Claims

1. A crystallization column, which comprises an upper head (1) with a gas outlet (4), a tower body (2) and a lower head (3) with a gas inlet (8) and a material outlet (7), the tower body (2) comprises a crystallization section (11); wherein a tray (14) is arranged in the crystallization section (11) and comprises a tray plate (15) transversely extending from the inner wall of the tower body (2) and a plurality of lower crystallization members (17) which are arranged on the lower surface of the tray plate (15) at intervals with each other, wherein the top end of the lower crystallization member (17) and the lower surface of the tray plate (15) are movably connected, so that two adjacent lower crystallization members (17) collide when swung.

2. The crystallization column according to claim 1, wherein a plurality of lifting lugs (16) is arranged on the lower surface of the tray plate (15) at intervals; the top end of the lower crystallization member (17) is provided with a hanger (18); the hanger (18) is buckled with the lifting lug (16), so that the lower crystallization member (17) may swing.

3. The crystallization column according to claim 2, wherein the plurality of lifting lugs (16) is uniformly disposed on the lower surface of the tray plate (15), and the plurality of lower crystallization members (17) are connected with the plurality of lifting lugs (16) in one-to-one correspondence.

4. The crystallization column according to claim 3, wherein the lower crystallization member (17) comprises the hanger (18) and a lower cylinder (19); and the radial distance between the cylinder centers of any two adjacent lower cylinders (19) overhanging downward is less than the axial height of the lower cylinder (19).

5. The crystallization column according to claim 4, wherein a cylinder surface of the lower cylinder (19) is provided with a projection.

6. The crystallization column according to claim 5, wherein the projection is a spiny object (20); a plurality of spiny objects (20) radially stretches outward from the cylinder surface of the lower cylinder (19), respectively, so that the lower cylinder (19) forms a mace structure.

7. The crystallization column according to claim 6, wherein the maximum radial stretching length of the spiny object (20) is 1/20 to 1/8 of the axial height of the lower

cylinder (19), preferably 1/15 to 1/10.

8. The crystallization column according to claim 6, wherein in the lower cylinder (19) of the mace structure, the height clearance between the upper and lower adjacent spiny objects (20) is 1/20 to 1/8 of the axial height of the lower cylinder (19), preferably 1/15 to 1/10.

9. The crystallization column according to claim 1, wherein the top end of the lower crystallization member (17) is connected to the lower surface of the tray plate (15) through a flexible rope.

10. The crystallization column according to claim 1, wherein the lower crystallization member (17) is an elastic or flexible member with a top end fixedly connected to the lower surface of the tray plate (15); the elastic or flexible member may bend, so that two adjacent lower crystallization members (17) may swing and collide.

11. The crystallization column according to claim 1, wherein the lower crystallization member (17) comprises a lower cylinder (19) and a flexible thread (22), the lower cylinder (19) equipped with the flexible thread (22) forms a torsion wire brush type structure.

12. The crystallization column according to any one of claims 1-11, wherein one end of the tray plate (15) is connected with the inner wall of the tower body (2), and the other end stretches crosswise and a gas flow gap forms between the stretching end and the inner wall of the opposite side of the tower body (2).

13. The crystallization column of the claim 12, wherein the crystallization section (11) is provided with multiple layers of the trays (14) spaced up and down orderly; the multiple layers of trays (14) are disposed on two sides of the central axis of the tower body (2) and form a left and right staggering arrangement, so that the gas phase may orderly pass through the gas flow gap of each tray plate (15) upward to form bend fluid.

14. The crystallization column according to claim 13, wherein the tray (14) further comprises a plurality of upper crystallization members (21) that stretch upward from the upper surface of the tray plate (15).

15. The crystallization column according to claim 14, wherein in the two adjacent up and down trays (14), a height clearance exists between the top end of the upper crystallization member (21) of the lower tray (14) and the bottom end of the lower crystallization member (17) of the upper tray (14); and the height clearance is preferably

20 mm to 150 mm, more preferably 50 mm to 100 mm.

16. The crystallization column according to claim 14, wherein the upper crystallization member (21) comprises an upper cylinder (23) and a flexible thread (22), the upper cylinder (23) equipped with the flexible thread (22) to form a torsion wire brush type structure.

17. The crystallization column according to claim 16, wherein the upper cylinder (23) is of stainless steel, tetrafluorohydrazine or carbon steel coated with tetrafluorohydrazine; the flexible thread (22) is a material that is not reacted with ammonium hydrogen sulfide and is insoluble in water, preferably any one of carbon fiber, nylon, fluoroplastics or stainless steel wire.

18. The crystallization column according to claim 16, wherein a diameter of the flexible thread (22) is 1 mm to 12 mm; when the flexible thread (22) is of metal material, the diameter of the flexible thread (22) is preferably 1 mm to 3 mm; and when the flexible thread (22) is of non-metal material, the diameter of the flexible thread (22) is preferably 2 mm to 5 mm.

19. The crystallization column according to claim 1, wherein the tower body (2) further comprises a cooling section (10) that is provided with a heat removing component (13); the heat removing component (13) is preferably any one of a shell and tube type evaporative cooler, a plate type heat exchanger, an electrical refrigeration unit and a gas type lithium bromide unit.

20. The crystallization column according to claim 19, wherein the tower body (2) further comprises a feed mixing section (9) located below the cooling section (10); the feed mixing section (9) is provided with a gas phase distributor (12); and the gas phase distributor (12) is preferably an aerator, a plate type gas phase distributor or a trough-pan gas phase distributor.

21. The crystallization column according to claim 1, wherein the upper head (1) is further provided with a water inlet (5); the water inlet (5) is connected with a water distribution pipe (6); and the water distribution pipe (6) is provided with several nozzles.

22. The crystallization column according to claim 21, wherein the water inlet (5) is the gas outlet (4), or the water inlet (5) and the gas outlet (4) are separately disposed, respectively.

23. A crystallization method using the crystallization column of any of claims 1-22, wherein gas to be crystallized enters a tower body (2) through a gas inlet (8), the gas to be crystallized reacts to crystallize on a tray (14) of a crystallization section (11), and crystallized gas is discharged out from the gas outlet (4).

24. The crystallization method according to claim 23, wherein the gas to be crystallized entering the tower body (2) is mixed gas of hydrogen sulfide-containing gas and ammonia gas.

25. The crystallization method according to claim 24, wherein the feed molar ratio of the hydrogen sulfide-containing gas and the ammonia gas is 1:1 to 1:2, preferably 5:6 to 2:3.

26. The crystallization method according to claim 24, wherein the reaction crystallization temperature of the hydrogen sulfide-containing gas and the ammonia gas is 0℃-40℃, preferably 0℃-20℃.

27. The crystallization method according to claim 23, wherein the crystallization method further comprises: water is added from the top of the tower body (2) to flush the crystal on the tray (14), and mixture of the water after flushing and the crystal outflows from the material outlet (7).