CLAIMS

1. A method for producing mesoporous beta zeolites comprising:

providing parent beta zeolites having a molar ratio of silicon to aluminum of at least 10;

selecting a target average mesopore size between 2 nm and 8 nm for the parent beta zeolites;

selecting a pore directing agent (PDA) based on the target average mesopore size, where a small cationic surfactant is selected as the PDA when the target average mesopore size is at least 5 nm, and a large cationic surfactant is selected as the PDA when the target average mesopore size is less than 5 nm, where the large cationic surfactant has a molecular weight of greater than 100 grams/mole, and the small cationic surfactant has a molecular weight of less than 100 grams/mole;

adding the selected PDA to an alkaline solution to form a PDA-base mixture; and

adding the parent beta zeolites to the PDA-base mixture to produce the mesoporous beta zeolites having an average mesopore size corresponding to the target average mesopore size.

2. The method of claim 1, wherein the molar ratio of silicon to aluminum is from 14 to 300.

3. The method of claim 1, wherein the molar ratio of silicon to aluminum is from 50 to 250.

4. The method of claim 1, wherein the large cationic surfactant and the small cationic surfactant are quaternary ammonium compounds.

5. The method of claim 1, wherein the selected PDA is the large cationic surfactant, the large cationic surfactant comprising dodecyltrimethylammonium, cetyltrimethylammonium, propyltrimethylammonium, tetraethylammonium, tetrapropylammonium, octyltrimethylammonium, or combinations thereof.

6. The method of claim 1, wherein the selected PDA is the small cationic surfactant and comprises tetramethylammonium.

7. The method of claim 1, wherein the alkaline solution comprises NaOH, KOH, or CsOH.

8. The method of claim 7, wherein the alkaline solution comprises NaOH.

9. The method of claim 1, wherein the mesoporous beta zeolites have a BET surface area greater than 700 m^2/g and the average mesopore size is less than 5 nm.

10. The method of claim 1, wherein the mesoporous beta zeolites have a BET surface area less than 700 m^2/g and the average mesopore size is at least 5 nm.

11. A method for producing mesoporous beta zeolites comprising:

providing parent beta zeolites having a molar ratio of silicon to aluminum of at least 10;

selecting a pore directing agent (PDA) based on the target average mesopore size, where a large cationic surfactant is selected as the PDA when the target average mesopore size is less than 5 nm;

adding the PDA comprising cationic surfactant having a molecular weight of more than 100 grams/mole to an alkaline solution to form a PDA-base mixture; and

adding the parent beta zeolites to the PDA-base mixture to produce the mesoporous beta zeolites having an average size of less than 5 nm.

12. The method of claim 11, wherein the molar ratio of silicon to aluminum is from 14 to 300.

13. A method for producing mesoporous beta zeolites comprising:

providing parent beta zeolites having a molar ratio of silicon to aluminum of at least 10;

selecting a pore directing agent (PDA) based on the target average mesopore size, where a small cationic surfactant is selected as the PDA when the target average mesopore size is at least 5 nm;

adding the PDA comprising cationic surfactant having a molecular weight of less than 100 grams/mole to an alkaline solution to form a PDA-base mixture; and

adding the parent beta zeolites to the PDA-base mixture to produce the mesoporous beta zeolites having an average size of at least 5 nm.

14. The method of claim 13, wherein the molar ratio of silicon to aluminum is from 14 to 300.

15. The method of claim 13, wherein the molar ratio of silicon to aluminum is from 50 to 250.

16. The method of claim 13, wherein the mesoporous beta zeolites have a BET surface area less than 700 m^2/g.

17. A method of for producing mesoporous beta zeolites comprising:

providing parent beta zeolites having a molar ratio of silicon to aluminum of at least 10;

selecting a pore directing agent (PDA) based on the target average mesopore size, where a non-ionic surfactant is selected as the PDA when the target average mesopore size is at least 2 nm;

adding the PDA comprising a non-ionic surfactant to an alkaline solution to form a PDA-base mixture; and

adding the parent beta zeolites to the PDA-base mixture to produce the mesoporous beta zeolites having an average mesopore size greater than 2 nm.

18. The method of claim 17, wherein the molar ratio of silicon to aluminum is from 14 to 300.

19. The method of claim 17, wherein the molar ratio of silicon to aluminum is from 50 to 250.

20. The method of claim 17, wherein the amine compound has from 2 to 6 carbon atoms.