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Orange Peel Ashes as Catalyst for Glycerol Carbonate Synthesis

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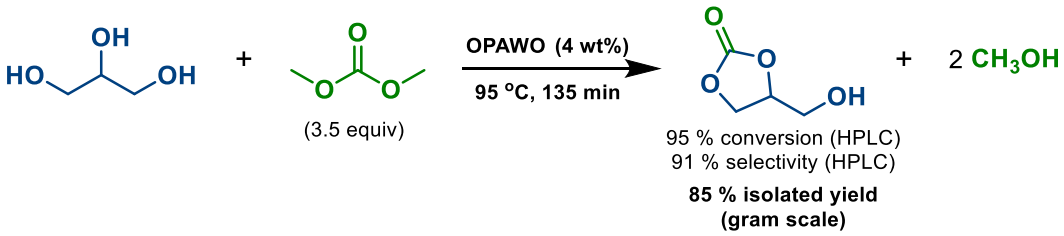
ABSTRACT

Glycerol carbonate (GC) is a versatile glycerol derivative[1] used as solvent, an ingredient in surface cleaners, dyes, plastics, cosmetic formulations, and an intermediate in polymer syntheses.[2] The transesterification reaction of dimethyl carbonate with glycerol catalyzed by basic metallic oxides is generally the most affordable approach to preparing GC. Biomass ashes are a rich source of alkaline metallic oxides,[4] thus a potential catalyst for GC synthesis. In this context, Brazil is the largest orange producer in the world,[3] resulting in large amounts of residual orange peels. Herein, we present a synthetic protocol using K_2O and CaO-rich orange peel ashes obtained after essential oil extraction, calcination at 650 °C, for 5 h, and designated as Orange Peel Ashes Without Oil (OPAWO). A Design of Experiments (DoE) with three-level and four-factor was employed to identify the optimal reaction conditions, which were determined to be a 1:3.5 ratio of glycerol and dimethyl carbonate, 4 wt% of catalyst at 95°C for 135 minutes. Under these conditions, GC was prepared with 85 % isolated yield.



Scheme 1. Synthesis of Glycerol Carbonate using Orange Peel Ashes Without Oil as catalyst.

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