

CLAIMS

1. A method for producing a solution of ammonium carbamate comprising:
providing an aqueous solution of ammonium hydroxide;
providing sodium bicarbonate; and
mixing said solution of ammonium hydroxide with said sodium bicarbonate to produce said solution of ammonium carbamate.
2. The method according to claim 1, wherein said solution of ammonium hydroxide has a concentration of about 25-28% (as ammonia).
3. The method according to claim 1 or claim 2, wherein said sodium bicarbonate is added as a solid to said solution of ammonium hydroxide.
4. The method according to claim 1 or claim 2, wherein said solution of ammonium hydroxide is added to an aqueous slurry of said sodium bicarbonate.
5. The method according to claim 4, wherein said slurry further comprises ammonium carbamate.
6. The method according to claim 5, wherein the weight ratio of said ammonium carbamate to said sodium bicarbonate prior to adding said ammonium hydroxide is from 1:10 to 1:1.
7. The method according to claim 5 or claim 6, wherein the weight ratio of said ammonium carbamate to said sodium bicarbonate prior to adding said ammonium hydroxide is from 1:2.5 to 1:1.5.
8. The method according to any one of claims 5 to 7, wherein ammonium carbamate does not crystallize from said solution of ammonium carbamate when stored at 0 °C.

9. The method according to any one of claims 5 to 8, wherein ammonium carbamate does not crystallize from said solution of ammonium carbamate when stored at -5 °C.

10. The method according to any one of claims 5 to 9, wherein ammonium carbamate does not crystallize from said solution of ammonium carbamate when stored at -10 °C.

11. The method according to any one of claims 1 to 10, further comprising monitoring the conductivity of said solution of ammonium carbamate during said mixing.

12. The method according to any one of claims 1 to 11, further comprising monitoring the temperature of said solution of ammonium carbamate during said mixing.

13. The method according to any one of claims 1 to 12, further comprising monitoring the pH of said solution of ammonium carbamate during said mixing.

14. The method according to any one of claims 1 to 13, wherein the concentration of said solution of ammonium carbamate at the end of said mixing is from about 15% to about 25%.

15. The method according to any one of claims 1 to 14, wherein the concentration of said solution of ammonium carbamate at the end of said mixing is about 20%.

16. The method according to any one of claims 1 to 15, wherein the pH of said solution of ammonium carbamate at the end of said mixing is at least 10.0.

17. The method according to any one of claims 1 to 16, wherein the pH of said solution of ammonium carbamate at the end of said mixing is at least 10.4.

18. The method according to any one of claims 1 to 17, wherein the pH of said solution of ammonium carbamate at the end of said mixing is at least 10.68.

19. The method according to any one of claims 1 to 18, wherein the conductivity of said solution of ammonium carbamate at the end of said mixing is between about 70 and about 130 mS/cm.

20. The method according to any one of claims 1 to 19, wherein the conductivity of said solution of ammonium carbamate at the end of said mixing is between about 80 and about 120 mS/cm.

21. The method according to any one of claims 1 to 20, wherein the conductivity of said solution of ammonium carbamate at the end of said mixing is between about 90 and about 110 mS/cm.

22. The method according to any one of claims 1 to 21, further comprising producing a biocide by mixing said solution of ammonium carbamate with a solution of a hypochlorite oxidant.

23. The method according to claim 22, wherein said hypochlorite oxidant is sodium hypochlorite.

24. The method according to claim 22 or claim 23, wherein said solution of a hypochlorite oxidant has a concentration from about 1000 to about 20,000 ppm.

25. The method according to any one of claims 22 to 24, wherein said solution of a hypochlorite oxidant has a concentration from about 3000 to about 10,000 ppm.

26. The method according to any one of claims 22 to 25, wherein said solution of a hypochlorite oxidant has a concentration from about 3500 to about 7000 ppm.

27. The method according to any one of claims 22 to 26, wherein said mixing said solution of ammonium carbamate with said solution of a hypochlorite oxidant comprises:

diluting said solution of ammonium carbamate with water or with a portion of said solution of a hypochlorite oxidant to form an ammonium carbamate dilution; and

adding a portion of said solution of a hypochlorite oxidant to said ammonium carbamate dilution.

28. The method according to claim 27, wherein said ammonium carbamate dilution has an ammonium carbamate concentration from about 1,000 to about 50,000 ppm.

29. The method according to claim 27 or claim 28, wherein said ammonium carbamate dilution has an ammonium carbamate concentration from about 12,000 to about 30,000 ppm.

30. The method according to any one of claims 27 to 29, further comprising monitoring the conductivity of the biocide during said adding.