CLAIMS

1. A process for production of cocoa butter equivalent (CBEO), the process comprising the steps of:

providing shea fat (SF);

separating the shea fat into a first shea stearin fraction (FSS) and a shea intermediate product (SIP);

feeding the first shea stearin fraction (FSS) into a first processing line (FPL);

feeding the shea intermediate product (SIP) into a second processing line (SPL);

processing the shea intermediate product (SIP) in the second production line (SPL) into a second shea stearin fraction (SSS);

obtaining two separate shea stearin outputs, the first shea stearin fraction (FSS) from the first processing line (FPL) and the second shea stearin fraction (SSS) from the second processing line (SPL); and

mixing the shea stearin outputs (FSS, SSS) with a palm oil mid fraction (MIX; MIX1, MIX2) to obtain cocoa butter equivalent (CBEO; CBEO1, CBEO2).

2. A process according to Claim 1, in which the shea stearin output comprising the first shea stearin fraction (FSS) and the second shea stearin fraction (SSS) is individually mixed with palm oil mid fraction (MIX1, MIX2) to obtain two separate cocoa butter equivalent (CBEO1, CBEO2) outputs.

3. A process according to Claim 1 or 2, in which the outputs of the two processing lines (FPL, SPL) are individually mixed with palm oil mid fraction (MIX1; MIX2).

4. A process according to Claim 1, 2 or 3, in which the outputs of the two processing lines (FPL, SPL) are mixed with palm oil mid fraction (MIX) in a common mixing process.

5. A process according to any of preceding claim in which the process comprises the steps of:

(a) separating the shea fat (SF, 3) into a first shea stearin fraction (4, FSS) rich in 1,3-distearyl-2-oleyl triglycerides (StOSt, where St = stearic acid and O = oleic acid) and a

first shea olein fraction (5, SIP) rich in 1-stearyl-2,3-dioleyl triglycerides (StOO) and/or trioleate triglycerides (OOO),

(b) feeding a shea olein fraction comprising the first shea olein fraction (5, SIP), together with a stearic acid source (6), into a reaction system comprising immobilized enzymes having transesterification activity to produce a transesterification product (8),

(c) separation from the transesterification product (8) a second shea stearin fraction (15) rich in StOSt,

thereby producing a shea stearin output (9) comprising the first shea stearin fraction (4, FSS) in a first processing line (FPL) and the second shea stearin fraction (15, SSS) in a second processing line (SPL).

6. A process according to any preceding claim, in which the first shea stearin fraction (4, FSS) comprises between 30 and 100 percent by weight of StOSt, such as between 40 and 90 percent by weight of StOSt, such as between 50 and 80 percent by weight of StOSt, such as between 60 and 70 percent by weight of StOSt, such as between 62 and 68 percent by weight of StOSt, such as between 63 and 67 percent by weight of StOSt.

7. A process according to any preceding claim, in which the first shea olein fraction (5, SIP) comprises between 30 and 70 percent by weight of StOO, such as between 40 and 60 percent by weight of StOO, such as between 45 and 55 percent by weight of StOO, such as between 45 and 50 percent by weight of StOO, such as 46, 47, 48, or 49 percent by weight of StOO.

8. A process according to any preceding claim, in which the first shea olein fraction (5, SIP) comprises between 1 and 20 percent by weight of OOO, such as between 5 and 15 percent by weight of OOO, such as between 8 and 12 percent by weight of OOO, such as 9, 10, or 11 percent by weight of OOO.

9. Process according to any preceding claim, in which the temperature in the reaction system is between 45 and 75°C, such as between 45 and 70°C, such as between 50 and 70°C, such as between 60 and 70°C.

10. A process according to any preceding claim, in which the water content of the first shea olein fraction (5,SIP) is between 0.01 and 0.5 percent by weight when it is fed into the

reaction system, such as between 0.01 and 0.3 percent by weight, such as between 0.01 and 0.1 percent by weight, such as between 0.015 and 0.03 percent by weight.

11. A process according to any preceding claim, in which the stearic acid source (6) is stearic acid.

12. A process according to any preceding claim, in which the stearic acid source (6) is an ester of stearic acid.

13. A process according to any preceding claim, in which the ester of stearic acid is a lower alkyl ester.

14. A process according to any preceding claim, in which the lower alkyl ester is a methyl ester.

15. A process according to any preceding claim, in which the transesterification product (8) is separated into at least a second shea olein fraction (14) and the second shea stearin fraction (15) by a fractionation process (13).

16. A process according to any preceding claim, in which the fractionation (13) is a solvent fractionation comprising the steps of:

adding a solvent to the transesterification product (8);

adjusting the temperature according to a temperature profile; and

separating from the transesterification product (8) the second shea stearin fraction (15) and the second shea olein fraction (14).

17. A process according to Claim 16, in which the solvent comprises hexane.

18. A process according to any preceding claim, in which the temperature profile comprises temperatures between -15 and 5°C, such as between -12 and 0°C , preferably between -10 and -2°C.

19. A process according to Claim 18, in which the end point temperature of the temperature profile is between -15 and 5°C, preferably between -10 and -2°C.

20. A process according to any of Claims 15 to 19, in which the second shea olein fraction (14) is recycled into the step of feeding the shea olein fraction, together with the stearic acid

source (6), into the reaction system comprising immobilized enzymes having transesterification activity to produce the transesterification product (8).

21. A process according to any preceding claim, in which a fatty acid ester mixture (19) comprising esters of stearic and/or oleic acid, are being separated from the transesterification product (8), this separated fatty acid ester mixture (19) being subjected to a hydrogenation step (18) so as to increase the relative content of esters of stearic acid, and in which the hydrogenated esters (20) are recycled into the step of feeding the shea olein fraction, together with the stearic acid source (6) into a reaction system comprising immobilized enzymes having transesterification activity to produce the transesterification product (8).

22. A process according to Claim 21, in which the separation of esters of stearic and/or oleic acid from the transesterification product (8) comprises a distillation (17) to separate a fatty acid esters mixture (19) comprising esters of stearic and/or oleic acid from the transesterification product (8).

23. A process according to Claim 21 or 22, in which the hydrogenation step (18) comprises use of a nickel catalyst.

24. A process according to any of Claims 15 to 23, in which a purge stream is separated from the second shea olein fraction.

25. A process according to any preceding claim, in which the purge stream comprises unsaponifiables.

26. A process according to any preceding claim, in which the purge stream comprises triterpenyl esters.

27. A process according to any preceding claim, in which between 40 and 100 percent by weight of the total content of triglycerides in the shea stearin output (9) are StOSt, such as between 50 and 100 percent by weight, such as between 60 and 100 percent by weight, such as between 60 and 80 percent by weight, such as between 60 and 70 percent by weight, preferably between 63 and 67 percent by weight, such as 66 percent by weight.

28. A process according to any preceding claim, in which the content of StOSt relative to the total content of triglycerides in the shea stearin output (9) is increased by 5 to 100 percent by weight compared to the provided shea fat (SF) by means of the process, such as between

15 and 100 percent by weight, such as between 15 and 50 percent by weight, such as between 15 and 30 percent by weight, such as between 15 and 20 percent by weight, such as 16, 17, 18, 19, 20, 21, 22, 23, or 24 percent by weight.

29. A process according to any preceding claim, in which the ratio between the stearic acid and oleic acid in the shea stearin output (9) is between 2:3 and 2:1.

30. A process according to any preceding claim, in which the ratio between the stearic acid and oleic acid in the shea stearin output (9) is between 6:5 and 2:1.

31. A process according to any preceding claim, in which the yield of StOSt in the shea stearin output (9) is between 20 and 100 percent by weight higher than the content of StOSt in the shea fat (3, SF), such as between 30 and 100 percent by weight, such as between 40 and 80 percent by weight, such as between 50 and 70 percent by weight, such as 55, 60, or 65 percent by weight.

32. A process according to any preceding claim, in which the content of StOSt in the shea stearin output (9) is between 50 and 80 percent by weight, such as between 60 and 70 percent by weight, such as between 63 and 67 percent by weight.

33. A process according to any preceding claim, in which the amount of StOSt in the shea stearin output is between 101 and 200 % of the amount of StOSt in the portion of shea fat used (9) to produce the shea stearin output (9), such as between 120 and 190 %, such as between 140 and 180 %, such as between 150 and 170%.

34. A process according to any preceding claim, in which a subsequent step of mixing the shea stearin output (9) with a palm oil mid fraction (11, POMF) to obtain a cocoa butter equivalent (12, CBEO).

35. A process according to any preceding claim, in which the cocoa butter equivalent (12, CBEO) comprises the shea stearin output (9) or a part thereof in the amount of between 40% and 50% by weight.

36. A process according to any preceding claim, in which the enzymes comprise 1,3-specific enzymes.

37. A process according to any preceding claim, in which the 1,3-specific enzymes comprise lipases.

38. A process according to any preceding claim, in which the process for efficient utilization of shea fat (3, SF) comprises a step (21) of removing karitene from the shea fat (3, SF) before the step of separating the shea fat (3, SF) into the first shea stearin fraction (4, FSS) the first shea olein fraction (5, SIP).

39. A process according to Claim 38, in which the concentration of karitene in the shea fat (3, SF) after the step of removing karitene is less than 0.6 percent by weight, such as less than 0.5 percent by weight, such as less than 0.4 percent by weight, such as less than 0.3 percent by weight, such as less than 0.2 percent by weight, such as less than 0.1 percent by weight.

40. A process according to Claim 38 or 39, in which the karitene is completely removed from the shea fat (3, SF).

41. A process according to any preceding claim, in which the shea fat (3, SF) is obtained from the shea nuts (1) by pressing and/or extraction.

42. A process according to any preceding claim, in which the second shea stearin fraction (15, SSS) is subjected to a bleaching step.

43. A process according to any preceding claim, in which the second shea olein fraction (14) is subjected to a bleaching step.

44. A process according to any preceding claim, the cocoa butter equivalent is subjected to a bleaching step.

45. A process for making cocoa butter equivalent (CBEO) from the shea stearin output (9) obtained by a process according to any of the preceding claims, and a palm oil mid fraction (POMF), in which between 1.2 and 2 kilograms of cocoa butter equivalent (CBEO) is produced for each kilogram of the shea fat (3, SF), such as between 1.4 and 1.8 kilograms, such as between 1.5 and 1.7 kilograms, such as 1.6 kilograms.

46. A system comprising:

a shea fat input (SFI) for receiving a shea fat;

a shea fat separator (SFS) adapted for separating shea fat into a first shea stearin fraction and a shea intermediate product;

a first processing line (FPL);

a second processing line (SPL) adapted for processing said shea intermediate product into a second shea stearin fraction;

a first stearin output (FSO) for outputting the first shea stearin fraction;

a second stearin output (SSO) for outputting the second shea stearin fraction; and

in which the system is adapted to operate according to a process according to any preceding claim.

CLAIMS

1. A process for production of cocoa butter equivalent (CBEO), the process comprising the steps of:

providing shea fat (SF);

separating the shea fat into a first shea stearin fraction (FSS) and a shea intermediate product (SIP);

feeding the first shea stearin fraction (FSS) into a first processing line (FPL);

feeding the shea intermediate product (SIP) into a second processing line (SPL);

processing the shea intermediate product (SIP) in the second production line (SPL) into a second shea stearin fraction (SSS);

obtaining two separate shea stearin outputs, the first shea stearin fraction (FSS) from the first processing line (FPL) and the second shea stearin fraction (SSS) from the second processing line (SPL); and

mixing the shea stearin outputs (FSS, SSS) with a palm oil mid fraction (MIX; MIX1, MIX2) to obtain cocoa butter equivalent (CBEO; CBEO1, CBEO2).

2. A process according to Claim 1, in which the shea stearin output comprising the first shea stearin fraction (FSS) and the second shea stearin fraction (SSS) is individually mixed with palm oil mid fraction (MIX1, MIX2) to obtain two separate cocoa butter equivalent (CBEO1, CBEO2) outputs.

3. A process according to Claim 1 or 2, in which the outputs of the two processing lines (FPL, SPL) are individually mixed with palm oil mid fraction (MIX1; MIX2).

4. A process according to Claim 1, 2 or 3, in which the outputs of the two processing lines (FPL, SPL) are mixed with palm oil mid fraction (MIX) in a common mixing process.

5. A process according to any of preceding claim in which the process comprises the steps of:

(a) separating the shea fat (SF, 3) into a first shea stearin fraction (4, FSS) rich in 1,3-distearyl-2-oleyl triglycerides (StOSt, where St = stearic acid and O = oleic acid) and a

first shea olein fraction (5, SIP) rich in 1-stearyl-2,3-dioleyl triglycerides (StOO) and/or trioleate triglycerides (OOO),

(b) feeding a shea olein fraction comprising the first shea olein fraction (5, SIP), together with a stearic acid source (6), into a reaction system comprising immobilized enzymes having transesterification activity to produce a transesterification product (8),

(c) separation from the transesterification product (8) a second shea stearin fraction (15) rich in StOSt,

thereby producing a shea stearin output (9) comprising the first shea stearin fraction (4, FSS) in a first processing line (FPL) and the second shea stearin fraction (15, SSS) in a second processing line (SPL).

6. A process according to any preceding claim, in which the first shea stearin fraction (4, FSS) comprises between 30 and 100 percent by weight of StOSt, such as between 40 and 90 percent by weight of StOSt, such as between 50 and 80 percent by weight of StOSt, such as between 60 and 70 percent by weight of StOSt, such as between 62 and 68 percent by weight of StOSt, such as between 63 and 67 percent by weight of StOSt.

7. A process according to Claim 5, in which the first shea olein fraction (5, SIP) comprises between 30 and 70 percent by weight of StOO, such as between 40 and 60 percent by weight of StOO, such as between 45 and 55 percent by weight of StOO, such as between 45 and 50 percent by weight of StOO, such as 46, 47, 48, or 49 percent by weight of StOO.

8. A process according to Claim 5 or 7, in which the first shea olein fraction (5, SIP) comprises between 1 and 20 percent by weight of OOO, such as between 5 and 15 percent by weight of OOO, such as between 8 and 12 percent by weight of OOO, such as 9, 10, or 11 percent by weight of OOO.

9. A process according to Claim 5, in which the temperature in the reaction system is between 45 and 75°C, such as between 45 and 70°C, such as between 50 and 70°C, such as between 60 and 70°C.

10. A process according to Claim 5 or 9, in which the water content of the first shea olein fraction (5,SIP) is between 0.01 and 0.5 percent by weight when it is fed into the reaction system, such as between 0.01 and 0.3 percent by weight, such as between 0.01 and 0.1 percent by weight, such as between 0.015 and 0.03 percent by weight.

11. A process according to Claim 5, in which the stearic acid source (6) is stearic acid.

12. A process according to Claim 11, in which the stearic acid source (6) is an ester of stearic acid.

13. A process according to Claim 12, in which the ester of stearic acid is a lower alkyl ester.

14. A process according to Claim 13, in which the lower alkyl ester is a methyl ester.

15. A process according to Claim 5, in which the transesterification product (8) is separated into at least a second shea olein fraction (14) and the second shea stearin fraction (15) by a fractionation process (13).

16. A process according to Claim 15, in which the fractionation (13) is a solvent fractionation comprising the steps of:

adding a solvent to the transesterification product (8);

adjusting the temperature according to a temperature profile; and

separating from the transesterification product (8) the second shea stearin fraction (15) and the second shea olein fraction (14).

17. A process according to Claim 16, in which the solvent comprises hexane.

18. A process according to Claim 16, in which the temperature profile comprises temperatures between -15 and 5°C, such as between -12 and 0°C , preferably between -10 and -2°C.

19. A process according to Claim 18, in which the end point temperature of the temperature profile is between -15 and 5°C, preferably between -10 and -2°C.

20. A process according to any of Claims 15 to 19, in which the second shea olein fraction (14) is recycled into the step of feeding the shea olein fraction, together with the stearic acid source (6), into the reaction system comprising immobilized enzymes having transesterification activity to produce the transesterification product (8).

21. A process according to any of Claims 5, 11, 12 and 15, in which a fatty acid ester mixture (19) comprising esters of stearic and/or oleic acid, are being separated from the transesterification product (8), this separated fatty acid ester mixture (19) being subjected to a

hydrogenation step (18) so as to increase the relative content of esters of stearic acid, and in which the hydrogenated esters (20) are recycled into the step of feeding the shea olein fraction, together with the stearic acid source (6) into a reaction system comprising immobilized enzymes having transesterification activity to produce the transesterification product (8).

22. A process according to Claim 21, in which the separation of esters of stearic and/or oleic acid from the transesterification product (8) comprises a distillation (17) to separate a fatty acid esters mixture (19) comprising esters of stearic and/or oleic acid from the transesterification product (8).

23. A process according to Claim 21 or 22, in which the hydrogenation step (18) comprises use of a nickel catalyst.

24. A process according to any of Claims 15 to 23, in which a purge stream is separated from the second shea olein fraction.

25. A process according to Claim 24, in which the purge stream comprises unsaponifiables.

26. A process according to Claim 24 or 25, in which the purge stream comprises triterpenyl esters.

27. A process according to Claim 5, in which between 40 and 100 percent by weight of the total content of triglycerides in the shea stearin output (9) are StOSt, such as between 50 and 100 percent by weight, such as between 60 and 100 percent by weight, such as between 60 and 80 percent by weight, such as between 60 and 70 percent by weight, preferably between 63 and 67 percent by weight, such as 66 percent by weight.

28. A process according to Claim 27, in which the content of StOSt relative to the total content of triglycerides in the shea stearin output (9) is increased by 5 to 100 percent by weight compared to the provided shea fat (SF) by means of the process, such as between 15 and 100 percent by weight, such as between 15 and 50 percent by weight, such as between 15 and 30 percent by weight, such as between 15 and 20 percent by weight, such as 16, 17, 18, 19, 20, 21, 22, 23, or 24 percent by weight.

29. A process according to Claim 27 or 28, in which the ratio between the stearic acid and oleic acid in the shea stearin output (9) is between 2:3 and 2:1.

30. A process according to Claim 27, 28 or 29, in which the ratio between the stearic acid and oleic acid in the shea stearin output (9) is between 6:5 and 2:1.

31. A process according to any of Claims 27 to 30, in which the yield of StOSt in the shea stearin output (9) is between 20 and 100 percent by weight higher than the content of StOSt in the shea fat (3, SF), such as between 30 and 100 percent by weight, such as between 40 and 80 percent by weight, such as between 50 and 70 percent by weight, such as 55, 60, or 65 percent by weight.

32. A process according to any of Claims 27 to 31in which the content of StOSt in the shea stearin output (9) is between 50 and 80 percent by weight, such as between 60 and 70 percent by weight, such as between 63 and 67 percent by weight.

33. A process according to any of Claims 27 to 32, in which the amount of StOSt in the shea stearin output is between 101 and 200 % of the amount of StOSt in the portion of shea fat used (9) to produce the shea stearin output (9), such as between 120 and 190 %, such as between 140 and 180 %, such as between 150 and 170%.

34. A process according to any of Claims 27 to 33, in which a subsequent step of mixing the shea stearin output (9) with a palm oil mid fraction (11, POMF) to obtain a cocoa butter equivalent (12, CBEO).

35. A process according to any of Claims 27 to 34, in which the cocoa butter equivalent (12, CBEO) comprises the shea stearin output (9) or a part thereof in the amount of between 40% and 50% by weight.

36. A process according to Claim 5, in which the enzymes comprise 1,3-specific enzymes.

37. A process according to Claim 36, in which the 1,3-specific enzymes comprise lipases.

38. A process according to any preceding claim, in which the process for efficient utilization of shea fat (3, SF) comprises a step (21) of removing karitene from the shea fat (3, SF) before the step of separating the shea fat (3, SF) into the first shea stearin fraction (4, FSS) the first shea olein fraction (5, SIP).

39. A process according to Claim 38, in which the concentration of karitene in the shea fat (3, SF) after the step of removing karitene is less than 0.6 percent by weight, such as less than

0.5 percent by weight, such as less than 0.4 percent by weight, such as less than 0.3 percent by weight, such as less than 0.2 percent by weight, such as less than 0.1 percent by weight.

40. A process according to Claim 38 or 39, in which the karitene is completely removed from the shea fat (3, SF).

41. A process according to any preceding claim, in which the shea fat (3, SF) is obtained from the shea nuts (1) by pressing and/or extraction.

42. A process according to Claim 5 or 15, in which the second shea stearin fraction (15, SSS) is subjected to a bleaching step.

43. A process according to Claim 15, in which the second shea olein fraction (14) is subjected to a bleaching step.

44. A process according to any preceding claim, the cocoa butter equivalent is subjected to a bleaching step.

45. A process for making cocoa butter equivalent (CBEO) from the shea stearin output (9) obtained by a process according to any of the preceding claims, and a palm oil mid fraction (POMF), in which between 1.2 and 2 kilograms of cocoa butter equivalent (CBEO) is produced for each kilogram of the shea fat (3, SF), such as between 1.4 and 1.8 kilograms, such as between 1.5 and 1.7 kilograms, such as 1.6 kilograms.

46. A system comprising:

a shea fat input (SFI) for receiving a shea fat;

a shea fat separator (SFS) adapted for separating shea fat into a first shea stearin fraction and a shea intermediate product;

a first processing line (FPL);

a second processing line (SPL) adapted for processing said shea intermediate product into a second shea stearin fraction;

a first stearin output (FSO) for outputting the first shea stearin fraction;

a second stearin output (SSO) for outputting the second shea stearin fraction; and

in which the system is adapted to operate according to a process according to any preceding claim.