

MERIT Internship Final Report

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Period

2018. 2. 14—2018. 3. 19

Place

National Institute of Advanced Industrial Science and Technology
Interdisciplinary Research Center for Catalytic Chemistry

Activity

Heterogeneous catalysts, which are easily recovered by simple filtration and reusable, have recently attracted attention because they meet one of the targets in synthetic organic chemistry which is to gain the desired products efficiently with less amount of waste. On the other hand, continuous-flow reactions, where reactions are performed in a thin tube or a column packed with catalysts, have a great advantage over batch reactions such as easy control of productivity and application to sequential multistep reactions. Especially, a continuous-flow reaction with heterogeneous catalysts is one of the ideal reaction systems because the desired products are selectively obtained continuously by simple feeding the starting materials to a column packed with the catalysts. During this internship at National Institute of Advanced Industrial Science and Technology, hydrogenation of quinone substrates under a continuous-flow system was focused on for the synthesis of biaryl compounds which is often found in natural compounds such as alkaloids.

After synthesis of the starting material, several metal nanoparticle-immobilized catalysts were screened. The reaction was performed by introducing a solution of the substrate with gas hydrogen to a glass column packed with the catalysts. Further optimization of the reaction conditions such as reaction temperature, flow rates of substrate and hydrogen with the catalyst which showed the highest activity gave the desired product quantitatively.

I have worked on development of heterogeneous catalysts which is effective in synthetic organic chemistry under a continuous-flow condition in my Ph. D. study. While I could do well on the work in the internship because of my previous experience, I sometimes faced a difficulty which I had never met before because equipment was totally different from that in our laboratory. For example, a pump for introducing the substrate often required maintenance because of a serious clogging of the substrate, which is caused by its complicated structure. On the other hand, the flow of substrate or hydrogen was frequently suspended due to stickiness of the solution. This problem was solved by diluting the catalyst with inorganic material which is rough particle. There were a lot of difficulties in the research, however, I am sure that it was a precious experience that conducting experiments using unfamiliar equipment.

Besides the research, I had an opportunity to attend some lecture provided by a professor in other university and symposium. Especially, I could learn a lot about a continuous-flow reaction from researchers from companies in the latter.

Acknowledgement

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