Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information
The value-added utilization of glycerol for synthesis of glycerol carbonate catalyzed with a novel porous ZnO catalyst

Pingbo Zhang*, Lihua Liu, Mingming Fan*, Yuming Dong and Pingping Jiang

The Key Laboratory of Food Colloids and Biotechnology, Ministry of Education, School of Chemical and Material Engineering, Jiangnan University, Wuxi 214122, P. R. China

*Corresponding author. *E-mail address*: pingbozhang@126.com, fanmm2000@126.com.

To investigate the influence of reaction temperature on glycerol carbonate yield, the transesterification reaction was carried out under the temperatures of 110 °C, 120 °C, 130 °C, 140 °C and 150 °C. And the results are summarized as shown in Fig. S1. In conclusion, 140 °C was regarded as the optimum reaction temperature.

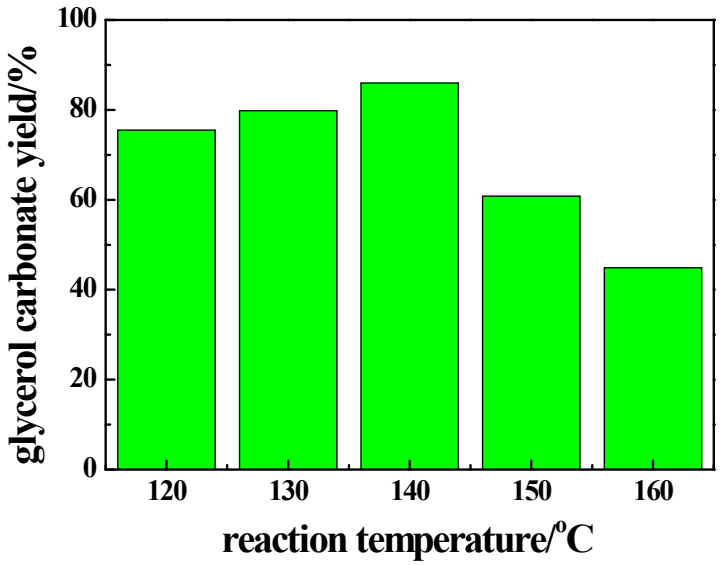

Fig. S1. Influence of reaction temperature on glycerol carbonate yield (Reaction conditions: glycerol/urea=1:1.5, catalyst dosage 5.0 wt.%, 140 °C, 1KPa)

The effect of molar ratio of urea and glycerol on glycerol carbonate yield was shown in Fig. S2. Finally, the yield of glycerol carbonate was observed to be about 85.97% under the optimum reaction condition: the molar ratio urea/glycerol was 1.5: 1.

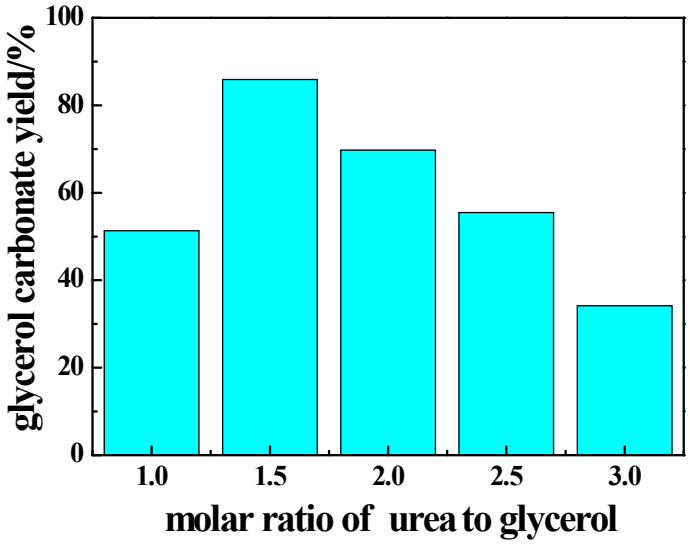

Fig. S2. Influence of different molar ratio of glycerol to urea on glycerol carbonate yield (Reaction conditions: catalyst dosage 5.0 wt.%, 140 ^{o}C, 6 h, 1KPa)

The influence of reaction time varying from 3 to 7 h on glycerol carbonate yield was investigated. As shown in Fig. S3. The optimal reaction condition: the reaction time was 6h.

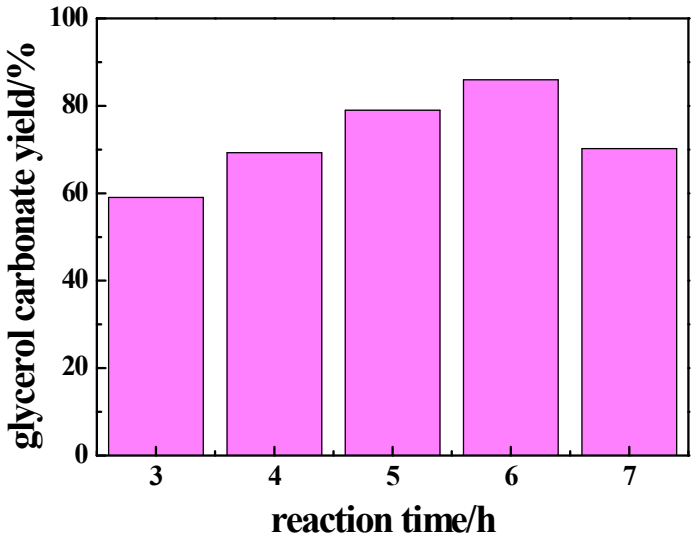

Fig. S3. Influence of reaction time on glycerol carbonate yield (Reaction conditions: glycerol/urea=1:1.5, catalyst dosage 5.0 wt.%, 140 ^{o}C, 1KPa)

The reaction runs were conducted with different amounts of catalysts while keeping the other reaction conditions unchanged. In this study, the effect of catalyst amount on the transesterification profile (glycerol conversion and GC yield) was investigated. The catalyst amount varied between 0.023-0.253 g (1–11 wt.% with respect to glycerol amount), whereas the other reaction were fixed, the molar ratio glycerol/urea of 1:1.5, reaction temperature of 140 ^{o}C, 1KPa and reaction time of 6 h. According to Fig. S4, it is clear that the addition of catalyst ameliorated the yield of GC.

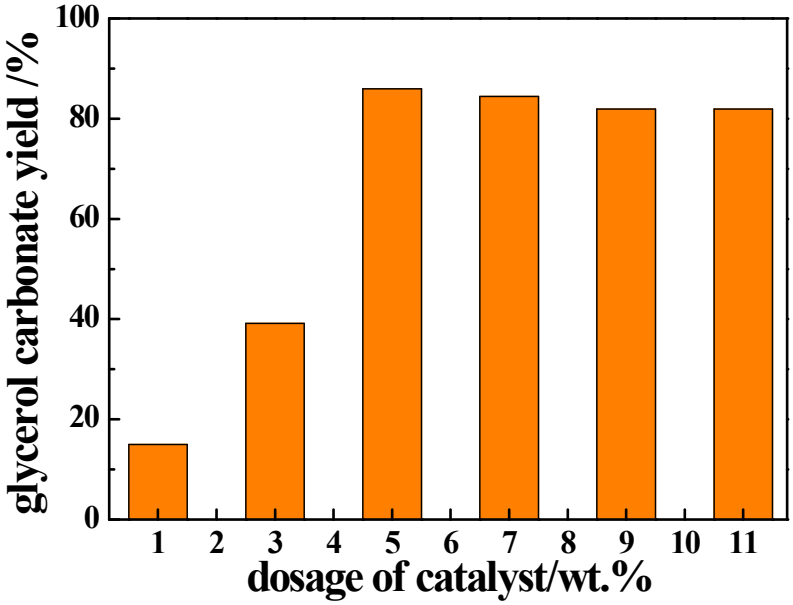

Fig. S4. Influence of dosage of catalyst on glycerol carbonate yield (Reaction conditions: glycerol/urea=1:1.5, 140 ^{o}C, 6 h, 1KPa)

The dispersion performance of catalyst in the transesterification reaction will affect the activity of the catalyst. In order to study the dispersion performance of catalyst in the reactants, two catalysts dispersed in the aqueous solution of glycerol were investigated. When the smaller the polydispersity index of the catalyst, the dispersibility of catalyst in the aqueous solution of glycerol was better. Thus, ZnO from ZMG have the better dispersibility in Tab. 1 and particle size distribution were presented in Fig. 1.

Tab.1. polydispersibility of two catalysts

catalyst	polydispersibility
ZnO from ZMG	0.012
ZnO	0.265

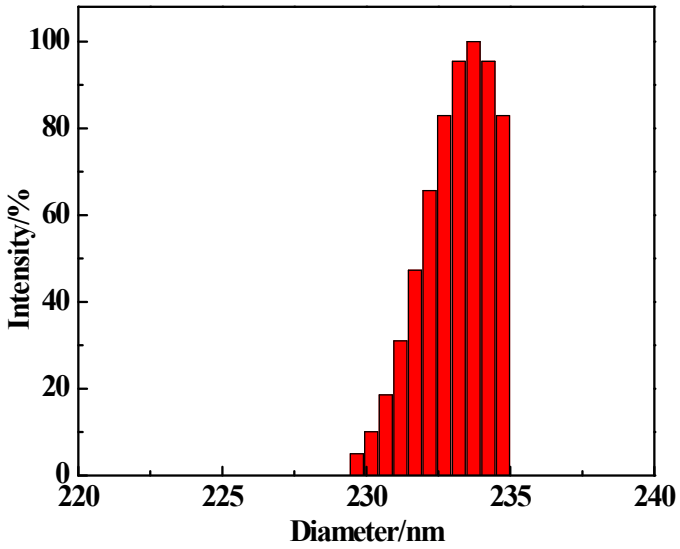

Fig. S5. Particle size distribution