

Indirect Synthesis of Dimethyl Carbonate from Urea and Methanol

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Background and Description

A flow sheeting process for producing dimethyl carbonate (DMC) by urea indirect alcoholysis method, The Flowsheet not only optimizes the process but also integrated Heat changes.

An environmentally safe chemical agent Di methyl carbonate (DMC) has recently caught limelight due to it being non toxic and very versatile. DMC can be used e.g as a methylation reagent to substitute extremely toxic dimethyl sulfate or methyl halides, and also as a carbonylation reagent for replacing of phosgene [3]. DMC was also a favourable high-octane gasoline additive with high oxygen content of 53.3% Moreover, DMC could also be used as electrolytes for lithium-ion batteries.

Various processes are being utilized in order to gain a steady supply of DMC direct CO₂ synthesis, oxidative carbonylation of methanol, transesterification of ethylene carbonate (EC) or propylene carbonate (PC) and the urea alcoholysis method. Of all the process the Direct synthesis of CO₂ gives us some novel benefits not only It utilizes green house gas but the product is a parent compound to thousands of other compounds. The transesterification method was more feasible for DMC synthesis compared with other routes. However, this method is greatly dependent on petroleum industry, because of the raw material, ethylene oxide and propylene oxide which makes the raw material a liability. In this flow sheeting project I have used a promising DMC synthesis route by the urea indirect alcoholysis method which uses 2-propylene glycol (PG) this project still gives us the edge of utilizing Green house gases in the later steps when By product ammonia is recycled in Urea.

PROCESS- According to the process, the PG and urea were fed to the reactor RC1 after preheated to 160 oC to generate PC and ammonia under the pressure of 30 kPa. The conversion of urea was set to not less than 99% and the PC yield was 94%, where the catalyst was neglected because of the little

weight percentage. The ammonia was separated from the partial condensation, which was then compressed by the multi-stages vacuum and purified.. The main product in the bottom of RC1 was fed into CS1 after cooling by COOL1 and separating of the unreacted urea and catalyst by Sep model. The unit of CS1 was operated under the pressure of 30 kPa. The intermediate PC was striped in the bottom with designed concentration of 99.25 wt%. Sequentially, the PC was fed in RC2, methanol was fed on RC2. The reaction of transesterification was assumed to take place on the stages of 11-30 according to the literature. The bottom flow was composed of PG and methanol.. Because of the large difference in boiling point, methanol was distilled from the top of T201. The PG was striped on the bottom and recycled to mix with the urea and PG after cooling by in order to feed to the first reaction unit of RC1. The cooler unit used here was to maintain a relative low temperature for recycled PG.

