WHAT IS CLAIMED IS:

1. A desalination system (10) for ion removal from an aqueous stream, wherein the desalination system comprises at least one desalination cell (11) configured to receive a first feed stream (13) and to produce an effluent stream (14) having a lower concentration of charged species than that of the first feed stream (13), wherein each desalination cell (11) comprises:

a first and second electrodes (22, 23);

an anion exchange layer (24) and a cation ion exchange layer (25) disposed on the respective first and second electrodes (22, 23);

a spacer (26) disposed between the first electrode (22) and the second electrode (23); and

an ion exchange resin (27) disposed between the first electrode (22) and second electrode (23) , wherein the ion exchange resin (27) comprises a mixture of anion exchange resin beads (28) and cation exchange resin beads (29), and wherein a proportion of volumes of the anion exchange resin beads (28) and the cation exchange resin beads (29) is 1:1, wherein the desalination system further comprises an electrodeionization (EDI) apparatus (12) in fluid communication with the at least one desalination cell (11) for further processing of the effluent stream (14) from the at least one desalination cell (11).

2. The desalination system (10) according to claim 1, wherein the ion exchange resin (27) demarcates flow paths through which the first feed stream (13) flows.

3. The desalination system (10) according to claim 1 or claim 2, wherein the first and the second electrodes (22, 23) are concentrically disposed and a spiral continuous space is formed between the electrodes.

4. The desalination system (10) according to any one of claim 1 to claim 3, wherein a distance between the first electrode (22) and the second electrode (23) is in a range of from 2 mm to 20 mm.

5. The desalination system (10) according to claim 4, wherein the distance between the first electrode (22) and the second electrode (23) is 8 mm.

6. The desalination system (10) according to any one of claim 1 to claim 5, wherein the desalination system (10) comprises a plurality of the desalination cells (11) stacked together with at least one insulating separator (31) disposed between the adjacent pair of desalination cells.

7. The desalination system (10) according to any one of claim 1 to claim 6, wherein the at least one desalination cell (11) is further configured so as to receive the second feed stream (15) and to produce a concentrate stream (16) in a state of discharge of the at least one desalination cell (11).

8. The desalination system (10) according to any one of claim 1 to claim 7, wherein the at least one desalination cell (11) is configured to remove hardness ions from the first feed stream (13).

9. A desalination system (10) for ion removal from an aqueous stream, wherein the desalination system comprises:

a desalination device (32) configured to receive a first feed stream (13) and to produce an effluent stream (14) having a lower concentration of charged species than that of the first feed stream (13), wherein the desalination device (32) comprises:

a first and second electrodes (22, 23);

at least one bipolar electrode (33) disposed between the first electrode (22) and the second electrode (23);

a plurality of spacers (26) disposed between each pair of the adjacent electrodes (22, 33, 33,23);

an anion exchange layer (24) and a cation exchange layer (25) disposed on the respective electrodes of each adjacent pair of electrodes (22, 33, 33,23); and

an ion exchange resin (27) disposed between each adjacent pair of electrodes (22, 33; 33,23), wherein the ion exchange resin (27) comprises a

mixture of anion exchange resin beads (28) and cation exchange resin beads (29), and wherein a proportion of volumes of the anion exchange resin beads (28) and the cation exchange resin beads (29) is 1:1, wherein the desalination system further comprises an EDI apparatus (12) in fluid communication with the desalination device (32) for further processing of the effluent stream (14) from the desalination device (32).

10. The desalination system (10) according to claim 9, wherein a distance between each adjacent pair of electrodes (22, 33; 33, 23) is in a range of from 2 mm to 20 mm.

11. The desalination system (10) according to claim 10, wherein the distance between each adjacent pair of electrodes (22, 33; 33, 23) is 8 mm.

12. The desalination system (10) according to any one of claim 9 to claim 11, wherein the ion exchange resin (27) demarcates flow paths through which the first feed stream (13) flows.

13. The desalination system (10) according to any one of claim 9 to claim 12, wherein the desalination device (32) is further configured so as to receive the second feed stream (15) and to produce a concentrate stream (16) in a state of discharge of the desalination device (32).

14. A method for ion removal from an aqueous stream using the desalination system (10) according to any one of claim 1 to claim 13 comprising:

making the first feed stream (13) run through the ion exchange resin (27) of the desalination cell(s) (11) or the desalination device (32) in a state of charge the desalination cell(s) (11) or the desalination device (32), to produce an effluent stream (14);

introducing the effluent stream (14) into the EDI apparatus (12) for further processing;

making the second feed stream (15) run through the ion exchange resin in a state of discharge of the desalination cell(s) (11) or the desalination device

(32), and driving ions removed from the first feed stream (13) out of the desalination cell(s) (11) or the desalination device (32) to produce a concentrate stream (16).

15. The method according to claim 14, further comprising recirculating the concentrate stream (16) into the second feed stream (15).

16. The method according to claim 14, wherein the first feed stream (14) works as the second feed stream (15) in a state of discharge of the desalination cell(s) (11) or the desalination device (32).