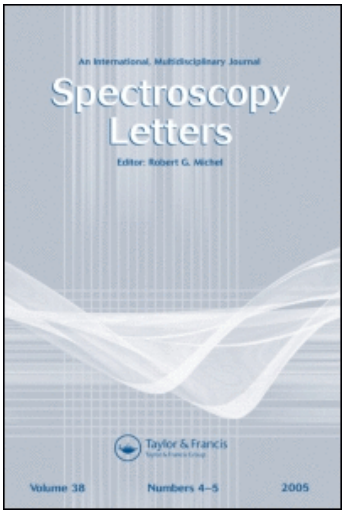

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LASER RAMAN AND INFRARED SPECTRA OF L-(-)-ETHYL LACTATE

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

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ABSTRACT

A new method for synthesizing L-(-)-ethyl lactate which is an important intermediates of R-phenoxypropionate herbicides catalyzed by $AICI_3$ 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 $AICI_3$ 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 mew 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 $AICI_3$ are presented. The result shows that the synthetic products of L-(-)-Ethyl lactate catalyzed by $AICI_3$ have few foreign substance and high quality.

EXPERIMENTAL

L-(-)-Ethyl lactate was synthesized with L-(-)-lactic acid as raw material and with $AICI_3$ as catalyst, the amount of $AICI_3$ 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

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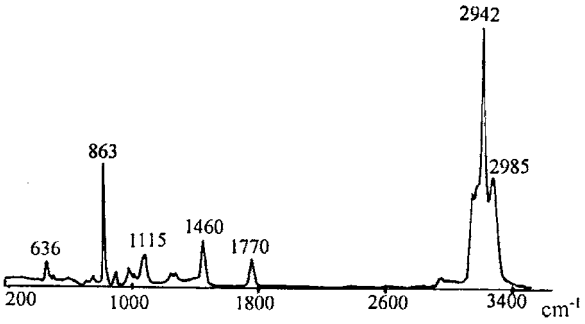

Figure 1. Raman spectra of the synthetic L-(-)- Ethyl lactate catalyzed by $AICI_3$ at 300 K.

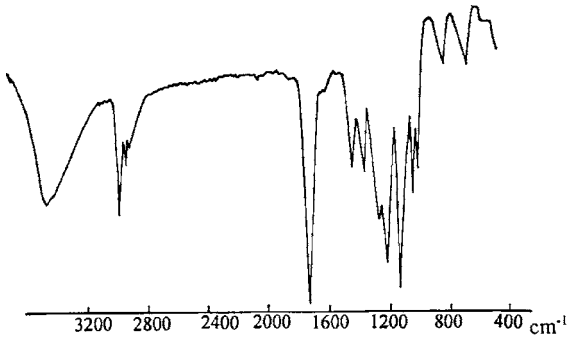

Figure 2. Infrared spectra of the synthetic L-(-)-Ethyl lactate catalyzed by $AICI_3$ at 300 K.

stretching vibration, 1460 cm^{-1} was $-CH_3$ nonsymmetrical stretching vibration, 1770 cm^{-1} was C=O stretching vibration, 2942 cm^{-1} was C–H stretching vibration and 2985 cm^{-1} was O–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 C–O– absorption peak at 1140 cm^{-1}, C=O absorption peak at

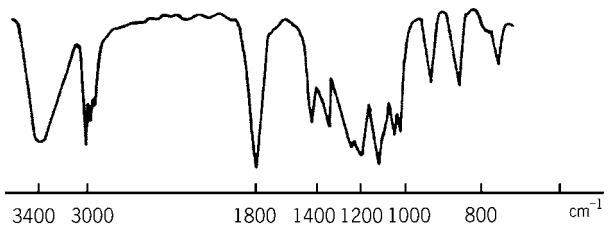

Figure 3. Infrared spectra of the standard L-(-)-Ethyl lactate at 300 K.

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 $AICI_3$ 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 $AICI_3$ 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.

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