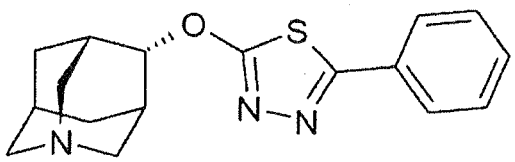
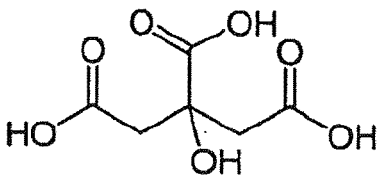
What is claimed is:

1. A crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate, wherin the *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane is represented by formula (I)



(I);

and wherein the dihydrogen citrate is represented by formula (II)



(2)

(II).

2. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 90% of the monohydrate form and not greater than 10% of the non-monohydrate form.

3. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 95% of the monohydrate form and not greater than 5% of the non-monohydrate form.

4. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 97% of the monohydrate form and not greater than 3% of the non-monohydrate form..

5. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, demonstrating at least one characteristic peak in the powder X-ray diffraction pattern at values in degrees two theta of 8.4 ± 0.20, 11.3 ± 0.20, 14.2 ± 0.20, 15.5 ± 0.20, 16.4 ± 0.20, 16.6 ± 0.20, 17.2 ± 0.20, 19.7 ± 0.20, 20.7 ± 0.20, 21.0 ± 0.20, 21.2 ± 0.20, 21.6 ± 0.20, 24.8 ± 0.20, and 26.9 ± 0.20.

6. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, having unit cell parameters wherein a is about 6.52 Å, b is about 20.99 Å, c is about 16.83 Å, α is about 90.0°, β is about 93.75°, γ is about 90.0°, the volume is about 2297.52 Å^3, and Z is about 4.

7. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate exhibits non-hygroscopic qualities when evaluated by dynamic moisture sorption gravimetry, having a weight loss of less than approximately 0.2% from relative humidities of 0% to 90%.

8. A crystalline monohydrate of claim 1 for use in treating or preventing conditions, disorders, or deficits modulated by α7 nicotinic acetylcholine receptors, α4β2 nicotinic acetylcholine receptors, or both α7 and α4β2 nicotinic acetylcholine receptors wherein the condition, disorder, or deficit is selected from the group consisting of a memory disorder, cognitive disorder, neurodegeneration, and neurodevelopmental disorder.

9. The use according to claim 8, wherein the condition or disorder is selected from the group consisting of attention deficit disorder, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease (AD), mild cognitive impairment, schizophrenia, age-associated memory impairment (AAMI), senile dementia, AIDS dementia, Pick's disease, dementia associated with Lewy bodies, dementia associated with Down's syndrome, amyotrophic lateral sclerosis, Huntington's disease, smoking cessation, nicotinic withdrawal syndrome, schizoaffective disorder, bipolar and manic disorders, diminished CNS function associated with traumatic brain injury, acute pain, post-surgical pain,

chronic pain, inflammatory pain, and neuropathic pain.

10. The use according to claim 8, wherein the condition or disorder is cognitive deficit associated with attention deficit hyperactivity disorder, schizophrenia, Alzheimer's disease, mild cognitive impairment, age-associated memory impairment, and cognitive deficits of schizophrenia.

11. The use according to claim 8, wherein said medicament according to claim 1 is to be administered in combination with an atypical antipsychotic.

12. A crystalline monohydrate of claim 1 for use of treating of preventing a condition or disorder selected from the group consisting of infertility, lack of circulation, need for new blood vessel growth associated with wound healing, need for new blood vessel growth associated with vascularization of skin grafts, ischemia, inflammation, arthritis and related disorders, wound healing, and complications associated with diabetes.

13. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate, the process comprising the steps of:

(a) dissolving *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane in at least one solvent at a temperature ranging from approximately 65° C to approximately 85° C;

(b) adjusting the temperature of the solution to a temperature ranging from approximately 55° C to approximately 75° C;

(c) adding at least one additional solvent to the solution and mixing;

(d) adjusting the temperature of the solutions to a temperature ranging from approximately 30° C to approximately 50° C;

(e) adding at least one additional solvent to the solution;

(f) maintaining the slurry at a temperature ranging from approximately 30° C to approximately 50° C;

(g) adjusting the temperature of the slurry to a temperature ranging from approximately -5° C to approximately 15° C;

(h) mixing the slurry for at least one hour; and

(i) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate.

14. The process of claim 13, wherein the solvent of step (a) comprises a combination of water and at least one other organic solvent, wherein the combination comprises a critical water activity of greater than or equal to 0.15.

15. The process of claim 14, wherein the at least one other solvent is selected from the group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, and mixtures thereof.

16. The process of claim 13, wherein the solvent of step (a) comprises a mixture of 2-propanol and water.

17. The process of claim 16, wherein the mixture of the at least one other solvent and water comprises a ratio of 2-propanol to water ranging from approximately 20:1 to approximately 1:10.

18. The process of claim 16, wherein the mixture of the at least one other solvent and water comprises a ratio of 2-propanol to water ranging from approximately 1:1 to approximately 7:1.

19. The process of claim 13, wherein the temperature of step (a) ranges from approximately 70° C to approximately 80° C.

20. The process of claim 13, wherein the temperature of step (a) ranges from approximately 74° C to approximately 76° C.

21. The process of claim 13, wherein step (b) comprises adjusting the temperature of the solution to a temperature of approximately 60° C to approximately 70° C.

22. The process of claim 13, wherein step (b) comprises adjusting the temperature of the solution to a temperature of approximately 64° C to approximately 66° C.

23. The process of claim 13, wherein the solvent of step (c) comprises an organic solvent, water, and combinations thereof.

24. The process of claim 13, wherein the solvent of step (c) is selected from the group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, water, and mixtures thereof.

25. The process of claim 13, wherein the solvent of step (c) comprises 2-propanol.

26. The process of claim 25, wherein the amount of 2-propanol used in step (c) comprises approximately 2 volumes to approximately 10 volumes compared to the amount of solvent used in step (a).

27. The process of claim 25, wherein the amount of 2-propanol used in step (c) comprises approximately 5 volumes to approximately 7 volumes compared to the amount of solvent used in step (a).

28. The process of claim 13, wherein step (d) comprises adjusting the temperature to approximately 35° C to approximately 45°C.

29. The process of claim 13, wherein step (d) comprises adjusting the temperature to approximately 39° C to approximately 41°C.

30. The process of claim 13, wherein the solvent of step (e) comprises an organic solvent, water, and combinations thereof.

31. The process of claim 13, wherein the solvent of step (e) is selected from the

group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, water, and mixtures thereof.

32. The process of claim 13, wherein the solvent of step (e) comprises 2-propanol.

33. The process of claim 32, wherein the amount of 2-propanol used in step (e) comprises approximately 1 volume to approximately 10 volumes compared to the amounts of solvent used in steps (a) and (c).

34. The process of claim 32, wherein the amount of 2-propanol used in step (e) comprises approximately 4 volumes to approximately 6 volumes compared to the amounts of solvent used in steps (a) and (c).

35. The process of claim 13, wherein step (f) comprises adjusting the temperature to approximately 35° C to approximately 45°C.

36. The process of claim 13, wherein step (f) comprises adjusting the temperature to approximately 39° C to approximately 41°C.

37. The process of claim 13, wherein step (g) comprises adjusting the temperature of the slurry to a temperature ranging from approximately 0° C to approximately 10° C.

38. The process of claim 13, wherein step (g) comprises adjusting the temperature of the slurry to a temperature ranging from approximately 4° C to approximately 6° C.

39. The process of claim 13, wherein step (i) comprises recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo [3.3.1.$1^{3,7}$] decane dihydrogen citrate by filtration.

40. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate the process

comprising the steps of:

(a) dissolving *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane in approximately 4 volumes of 2-propanol and approximately 1 volume of water at a temperature of approximately 75° C;

(b) adjusting the temperature of the solution to a temperature ranging from approximately 65° C;

(c) adding approximately 6 volumes of 2-propanol to the solution and mixing;

(d) adjusting the temperature to approximately 40° C;

(e) adding approximately 5 volumes of 2-propanol to the solution;

(f) maintaining the slurry at a temperature of approximately 40° C;

(g) adjusting the temperature of the slurry to a temperature of approximately 5° C;

(h) mixing the slurry; and

(i) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane.

41. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate, the process comprising the steps of:

(a) contacting anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate with a solvent in a reaction vessel;

(b) sealing the reaction vessel and protecting the suspension from light at ambient conditions; and

(c) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane.

42. The process of claim 41, wherein the solvent of step (a) comprises water.

43. The process of claim 42, wherein the amount of anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate comprises approximately 10 mg to approximately 500 mg, and wherein the amount of water comprises approximately 0.1 mL to approximately 2.0 mL.

44. The process of claim 42, wherein the amount of anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate comprises approximately 50 mg to approximately 150 mg, and wherein the amount of water comprises approximately 0.8 mL to approximately 1.2 mL.

45. The process of claim 41, wherein the solvent of step (a) comprises a mixture of an organic solvent and water, wherein the mixture comprises a critical water activity of greater than or equal to 0.15.

46. The process of claim 45, wherein the organic solvent comprises methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, and mixtures thereof.

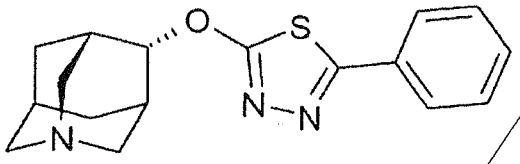
47. A pharmaceutical composition comprising the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate as an active ingredient and a pharmaceutically acceptable carrier, diluent, or excipient.

48. The pharmaceutical composition of claim 47, wherein the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate is present in an amount ranging from approximately 0.1% to approximately 99.9% by weight based on the total weight of the composition.

49. The pharmaceutical composition of claim 47, wherein the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate demonstrates at least one characteristic peak in the powder X-ray diffraction pattern at values in degrees two theta of 8.4 ± 0.20, 11.3 ± 0.20, 14.2 ± 0.20, 15.5 ± 0.20, 16.4 ± 0.20, 16.6 ± 0.20, 17.2 ± 0.20, 19.7 ± 0.20, 20.7 ± 0.20, 21.0 ± 0.20, 21.2 ± 0.20, 21.6 ± 0.20, 24.8 ± 0.20, and 26.9 ± 0.20.

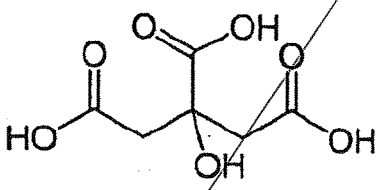
What is claimed is:

1. A crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate, wherin the *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane is represented by formula (I)



(I);

and wherein the dihydrogen citrate is represented by formula (II)



(2)

(II).

2. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 90% of the monohydrate form and not greater than 10% of the non-monohydrate form.

3. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 95% of the monohydrate form and not greater than 5% of the non-monohydrate form.

4. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate comprises a purity of at least 97% of the monohydrate form and not greater than 3% of the non-monohydrate form.

5. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, demonstrating at least one characteristic peak in the powder X-ray diffraction pattern at values in degrees two theta of 8.4 ± 0.20, 11.3 ± 0.20, 14.2 ± 0.20, 15.5 ± 0.20, 16.4 ± 0.20, 16.6 ± 0.20, 17.2 ± 0.20, 19.7 ± 0.20, 20.7 ± 0.20, 21.0 ± 0.20, 21.2 ± 0.20, 21.6 ± 0.20, 24.8 ± 0.20, and 26.9 ± 0.20.

6. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, having unit cell parameters wherein a is about 6.52 Å, b is about 20.99 Å, c is about 16.83 Å, α is about 90.0°, β is about 93.75°, γ is about 90.0°, the volume is about 2297.52 Å^3, and Z is about 4.

7. The crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate of claim 1, wherein the monohydrate exhibits non-hygroscopic qualities when evaluated by dynamic moisture sorption gravimetry, having a weight loss of less than approximately 0.2% from relative humidities of 0% to 90%.

8. A crystalline monohydrate of claim 1 for use in treating or preventing conditions, disorders, or deficits modulated by α7 nicotinic acetylcholine receptors, α4β2 nicotinic acetylcholine receptors, or both α7 and α4β2 nicotinic acetylcholine receptors wherein the condition, disorder, or deficit is selected from the group consisting of a memory disorder, cognitive disorder, neurodegeneration, and neurodevelopmental disorder.

9. The use according to claim 8, wherein the condition or disorder is selected from the group consisting of attention deficit disorder, attention deficit hyperactivity disorder (ADHD), Alzheimer's disease (AD), mild cognitive impairment, schizophrenia, age-associated memory impairment (AAMI), senile dementia, AIDS dementia, Pick's disease, dementia associated with Lewy bodies, dementia associated with Down's syndrome, amyotrophic lateral sclerosis, Huntington's disease, smoking cessation, nicotinic withdrawal syndrome, schizoaffective disorder, bipolar and manic disorders, diminished CNS function associated with traumatic brain injury, acute pain, post-surgical pain,

chronic pain, inflammatory pain, and neuropathic pain.

10. The use according to claim 8, wherein the condition or disorder is cognitive deficit associated with attention deficit hyperactivity disorder, schizophrenia, Alzheimer's disease, mild cognitive impairment, age-associated memory impairment, and cognitive deficits of schizophrenia.

11. The use according to claim 8, wherein said medicament according to claim 1 is to be administered in combination with an atypical antipsychotic.

12. The use according to claim 8, wherein the condition or disorder is selected from the group consisting of infertility, lack of circulation, need for new blood vessel growth associated with wound healing, need for new blood vessel growth associated with vascularization of skin grafts, ischemia, inflammation, arthritis and related disorders, wound healing, and complications associated with diabetes.

13. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate, the process comprising the steps of:

(a) dissolving *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane in at least one solvent at a temperature ranging from approximately 65° C to approximately 85° C;

(b) adjusting the temperature of the solution to a temperature ranging from approximately 55° C to approximately 75° C;

(c) adding at least one additional solvent to the solution and mixing;

(d) adjusting the temperature of the solutions to a temperature ranging from approximately 30° C to approximately 50° C;

(e) adding at least one additional solvent to the solution;

(f) maintaining the slurry at a temperature ranging from approximately 30° C to approximately 50° C;

(g) adjusting the temperature of the slurry to a temperature ranging from approximately -5° C to approximately 15° C;

(h) mixing the slurry for at least one hour; and

(i) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate.

14. The process of claim 13, wherein the solvent of step (a) comprises a combination of water and at least one other organic solvent, wherein the combination comprises a critical water activity of greater than or equal to 0.15.

15. The process of claim 14, wherein the at least one other solvent is selected from the group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, and mixtures thereof.

16. The process of claim 13, wherein the solvent of step (a) comprises a mixture of 2-propanol and water.

17. The process of claim 16, wherein the mixture of the at least one other solvent and water comprises a ratio of 2-propanol to water ranging from approximately 20:1 to approximately 1:10.

18. The process of claim 16, wherein the mixture of the at least one other solvent and water comprises a ratio of 2-propanol to water ranging from approximately 1:1 to approximately 7:1.

19. The process of claim 13, wherein the temperature of step (a) ranges from approximately 70° C to approximately 80° C.

20. The process of claim 13, wherein the temperature of step (a) ranges from approximately 74° C to approximately 76° C.

21. The process of claim 13, wherein step (b) comprises adjusting the temperature of the solution to a temperature of approximately 60° C to approximately 70° C.

22. The process of claim 13, wherein step (b) comprises adjusting the temperature of the solution to a temperature of approximately 64° C to approximately 66° C.

23. The process of claim 13, wherein the solvent of step (c) comprises an organic solvent, water, and combinations thereof.

24. The process of claim 13, wherein the solvent of step (c) is selected from the group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, water, and mixtures thereof.

25. The process of claim 13, wherein the solvent of step (c) comprises 2-propanol.

26. The process of claim 25, wherein the amount of 2-propanol used in step (c) comprises approximately 2 volumes to approximately 10 volumes compared to the amount of solvent used in step (a).

27. The process of claim 25, wherein the amount of 2-propanol used in step (c) comprises approximately 5 volumes to approximately 7 volumes compared to the amount of solvent used in step (a).

28. The process of claim 13, wherein step (d) comprises adjusting the temperature to approximately 35° C to approximately 45°C.

29. The process of claim 13, wherein step (d) comprises adjusting the temperature to approximately 39° C to approximately 41°C.

30. The process of claim 13, wherein the solvent of step (e) comprises an organic solvent, water, and combinations thereof.

31. The process of claim 13, wherein the solvent of step (e) is selected from the

group consisting of methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, water, and mixtures thereof.

32. The process of claim 13, wherein the solvent of step (e) comprises 2-propanol.

33. The process of claim 32, wherein the amount of 2-propanol used in step (e) comprises approximately 1 volume to approximately 10 volumes compared to the amounts of solvent used in steps (a) and (c).

34. The process of claim 32, wherein the amount of 2-propanol used in step (e) comprises approximately 4 volumes to approximately 6 volumes compared to the amounts of solvent used in steps (a) and (c).

35. The process of claim 13, wherein step (f) comprises adjusting the temperature to approximately 35° C to approximately 45°C.

36. The process of claim 13, wherein step (f) comprises adjusting the temperature to approximately 39° C to approximately 41°C.

37. The process of claim 13, wherein step (g) comprises adjusting the temperature of the slurry to a temperature ranging from approximately 0° C to approximately 10° C.

38. The process of claim 13, wherein step (g) comprises adjusting the temperature of the slurry to a temperature ranging from approximately 4° C to approximately 6° C.

39. The process of claim 13, wherein step (i) comprises recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo [3.3.1.$1^{3,7}$] decane dihydrogen citrate by filtration.

40. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate the process

comprising the steps of:

(a) dissolving *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane in approximately 4 volumes of 2-propanol and approximately 1 volume of water at a temperature of approximately 75° C;

(b) adjusting the temperature of the solution to a temperature ranging from approximately 65° C;

(c) adding approximately 6 volumes of 2-propanol to the solution and mixing;

(d) adjusting the temperature to approximately 40° C;

(e) adding approximately 5 volumes of 2-propanol to the solution;

(f) maintaining the slurry at a temperature of approximately 40° C;

(g) adjusting the temperature of the slurry to a temperature of approximately 5° C;

(h) mixing the slurry; and

(i) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane.

41. A process for preparing a crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate, the process comprising the steps of:

(a) contacting anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate with a solvent in a reaction vessel;

(b) sealing the reaction vessel and protecting the suspension from light at ambient conditions; and

(c) recovering the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane.

42. The process of claim 41, wherein the solvent of step (a) comprises water.

43. The process of claim 42, wherein the amount of anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.$1^{3,7}$]decane dihydrogen citrate comprises approximately 10 mg to approximately 500 mg, and wherein the amount of water comprises approximately 0.1 mL to approximately 2.0 mL.

44. The process of claim 42, wherein the amount of anhydrous *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate comprises approximately 50 mg to approximately 150 mg, and wherein the amount of water comprises approximately 0.8 mL to approximately 1.2 mL.

45. The process of claim 41, wherein the solvent of step (a) comprises a mixture of an organic solvent and water, wherein the mixture comprises a critical water activity of greater than or equal to 0.15.

46. The process of claim 45, wherein the organic solvent comprises methanol, ethanol, 2-propanol, butanol, butanol acetonitrile, acetone, formamide, dimethyl formamide, toluene, benzene, anisole, ethyl acetate, isopropyl acetate, tetrahydrofuran, 1,4-dioxane, methyl tert-butyl ether, dichloromethane, chloroform, hexanes, n-heptane, 2-butanone, dimethyl sulfoxide, nitromethane, 1-methyl-2-pyrrolidone, triethylamine, tributylamine, triflourotoluene, and mixtures thereof.

47. A pharmaceutical composition comprising the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate as an active ingredient and a pharmaceutically acceptable carrier, diluent, or excipient.

48. The pharmaceutical composition of claim 47, wherein the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate is present in an amount ranging from approximately 0.1% to approximately 99.9% by weight based on the total weight of the composition.

49. The pharmaceutical composition of claim 47, wherein the crystalline monohydrate of *(4s)*-4-(5-phenyl-1,3,4-thiadiazol-2-yloxy)-1-azatricyclo[3.3.1.1^{3,7}]decane dihydrogen citrate demonstrates at least one characteristic peak in the powder X-ray diffraction pattern at values in degrees two theta of 8.4 ± 0.20, 11.3 ± 0.20, 14.2 ± 0.20, 15.5 ± 0.20, 16.4 ± 0.20, 16.6 ± 0.20, 17.2 ± 0.20, 19.7 ± 0.20, 20.7 ± 0.20, 21.0 ± 0.20, 21.2 ± 0.20, 21.6 ± 0.20, 24.8 ± 0.20, and 26.9 ± 0.20.