Claims:

1. A method for removing a soluble heavy metal-sulfur complex from an aqueous or glycol process solution, the method comprising the steps of:

(i)a contacting the process solution with an oxidant to oxidize the heavy metal-sulfur complex and form an oxidized complex precipitate; wherein the process solution is formed by addition of one or more inorganic water-soluble polysulfides to an aqueous or glycol process stream in a molar ratio ranging from 2:1 (mol sulfur in the polysulfides:mol heavy metal) to 10,000:1; and/or

(i)b contacting the process solution with an acid, preferably a weak acid, to precipitate the heavy metal-sulfur complex and form an acidified complex precipitate; and

(ii) removing the precipitates from the process solution to provide a heavy metal-reduced process solution.

2. The method of claim 1, wherein the heavy metal-sulfur complex comprises one or more sulfide complexes of elemental mercury, cadmium, barium, iron, vanadium and/or manganese.

3. The method of claim 2, wherein the heavy metal-sulfur complex comprises a mercury-sulfide complex.

4. The method of claim any one of claims 1-3, wherein the heavy metal-sulfur complex is the reaction product of a heavy metal and an inorganic alkaline, alkaline earth and/or ammonium polysulfide.

5. The method of claim 4, wherein the heavy metal-sulfur complex is the reaction product of a heavy metal and calcium, sodium, potassium and/or ammonium polysulfide.

6. The method of claim 4 or 5, wherein the polysulfide has from 2 to 5 sulfide anions.

7. The method of any one of claims 1-6, wherein the contacting step (i)a is conducted with a stirred tank reactor with one or more agitators, inline high shear and/or high impacting mixing equipment, a tank with cavitation technology, a tubular reactor, sparging, or a combination of two or more thereof.

8. The method of claim 7, wherein the contacting step (i)a is conducted in a stirred tank reactor with one or more of impellers, turbines and/or blades, bubble columns, packed columns, tray columns, spray columns, jet loops, a cavitation propeller or distributor, a cavitational pump, a tubular reactor, and sparging.

9. The method of any one of claims 1-6, wherein the contacting step (i)a comprises sparging the process solution with an oxidant.

10. The method of claim any one of claims 1-9, wherein the oxidant comprises one or more of air, oxygen, ozone, persulfate salts, permanganate salts , inorganic peroxides and/or organic peroxides.

11. The method of any one of claims 1-10, wherein the acid is a weak acid, preferably a weak acid having a molecular weight of less than 300 g/mol and a pKa of less than 12, preferably a pKa in the range of 3-11, more preferably a pKa in the range of 3-8, most preferably a pKa in the range of 3.5-6.

12. The method of any one of claims 1-11, wherein the acid is selected from the group consisting of acetic acid, carbonic acid, oxalic acid, hydrogen oxalate, citric acid, dihydrogen citrate, hydrogen citrate, fumaric acid, hydrogen fumarate, maleic acid, hydrogen maleate, succinic acid, hydrogen succinate, itaconic acid, hydrogen itaconate, p-toluenesulfonic acid, ammonium chloride, sulfurous acid, bisulfites, phosphoric acid, dihydrogen phoshates, hydrogen phosphates, boric acid, bisulfates, nitrous acid, formic acid, benzoic acid and combinations

thereof, preferably selected from formic acid, citric acid, acetic acid, carbonic acid and combinations thereof.

13. The method of any one of claims 1-12, wherein step (i)a is performed.

14. The method of any one of claims 1-13, wherein the removing step (ii) comprises one or more of filtration, flotation, thickening, membrane separation, field assisted separation, and/or centrifugation.

15. The method of claim 14, wherein the filtration comprises microfiltration and/or ultrafiltration, the flotation comprises dissolved air flotation, the thickening comprises a sedimentation, hydrocyclonic, cross flow filtration, and/or gravity technique, and/or the field assisted separation comprises a magnetic, electric, dielectric, and/or acoustic field.

16. The method of any one of claims 1-15, wherein, after removal of the precipitate from the process solution in step (ii), the heavy metal-reduced solution is contacted with an ion exchange resin to remove at least a portion of remaining heavy metal-sulfur complex.

17. The method of any one of claims 1-16, wherein the heavy metal-reduced solution comprises less than 80 wt %, less than 85 wt %, less than 90 wt %, less than 95 wt %, or less than 99 wt %, of the heavy metal contained in the process solution.

18. The method of any one of claims 1-17, wherein the heavy metal-reduced solution comprises less than 5000 ppb, less than 4000 ppb, less than 3000 ppb, less than 2000 ppb, or less than 1000 ppb heavy metal.

19. The method of any one of claims 1-18, wherein the process solution further comprises a thermodynamic inhibitor to decrease the temperature at which heavy metal in the process solution forms a hydrate.

20. The method of any one of claims 1-19, wherein the process solution originates from a natural gas production process.

21. The method of claim 20, wherein the process solution comprises an aqueous process solution.

22. The method of claim 20, wherein the process solution comprises a glycol process solution.

23. The method of any one of claims 1-19, wherein the process solution originates from a petroleum production process.

24. The method of any one of claims 1-19, wherein the process solution comprises an aqueous process solution and originates from a water treatment process.

25. The method of any one of claims 1-19, wherein the process solution comprises an aqueous process solution and originates from a non-precious metal mining process.

26. The method of any one of claims 1-25, wherein a flocculation aid is added after the treatment of step (i)a and/or (i)b.

27. The method of any one of claims 1-25, where a flocculation aid is added before the treatment of step (i)a and/or (i)b.