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(54) **Title**: SYNTHESIS OF METHYL CARBAMATE AND DIMETHYL CARBONATE (DMC) IN PRESENCE OF STRIPPING WITH INERT GAS OR SUPERHEATED VAPOURS AND A REACTOR FOR THE SAME

(57) **Abstract**: The invention relates to synthesis of methyl carbamate (MC) and dimethyl carabonate (DMC) in presence of stripping inert gas or superheated methanol vapors using packed column reactor and bubble column reactor.

AMENDED CLAIMS
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1. A process for synthesis of methyl carbamate and dimethyl carbonate (DMC) in reactor comprising:
   a. feeding liquid reactant feed comprising of urea and methanol or methyl carbamate and methanol into a reactor vessel [201] containing expanded slurry bed of solid catalyst particles suspended in a suspension liquid or in a packed bed of solid catalyst and allowing to react, said catalyst being homogeneous or heterogeneous;
   b. passing the inert gas or superheated methanol vapours into said reactor vessel [201] through inlet valve [203] by regulating the pressure to ensure positive flow of the inert gas and stripping ammonia and DMC formed during the reaction through the outlet port [207];
   c. passing the product gases collected from the outlet port [207] through condenser [209] and gas-liquid separator [210];
   d. removing liquid phase products from the reactor [200] through liquid outlet post [206];
   e. optionally, recycling methanol or gaseous product into the reactor vessel for further reaction through inlet port [204].
2. The process according to claim 1, wherein, If said homogeneous catalyst is used the catalyst will be soluble in the reaction mixture.
3. The process according to claim 1, wherein reactor used is selected from packed bed reactors and bubble column reactors having counter-current and cross-current stripping preferably horizontal bubble column AND horizontal sectionalized bubble column reactors [200].
4. The process according to claim 1, wherein, optionally the reaction is carried out in presence of catalyst selected from the group consisting of hydrotalcite and hydrotalcite like compunds, double metal cyanides, cenosphere or ionic liquids.
5. The process according to claim 1 or 2, wherein the process step (a) is carried out in a reactor comprising feeding liquid reactant feed comprising of urea and methanol or methyl carbamate and methanol into a reactor vessel [201] containing an expanded slurry bed of solid catalyst particles suspended in a suspension liquid or in a packed bed of solid catalyst and allowing to react or in a packed bed of solid catalyst and allowing to react.

6. The process according to claim 2, wherein the concentration of catalyst particles present in the slurry bed is in the range of 0.01 to 10 weight percentage.
7. The process according to claim 1, wherein the inert gas is selected from air, $CO_2$, He, Ar, N2 and such like.
8. The process according to claim 1, wherein velocity of inert gas or superheated methanol vapors used for stripping ammonia and DMC is in the range of 1. x 10-4 to 0.1 m/s.
9. The process according to claim 1, wherein pressure in step (b) is regulated by maintaining a constant pressure difference between constant pressure regulator fitted to an inlet valve and back pressure regulator fitted to an outlet valve to ensure positive flow of inert gas.
10. The process according to claim 1, wherein the temperature of the reactor is maintained at a temperature in the range of 130-210°C.
11. The process according to claim 1, wherein the process is batch or continuous.
12. The process according to claim 1, wherein the ratio of recycle gas stream /liquid reactant feed is in the range of 0.5 to 15.
13. A horizontal sectionalized bubble column reactor [200] for synthesis of methyl carbamate and dimethyl carbonate (DMC) comprising:
    a. reactor with single or multiple compartments [201] to receive liquid reactant feed comprising of urea and methanol or methyl carbamate and methanol through the inlet ports [204] for the reaction to occur;
    b. Gas distributor chamber [202] located within the cylindrical bubble column reactor [200] comprising a plate intersecting the cylinder with or without an angle to the axis of the cylinder [200];
    c. Single or multiple inlet ports [203] fitted to the Gas distributor chamber [202] for distributing gas;
    d. Single or multiple inlet ports[203] fitted with constant pressure regulator, single or multiple gas/ vapor outlet ports [207] fitted with back pressure regulator [209] for gaseous phase, wherein, the pressure difference of 10psi is maintained to ensure positive flow of inert gas into the reactor [201];
    e. Single or multiple liquid outlet ports [206] with in-line filter [206a] fitted to reactor [200] for liquid phase withdrawal;

f. Heat transfer device [208] fitted to the reactor [200] for maintaining temperature of the reaction;

g. Condenser and gas-liquid separator [210] fitted to the outlet ports [207] wherein the product in vapor form is condensed and separated from the liquid components;

h. Outlet for condensate [211] and Outlet for non-condensate [212] connected to gas-liquid separator [210].

14. The reactor as claimed in claim 13, wherein the reactor [201] optionally comprises an expanded slurry bed of solid catalyst particles suspended in a suspension liquid or in a packed bed of solid catalyst.

15. The horizontal sectionalized bubble column reactor according to claim 12, optionally comprising a recycling inlet for recycling methanol or gaseous product into the reactor vessel for further reaction through inlet port [204].