Claims

1. Process for performing a heterogeneously catalysed reaction in a three-phase reactor, wherein there is at least one liquid phase, at least one gaseous phase and at least one solid phase in the reactor and the reactor has at least two zones, with a reaction mixture being conveyed downward in zone 1, the reaction mixture being conveyed upward in zone 2, zones 1 and 2 being separated from one another by a dividing wall, wherein a ratio between average catalyst concentrations in zone 2 and in zone 1 is greater than 2, wherein the heterogeneously catalysed reaction is an oxidation reaction with an oxygen-containing gas, and wherein the heterogeneously catalysed reaction is a continuous oxidative esterification of methacrolein with oxygen and methanol for preparation of methyl methacrylate.

2. Process according to Claim 1, wherein the ratio between the average catalyst concentrations in zone 2 and in zone 1 is greater than 5, preferably greater than 10.

3. Process according to Claim 1 or 2, wherein the gas required for the process, in the course of operation, is almost exclusively in zone 2, while zone 1 remains very substantially free of an undissolved gas.

4. Process according to at least one of Claims 1 to 3, wherein a ratio between a catalyst concentration in zone 2 at 90% of a fill height of the reactor measured from a bottom and a catalyst concentration at 20% of the fill height measured from the bottom is less than 0.3, preferably less than 0.2, even more preferably less than 0.1.

5. Process according to at least one of Claims 1 to 4, wherein a ratio between an average vertical flow rate in zone 1 and an average vertical flow rate in zone 2 is between 5 and 50, preferably between 10 and 40.

6. Process according to at least one of Claims 1 to 5, wherein a ratio of a reactor diameter in the upper portion to that in the lower portion is between 1 and 2, preferably between 1.1 and 1.5.

7. Process according to at least one of Claims 1 to 6, wherein a ratio of a diameter in the upper portion of zone 1 to that in the lower portion of zone 1 is between 1 and 5, preferably between 2 and 4.

8. Process according to at least one of Claims 1 to 7, wherein the reaction mixture is conveyed downward in zone 1 by means of at least one pump or at least one stirrer.

9. Process according to at least one of Claims 1 to 8, wherein at least one liquid feed stream is, and preferably all liquid feed streams are, introduced into the upper portion of zone 1.

10. Process according to at least one of Claims 1 to 9, wherein at least one continuously operable and back-washable filter is installed in the upper portion of zone 2.

11. Process according to at least one of Claims 1 to 10, wherein reaction mixture is discharged continuously from the reactor and filtered through at least one external filter and the catalyst is passed back into the reactor after the filtration.

12. Process according to at least one of Claims 1 to 11, wherein zone 2 is divided into at least 2 segments by dividing walls, and wherein at least one gas is metered in and finely distributed in the lower portion of zone 2.

13. Process according to at least one of Claims 1 to 12, wherein a ratio between an oxygen concentration in the gas phase of zone 2 at 20% of the fill height of the reactor measured from the bottom and an oxygen concentration in the gas phase of zone 2 at 90% of the fill height measured from the bottom is greater than 2, preferably greater than 4.