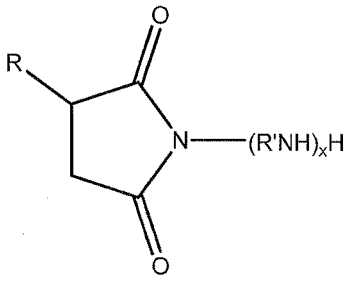
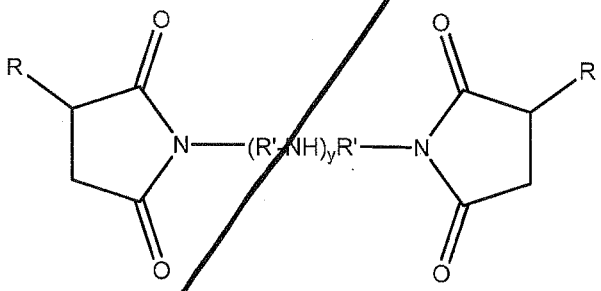
WHAT IS CLAIMED IS:

1. A process for preparing a molybdated succinimide complex, the process comprising:

(a) reacting an alkyl or alkenyl mono- or bis-succinimide of a polyamine of formula I or formula II or mixtures thereof:



Formula (I)



Formula (II)

wherein R is an alkyl or alkenyl group having a number average molecular weight of about 500 to about 5,000, R' is a straight or branched-chain alkylene group having 2 to 3 carbon atoms, x is 2 to 11, and y is 1 to 10, with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester, in a charge mole ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester to the succinimide of formula I or formula II or mixtures thereof of greater than 1.05:1 to about 6:1, and wherein the reaction temperature is in the range of from greater than 80°C to no greater than about 150°C; and

(b) reacting the succinimide product of step (a) with an acidic molybdenum compound to provide the molybdated succinimide complex, wherein the molybdated succinimide complex is a liquid at room temperature.

2. The process of Claim 1, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is selected from the group consisting of acrylic acid, methacrylic acid and mixtures thereof.

3. The process of Claim 1, wherein the acidic molybdenum compound is selected from the group consisting of molybdic acid, ammonium molybdate, sodium molybdate, potassium molybdates, hydrogen sodium molybdate, $MoOCl_4$, MoO_2Br_2, $Mo_2O_3Cl_6$, molybdenum trioxide and mixtures thereof.

4. The process of Claim 1, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is acrylic acid and the acidic molybdenum compound is molybdenum trioxide.

5. The process of Claim 1, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 6:1.

6. The process of Claim 1, wherein the molar ratio of the molybdenum compound to the succinimide product of step (a) is about 0.1:1 to about 2:1.

7. The process of Claim 1, wherein the alkyl or alkenyl succinimide of step (a) is a mixture of the succinimides of formula I and formula II.

8. The process of Claim 7, wherein the ratio of the succinimide of formula I to the succinimide of formula II in the succinimide mixture is from about 1:1 to 10:1.

9. The process of Claim 1, wherein the reaction temperature of step (a) is at least 90°C.

10. The process of Claim 1, wherein the reaction temperature of step (a) is at least 100°C.

11. The process of Claim 1, wherein the reaction temperature of step (a) is no greater than 140°C.

12. The process of Claim 1, wherein the molybdated succinimide complex is a molybdated mono- succinimide complex.

13. The process of Claim 1, wherein the molybdated succinimide complex is a molybdated bis- succinimide complex.

14. The process of Claim 1, wherein the molybdated succinimide complex is a mixture of molybdated mono- succinimide complex and molybdated bis- succinimide complex.

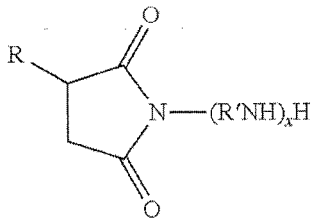
15. The product made by the process of Claim 1.

WHAT IS CLAIMED IS:

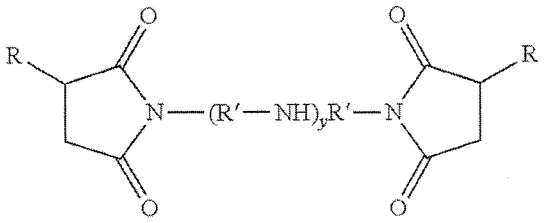
1. A process for preparing a molybdated succinimide complex, the process comprising:

(a) reacting an alkyl or alkenyl mono- or bis-succinimide of a polyamine of formula I or formula II or mixtures thereof:

Formula (I)



Formula (II)



wherein R is an alkyl or alkenyl group having a number average molecular weight of about 500 to about 5,000, R′ is a straight or branched-chain alkylene group having 2 to 3 carbon atoms, x is 2 to 11, and y is 1 to 10, with an α,β-unsaturated mono-carboxylic acid or carboxylic acid ester, in a charge mole ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester to the succinimide of formula I or formula II or mixtures thereof of greater than 1.05:1 to about 6:1, and wherein the reaction temperature is in the range of from greater than 80° C. to no greater than about 150° C.; and

(b) reacting the succinimide product of step (a) with an acidic molybdenum compound to provide the molybdated succinimide complex, wherein the molybdated succinimide complex is a liquid at room temperature.

2. The process of claim 1, wherein R is an alkyl or alkenyl group having a number average molecular weight of about 700 to about 2,500, R′ is an alkylene group having 2 carbon atoms, x is 2 to 5, and y is 1 to 4.

3. The process of claim 1, wherein R is an alkyl or alkenyl group having a number average molecular weight of about 710 to about 1,100, R′ is an alkylene group having 2 carbon atoms, x is 2 to 5, and y is 1 to 4.

4. The process of claim 1, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is selected from the group consisting of acrylic acid, methacrylic acid and mixtures thereof.

5. The process of claim 1, wherein the acidic molybdenum compound is selected from the group consisting of molybdic acid, ammonium molybdate, sodium molybdate, potassium molybdates, hydrogen sodium molybdate, $MoOCl_4$, MoO_2Br_2, $Mo_2O_3Cl_6$, molybdenum trioxide and mixtures thereof.

6. The process of claim 1, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is acrylic acid and the acidic molybdenum compound is molybdenum trioxide.

7. The process of claim 2, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is acrylic acid and the acidic molybdenum compound is molybdenum trioxide.

8. The process of claim 3, wherein the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester is acrylic acid and the acidic molybdenum compound is molybdenum trioxide.

9. The process of claim 1, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 6:1.

10. The process of claim 1, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 4:1.

11. The process of claim 1, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 2:1.

12. The process of claim 2, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 6:1.

13. The process of claim 2, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 4:1.

14. The process of claim 2, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 2:1.

15. The process of claim 3, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 6:1.

16. The process of claim 3, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 1.5:1 to about 4:1.

17. The process of claim 3, wherein the molar ratio of the α,β-unsaturated mono-carboxylic acid or carboxylic acid ester thereof to the succinimide of formula I or formula II or mixtures thereof is about 2:1.

18. The process of claim 1, wherein the molar ratio of the molybdenum compound to the succinimide product of step (a) is about 0.1:1 to about 2:1.

19. The process of claim 1, wherein the molar ratio of the molybdenum compound to the succinimide product of step (a) is about 0.5:1 to about 1.5:1.

20. The process of claim 1, wherein the molar ratio of the molybdenum compound to the succinimide product of step (a) is about 1:1.

21. The process of claim 1, wherein the alkyl or alkenyl succinimide of step (a) is a mixture of the succinimides of formula I and formula II.

22. The process of claim 21, wherein the ratio of the succinimide of formula I to the succinimide of formula II in the succinimide mixture is from about 1:1 to 10:1.

23. The process of claim 21, wherein the ratio of the succinimide of formula I to the succinimide of formula II in the succinimide mixture is at least about 4:1.

24. The process of claim 21, wherein the ratio of the succinimide of formula I to the succinimide of formula II in the succinimide mixture is about 9:1.

25. The process of claim 1, wherein the reaction temperature of step (a) is at least 90° C.

26. The process of claim 1, wherein the reaction temperature of step (a) is at least 100° C.

27. The process of claim 1, wherein the reaction temperature of step (a) is at least 120° C.

28. The process of claim 1, wherein the reaction temperature of step (a) is no greater than 140° C.

29. The process of claim 1, wherein the reaction temperature of step (a) is no greater than 135° C.

30. The process of claim 1, wherein the molybdated succinimide complex is a molybdated mono-succinimide complex.

31. The process of claim 1, wherein the molybdated succinimide complex is a molybdated bis-succinimide complex.

32. The process of claim 1, wherein the molybdated succinimide complex is a mixture of molybdated mono-succinimide complex and molybdated bis-succinimide complex.