Claims

1. Continuous process for preparing methacrolein by a Mannich condensation reaction of formaldehyde with propanal,

wherein

a methacrolein polymerisation inhibitor is introduced into a distillation column in a production process system, and a part of said methacrolein polymerisation inhibitor is recycled back into a reactor where the Mannich condensation reaction is carried out,

said production process system comprising flow lines, a reactor, the distillation column, a reboiler, a condenser and a phase separator.

2. The continuous process for preparing methacrolein according to claim 1, wherein the methacrolein polymerization inhibitor is introduced into the distillation column at an upper portion thereof.

3. The continuous process for preparing methacrolein according to claim 2, wherein the temperature at the upper portion of the distillation column is in the range from 40 to 85°C.

4. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connecting the upper portion of the distillation column and the condenser in the production process system.

5. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connecting the condenser with the phase separator in the production process system.

6. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connected to the entrance of the reactor in the production process system.

7. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connecting the phase separator back to the distillation column.

8. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connecting the lower portion of the distillation column with the entrance to the reboiler, being the exit from the reboiler connected back to the lower portion of the distillation column.

9. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is introduced into the flow line connecting the exit of the reactor with the distillation column.

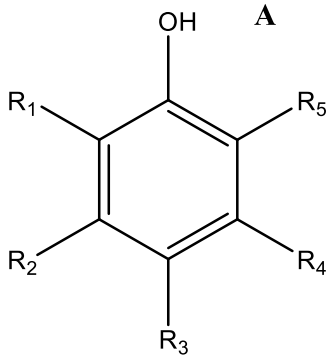
10. The continuous process for preparing methacrolein according to any one of the previous claims, wherein the Mannich condensation reaction is carried out in presence of a secondary amine and at least one organic acid, being the molar ratio of acid to organic base in the range from 20:1 to 1:20.

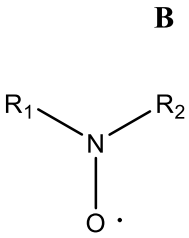
11. The continuous process according to according to any one of the previous claims, wherein the Mannich condensation reaction is carried out with a residence time in the range from 0.1 to 300 seconds.

12. The continuous process according to any one of the previous claims, wherein the Mannich condensation reaction is carried out at a temperature of from 100 to 300°C and at a pressure of from 5 to 100 bar.

13. The continuous process according to any one of the previous claims, wherein the concentration of methacrolein polymerization inhibitor in the reaction mixture is between 10 and 10000 ppm.

14. The continuous process according to any one of the previous claims, wherein the methacrolein polymerization inhibitor is selected from at least one of the compounds A or B





, with R_1 to R_5 selected independently from each other from Alkyl, Aryl, Hydroxyl, Carboxyl or Amino.

15. The continuous process according to claim 14, wherein the methacrolein polymerization inhibitor is selected from the group consisting of hydroquinones, hydroquinone ethers, such as hydroquinone monomethyl ether or di-tert-butylpyrocatechol, phenothiazine, N,N'- diphenyl–p–phenylenediamine, 4–hydroxyl-2,2,6,6-tetramethylpiperidin-1-oxyl, p-phenylenediamine, methylene blue and sterically hindered phenols, tempol, EDTA or a mixture thereof.

16. The continuous process according to claim 15, wherein the methacrolein polymerization inhibitor is hydroquinone, tempol, topanol A, hydroquinone mono methylether or a mixture thereof.

17. The continuous process according to claim 16, wherein the methacrolein is further reacted with oxygen and methanol in a direct oxidative esterification to give methylmethacrylate.