



DMAP is added under nitrogen atmosphere to a solution of permethric acid chloride in acetonitrile. The mixture was stirred at 80°C. After the reaction, ethanol is added to the reaction system until esterification is complete. The progress of the reaction can be monitored by gas chromatography or <sup>1</sup>HNMR analysis. The experimental results are summarized in **Table 1**.

**Table 1.** Conversion reaction of *cis/trans*-1 to *trans*-2.

Entry	<b>1</b> ( <i>trans/cis</i> -%) <sup>a</sup>	catalyst	catalyst : <b>1</b> (mol)	time (hour)	product <b>2</b> ( <i>trans/cis</i> -%) <sup>a</sup> yield (%)	
1	60.0/40.0	DMAP	0.02:1	6	75.4/24.6	93.2
2	60.0/40.0	DMAP/Me <sub>4</sub> NI	0.02:0.02:1	6	80.5/19.5	92.8
3	60.0/40.0	DMAP	0.25:1	6	83.8/16.8	94.7
4	60.0/40.0	DMAP/NaI	0.25:0.08:1	4	86.1/13.9	93.8
5	60.0/40.0	DMAP	0.5:1	6	92.8/7.2	94.9
6	60.0/40.0	DMAP	0.5:1	8	96.0/4.0	95.9
7	60.0/40.0	C <sub>5</sub> H <sub>5</sub> N	0.5:1	6	82.3/17.7	90.7
8	60.0/40.0	----	----	8	62.0/38.0	98.4 <sup>b</sup>

a) Determined by gas chromatography. b) The crude product is not distilled.

**Table 1** reveals the following facts. First, the presence of halogen compounds, such as tetramethylammonium iodide or sodium iodide, facilitates the conversion. Second, the molar ratio of catalyst to permethric acid chloride has influence on the *trans/cis* ratio of product **2**. Third, the *trans/cis* ratio of the final product could be raised to 96.0/4.0 at reflux temperature for 8 hours.

The *trans/cis* ratio of the target product **2** is affected by other factors such as solvent, we will discuss it in the near future.

### Acknowledgments

We would like to acknowledge the National Natural Science Foundation of China for financial support. We would also like to thank Professor Guang Ren Li for many helpful discussions and Dr. Jia Zhou for encouragement and advice.

### References

1. M. Elliott, A. W. Farnham, N. F. Janes, *et al.*, *Nature* (London), **1973**, 244, 456.
2. F. C. Bi, W. L. Wang, X. R. Chen, L. H. Zhu, R. Q. Huang, *Plant Protection*, **1993**, 4, 43.
3. L. Pal, M. Kelemen, A. Toth, *et al.*, *J. Environ. Sci. Health*, **1996**, B31 (3), 527-543.
4. T. Honda, N. Itaya, F. Horiuchi, *et al.*, *Jpn. Kokai Tokkyo Koho JP* 50-131, 953 (1975)
5. G. Suzukamo, Y. Sakito, M. Fukao, *et al.*, *Eur. Pat. Appl. EP* 340, 985 (1989).
6. G. Suzukamo, M. Fukao, K. Hagitani, *et al.*, *Jpn. Kokai Tokkyo Koho JP* 01-283, 250 (1989).
7. K. Hagitani, T. Oike, M. Fukao, *et al.*, *Jpn. Kokai Tokkyo Koho JP* 03-112, 941 (1991).

Received 4 September 1998