CLAIMS:

1. A method of removing ionic species from a desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising a desalination unit and a precipitation unit, the wash stream flowing at a linear velocity of at least 5 cm/second through the desalination unit, the wash stream becoming more saline after passage through the desalination unit;

(b) removing a portion of calcium sulfate from the wash stream by precipitation in the precipitation unit to obtain a supersaturation degree of calcium sulfate in the wash stream entering the desalination unit in a range of from about 1.0 to about 3.0.

2. The method according to claim 1, wherein the desalination unit is a supercapacitive desalination unit operating in a discharge mode.

3. The method according to claim 2, wherein the desalination unit is additionally operated at least periodically in a charge mode, in which a feed stream becomes less saline after passage through the desalination unit.

4. The method according to claim 3, wherein the discharge mode alternates with the charge mode.

5. The method according to claim 1, wherein a portion of the calcium sulfate in the precipitation unit is removed as a waste stream.

6. The method according to claim 5, wherein the waste stream comprises a liquid, the liquid having a volume corresponding to from about 0.5 to about 30 percent of a total volume of a feed stream presented to the desalination unit.

7. The method according to claim 5, wherein the waste stream comprises a liquid, the liquid having a volume corresponding to from about 1 to about 20 percent of a total volume of a feed stream presented to the desalination unit.

8. The method according to claim 5, wherein the waste stream comprises a liquid, the liquid having a volume corresponding to from about 1 to about 10 percent of a total volume of a feed stream presented to the desalination unit.

9. The method according to claim 5, wherein the waste stream comprises a liquid, the liquid having a volume corresponding to from about 1 to about 5 percent of a total volume of a feed stream presented to the desalination unit.

10. The method according to claim 5, wherein the waste stream comprises solid calcium sulfate.

11. The method according to claim 1, wherein the supersaturation degree of calcium sulfate in the wash stream entering the desalination unit is in a range of from about 1.0 to about 2.0.

12. The method according to claim 1, wherein the supersaturation degree of calcium sulfate in the wash stream entering the desalination unit is in a range of from about 1.0 to about 1.5.

13. The method according to claim 1, wherein the linear velocity of the wash stream in the desalination unit is in a range of from about 5 cm/sec to about 100 cm/sec.

14. The method according to claim 1, wherein the linear velocity of the wash stream in the desalination unit is in a range of from about 5 cm/sec to about 50 cm/sec.

15. The method according to claim 1, wherein a residence time of the wash stream in the precipitation unit is in a range of from about 3 minutes to about 300 minutes.

16. The method according to claim 1, wherein a residence time of the wash stream in the precipitation unit is in a range of from about 3 minutes to about 60 minutes.

17. The method according to claim 1, wherein the precipitation unit comprises at least one of a stirred tank, a settling tank, and a clarifier unit.

18. The method according to claim 1, wherein the desalination unit is an electrodialysis desalination unit.

19. A method for removing calcium sulfate from a supercapacitive desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising a supercapacitive desalination unit and a precipitation unit, the wash stream flowing at a linear velocity of at least 5 cm/second through the supercapacitive desalination unit, the wash stream having a higher concentration of calcium sulfate after passage through the supercapacitive desalination unit;

(b) removing a portion of the calcium sulfate from the precipitation unit to obtain a supersaturation degree of calcium sulfate in the wash stream entering the supercapacitive desalination unit in a range of from about 1.0 to about 2.0.

20. A method for removing calcium sulfate from an electrodialysis desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising an electrodialysis desalination unit and a precipitation unit, the wash stream flowing at a linear velocity of at least 5 cm/second through the electrodialysis desalination unit, the wash stream having a higher concentration of calcium sulfate after passage through the electrodialysis desalination unit;

(b) removing a portion of the calcium sulfate from the precipitation unit to obtain a supersaturation degree of calcium sulfate in the wash stream entering the electrodialysis desalination unit in a range of from about 1.0 to about 2.0.

CLAIMS

1. A method of removing ionic species from a desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising a desalination unit and a precipitation unit, the wash stream flowing at a linear velocity in a range of from about 8.6 cm/sec to about 25.7 cm/sec through the desalination unit, the wash stream comprising solid calcium sulfate, the wash stream becoming more saline after passage through the desalination unit, a residence time of the wash stream in the precipitation unit being in a range of from about 3 minutes to about 300 minutes;

(b) removing a portion of calcium sulfate from the wash stream by physical precipitation in the precipitation unit;

(c) removing a waste stream from the precipitation unit and providing a make-up stream into the precipitation unit to maintain a supersaturation degree of calcium sulfate in the wash stream entering the desalination unit in a range of from about 1.0 to about 1.5, wherein the waste stream comprises a liquid and the liquid has a volume corresponding to from about 1 to about 10 percent of a total volume of a feed stream presented to the desalination unit; and

(d) switching an inlet stream of the desalination unit from the wash stream to the feed stream before switching an outlet stream of the desalination unit from the wash stream to a recovery stream, the recovery stream having a lower concentration of ionic species than the feed stream.

2. The method according to claim 1, wherein a residence time of the wash stream in the precipitation unit is in a range of from about 3 minutes to about 60 minutes.

3. The method according to claim 1, wherein the precipitation unit comprises at least one of a stirred tank, a settling tank, and a clarifier unit.

4. The method according to claim 1, wherein the desalination unit is an electrodialysis desalination unit.

5. The method according to claim 1, wherein a portion of the calcium sulfate in the precipitation unit is removed in the waste stream.

6. The method according to claim 5, wherein the liquid having a volume corresponding to from about 1 to about 5 percent of a total volume of a feed stream presented to the desalination unit.

7. The method according to claim 5, wherein the waste stream comprises solid calcium sulfate.

8. The method according to claim 1, wherein the desalination unit is a supercapacitive desalination unit operating in a discharge mode when the inlet stream is the wash stream.

9. The method according to claim 8, wherein in a charge mode, the feed stream becomes the recovery stream after passage through the desalination unit.

10. The method according to claim 9, wherein the discharge mode alternates with the charge mode.

11. A method for removing calcium sulfate from a supercapacitive desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising a supercapacitive desalination unit and a precipitation unit, the wash stream flowing at a linear velocity in a range of from about 8.6 cm/sec to about 25.7 cm/sec through the supercapacitive desalination unit, the wash stream comprising solid calcium sulfate,the wash stream having a higher concentration of calcium sulfate after passage through the supercapacitive desalination unit, a residence time of the wash stream in the precipitation unit being in a range of from about 3 minutes to about 300 minutes;

(b) removing a portion of the calcium sulfate by physical precipitation in the precipitation unit; and

(c) removing a waste stream from the precipitation unit and providing a make-up stream into the precipitation unit to maintain a supersaturation degree of calcium sulfate in the wash stream entering the supercapacitive desalination unit in a range of from about 1.0 to about 1.5, wherein the waste stream comprises a liquid and the liquid has a volume corresponding to from about 1 to about 10 percent of a total volume of a feed stream presented to the supercapacitive desalination unit; and

(d) switching an inlet stream of the supercapacitive desalination unit from the wash stream to the feed stream before switching an outlet stream of the supercapacitive desalination unit from the wash stream to a recovery stream, the recovery stream having a lower concentration of ionic species than the feed stream.

12. A method for removing calcium sulfate from an electrodialysis desalination unit, comprising:

(a) circulating a wash stream in a closed loop comprising an electrodialysis desalination unit and a precipitation unit, the wash stream flowing at a linear velocity in a range of from about 8.6 cm/sec to about 25.7 cm/sec through the electrodialysis desalination unit, the wash stream comprising solid calcium sulfate, the wash stream having a higher concentration of calcium sulfate after passage through the electrodialysis desalination unit, a residence time of the wash stream in the precipitation unit being in a range of from about 3 minutes to about 300 minutes;

(b) removing a portion of the calcium sulfate by physical precipitation in the precipitation unit; and

(c) removing a waste stream from the precipitation unit and providing a make-up stream into the precipitation unit to maintain a supersaturation degree of calcium sulfate in the wash stream entering the electrodialysis desalination unit in a range of from about 1.0 to about 1.5, wherein the waste stream comprises a liquid and the liquid has a volume corresponding to from about 1 to about 10 percent of a total volume of a feed stream presented to the electrodialysis desalination unit; and

(d) switching an inlet stream of the electrodialysis desalination unit from the wash stream to the feed stream before switching an outlet stream of the electrodialysis desalination unit from the wash stream to a recovery stream, the recovery stream having a lower concentration of ionic species than the feed stream.