Claims

1. A process for producing dialkyl succinate, the process comprising hydrogenating dialkyl maleate in a multi-stage process comprising at least two hydrogenation stages wherein:

in a first hydrogenation stage a feed stream comprising the dialkyl maleate is exposed to hydrogenating conditions over a catalyst at a temperature T_1 to produce a first stream comprising dialkyl succinate and unsaturated compound(s), and

in a second hydrogenation stage the first stream is exposed to hydrogenating conditions over a catalyst at a temperature T_2 to produce a second stream comprising dialkyl succinate and a lower concentration of the unsaturated compound(s) than the first stream;

wherein T_2 is less than T_1.

2. A process according to claim 1, wherein T_1 is at least 140°C.

3. A process according to claim 1 or claim 2, wherein T_2 is less than 140°C.

4. A process according to any preceding claim, wherein in the first hydrogenation stage the feed stream is exposed to hydrogenating conditions over a platinum group metal catalyst, which is optionally a supported catalyst.

5. A process according to any preceding claim, wherein in the second hydrogenation stage the first stream is exposed to hydrogenating conditions over a platinum group metal catalyst, which is optionally a supported catalyst.

6. A process according to any of claims 1 to 4, wherein in the second hydrogenation stage the first stream is exposed to hydrogenating conditions over a base metal catalyst, which is optionally a supported catalyst.

7. A process according to claim 6, wherein the base metal is nickel.

8. A process according to any preceding claim, wherein the first hydrogenation stage includes a liquid recycle in which the dialkyl maleate feed is diluted with dialkyl succinate from the first stream.

9. A process according to claim 8, wherein the liquid recycle is operated such that the molar ratio of dialkyl maleate to dialkyl succinate fed into the hydrogenation stage is maintained in the range of 10:1 to 100:1, preferably 20:1 to 30:1.

10. A process according to any preceding claim, wherein the first stream comprises less than 1000 ppmw, preferably less than 250 ppmw, more preferably less than 100 ppmw of γ-butyrolactone.

11. A process according to any preceding claim, wherein the second stream comprises less than 1000 ppmw, preferably less than 250 ppmw, more preferably less than 100 ppmw of the unsaturated compound(s).

12. A process according to any preceding claim, wherein the second stream comprises less than 1000 ppmw, preferably less than 250 ppmw, more preferably less than 100 ppmw of γ-butyrolactone.

13. A process according to any preceding claim, wherein the second stream is fed to a refining zone.

14. A process according to claim 13, wherein the refining zone comprises a distillation column operated to produce a dialkyl succinate stream comprising greater than 99.5 wt% dialkyl succinate.

15. A process according to any preceding claim, wherein the feed stream comprising dialkyl maleate is obtained by esterification of maleic anhydride with the corresponding alkyl alcohol.

16. A process according to claim 15, wherein the feed stream comprising dialkyl maleate comprises less than 1 wt% monoalkyl maleate, preferably less than 0.5 wt% monoalkyl maleate.

17. A process according to claim 15 or claim 16, wherein the feed stream comprising dialkyl maleate comprises less than or equal to 5 wt% alkyl alcohol.

18. A process for producing polybutylene succinate, the process comprising producing dialkyl succinate by the process of any preceding claim, then polymerising the dialkyl succinate with 1,4-butanediol in a subsequent polymerisation stage.

19. A process according to claim 18, wherein the 1,4-butanediol is produced from a dialkyl maleate.

20. The process according to claim 18 or claim 19, wherein the dialkyl succinate, 1,4-butanediol, and polybutylene succinate are produced on the same plant.

21. A process according to any preceding claim, wherein alkyl is methyl.