CLAIMS

What is claimed is:

1. A method for separating water from a saline solution using a directional solvent, the method comprising:

providing the directional solvent and the saline solution comprising water and at least one salt, wherein the directional solvent includes a carboxylic acid with a carbon chain length from 6 to 13 carbon atoms;

making an emulsion of the saline solution in the directional solvent;

heating the directional solvent before or after contact with the saline solution to produce a first phase that includes the directional solvent and water from the saline solution dissolved in the directional solvent, and a second phase that includes a highly concentrated remainder of the saline solution;

allowing the first phase to separate from the second phase;

extracting the first phase including the directional solvent and the dissolved water from the highly concentrated remainder of the saline solution or extracting the highly concentrated remainder of the saline solution from the first phase;

cooling the first phase after extraction to precipitate the water from the directional solvent; and

removing the precipitated water from the directional solvent.

2. The method of claim 1, wherein the directional solvent includes a compound that dissolves water but does not dissolve water-soluble salts and impurities and that is completely or substantially insoluble in water.

3. The method of claim 1, wherein the carboxylic acid includes a hydrophilic hydroxide group that binds to water from the saline solution.

~~7~~4. The method of claim ~~6~~1, wherein the carboxylic acid includes decanoic acid.

~~8~~5. The method of claim 1, wherein the directional solvent is a solid at temperatures of 30°C and below.

~~9~~6. The method of claim 1, further comprising mixing the directional solvent and the saline solution to produce the emulsion before heating the directional solvent and saline solution.

~~10~~7. The method of claim 1, further comprising mixing the directional solvent and the saline solution to produce the emulsion after heating the directional solvent.

~~11~~8. The method of claim 1, further comprising using dielectrophoresis to separate the precipitated water from the directional solvent.

~~12~~9. The method of claim 1, wherein the directional solvent is heated using energy from a mid-temperature heat source of no greater than 75 ºC.

~~13~~10. The method of claim 1, wherein the directional solvent is heated using energy from a low-temperature heat source of no greater than 40 ºC.

~~14~~11. The method of claim 1, wherein the directional solvent and the saline solution are heated using heat from another process.

~~15~~12. The method of claim 1, wherein the directional solvent and the saline solution are heated using terrestrial heat or solar heat.

~~16~~13. The method of claim 1, wherein the extracted precipitated water has a weight-to-weight salt content of less than 1.5%.

~~17~~14. The method of claim 1, wherein the extracted precipitated water has a weight-to-weight salt content of less than 0.14%.

~~18~~15. The method of claim 1, wherein the extracted precipitated water has a weight-to-weight salt content of less than 0.05%.

~~19~~16. The method of claim 1, wherein separation of the water from the saline solution using the directional solvent is a first stage in a multi-stage desalination process, the method further comprising subjecting the precipitated water, after extraction, to a second stage of desalination to reach a higher level of purity.

~~20~~17. The method of claim ~~19~~16, wherein the second stage of desalination includes reverse osmosis or flash distillation.

~~21~~18. The method of claim 1, further comprising reusing the directional solvent to repeat the method of separating water from saline solution.

~~22~~19. A method for separating water from a saline solution using a directional solvent, the method comprising:

providing the directional solvent and the saline solution comprising water and at least one salt;

making an emulsion of the saline solution in the directional solvent;

heating the directional solvent before or after contact with the saline solution to a temperature no greater than 110°C to produce a first phase that includes the directional solvent and water from the saline solution dissolved in the directional solvent, and a second phase that includes a highly concentrated remainder of the saline solution;

allowing the first phase to separate from the second phase;

extracting the first phase including the directional solvent and the dissolved water from the highly concentrated remainder of the saline solution or extracting the highly concentrated remainder of the saline solution from the first phase;

cooling the first phase after extraction to precipitate the water from the directional solvent; and

removing the precipitated water from the directional solvent.