks, patents, logos, graphics and images (the "Materials"), are the copyrighted works and other forms of intellectual property of Marcel Dekker, Inc., or its licensors. All rights not expressly granted are reserved.

Get permission to lawfully reproduce and distribute the Materials or order reprints quickly and painlessly. Simply click on the "Request Permission/Reprints Here" link below and follow the instructions. Visit the [U.S. Copyright Office](#) for information on Fair Use limitations of U.S. copyright law. Please refer to The Association of American Publishers' (AAP) website for guidelines on [Fair Use in the Classroom](#).

The Materials are for your personal use only and cannot be reformatted, reposted, resold or distributed by electronic means or otherwise without permission from Marcel Dekker, Inc. Marcel Dekker, Inc. grants you the limited right to display the Materials only on your personal computer or personal wireless device, and to copy and download single copies of such Materials provided that any copyright, trademark or other notice appearing on such Materials is also retained by, displayed, copied or downloaded as part of the Materials and is not removed or obscured, and provided you do not edit, modify, alter or enhance the Materials. Please refer to our [Website User Agreement](#) for more details.

Order now!

Reprints of this article can also be ordered at
<http://www.dekker.com/servlet/product/DOI/101081SL100002292>