

Microwave Assisted Solvent-free Catalytic Transesterification of Glycerol to Glycerol Carbonate

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Abstract : As a by-product of the biodiesel industries, glycerol has been vastly generated which surpasses the market demand. It is imperative to develop an efficient glycerol valorization processes in minimizing the net energy requirement and intensifying the biodiesel production. In this study, base-catalyzed transesterification of glycerol with dimethyl carbonate using microwave irradiation as heating method to produce glycerol carbonate was conducted by varying grades of glycerol i.e. 70%, 86% and 99% purity that obtained from biodiesel plant. Metal oxide catalysts were used with varying operating parameters including reaction time, DMC/glycerol molar ratio, catalyst weight %, temperature and stirring speed. From the study on the effect of different operating parameters; it was found that the type of catalyst used has the most significant effect on the transesterification reaction. Admist the metal oxide catalysts examined, CaO gave the best performance. This study indicates the feasibility of producing glycerol carbonate using different grade of glycerol in both conventional thermal activation and microwave irradiation with CaO as catalyst. Microwave assisted transesterification (MAT) of glycerol into glycerol carbonate has demonstrated itself as an energy efficient route by achieving 94.3% yield of GC at 65°C, 5 minutes reaction time, 1 wt% CaO and DMC/glycerol molar ratio of 2. The advantages of MAT transesterification route has made the direct utilization of bioglycerol from biodiesel production without the need of purification. This has marked a more economical and less-energy intensive glycerol carbonate synthesis route.

Keywords : base-catalyzed transesterification, glycerol, glycerol carbonate, microwave irradiation

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