~~WHAT IS CLAIMED IS:~~

CLAIMS

1. An adsorbent composition comprising a bismuth material, a promoter, and a support, wherein the support comprises particles having a particle size of from about 1 μm to 10 ~~mm.~~ mm, wherein the bismuth material and the promoter are each dispersed within pores of the support via incipient-wetness impregnation of precursors of the bismuth material and the promoter onto the support, wherein the promoter comprises a silicon material or a tungsten material, and wherein:

~~2. The adsorbent composition according to claims 1, wherein the bismuth material and the promoter are in a bulk form or dispersed form.~~

~~3. The adsorbent composition according to any of the preceding claims, wherein~~ the bismuth material is ~~selected from a group consisting of elemental bismuth and bismuth compounds.~~

~~4. The adsorbent composition according to any of the preceding claims, wherein the bismuth material comprises a~~ present as bismuth oxide~~.~~

~~5. The adsorbent composition according to any of the preceding claims, wherein the bismuth material comprises bismuth (III) oxide (Bi_2O_3).~~

~~6. The adsorbent composition according to any of the preceding claims, wherein the composition comprises~~ from about ~~0.~~1~~2~~ wt% to about ~~50.0~~20 wt% ~~bismuth material~~ on a bismuth metal basis, based on the total weight of the adsorbent composition~~.~~.

~~7. The adsorbent composition according to any of the preceding claims, wherein the promoter comprises a tungsten material or a silicon material.~~

~~8. The adsorbent composition according to any of the preceding claims, wherein the promoter comprises tungsten oxide or silicon oxide.~~

~~9. The adsorbent composition according to any of the preceding claims, wherein the composition comprises~~the promoter is present from about ~~0.05~~1 wt% to about ~~25.0~~11 wt~~% promoter,~~%, based on the total weight of the adsorbent composition~~.~~, and

~~10. The~~ the balance of the weight of the adsorbent composition ~~according to any~~consists essentially of the ~~preceding claims, wherein~~support, the support ~~is~~being selected from a ~~group consisting of metal oxides, metalloid oxides~~titanium oxide, an aluminum oxide, activated ~~carbons and~~carbon, or a molecular ~~sieves~~sieve.

~~11~~2. The adsorbent composition according to ~~any of the preceding claims, wherein the support is selected from a group consisting of high surface area metal oxides.~~claim 1, wherein the bismuth material comprises bismuth (III) oxide (Bi_2O_3).

3.

~~12.~~ The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the support comprises titanium dioxide~~.~~

~~13. The adsorbent composition according to any of the preceding claims, wherein the support comprises~~ or anatase titanium dioxide.

~~14~~4. The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the support comprises aluminum oxide~~.~~

~~15. The adsorbent composition according to any of the preceding claims, wherein the support comprises titanium dioxide and aluminum~~ or titanium oxide.

~~16~~5. The adsorbent composition according to ~~any of the preceding claims, wherein the support comprises silica.~~

~~17. The adsorbent composition according to any of the preceding claims, comprising ≥ 5 wt% support, based on the total weight of the composition.~~

~~18. The adsorbent composition according to any of the preceding claims, wherein the support comprises ≥ 5 wt%, ≥ 10 wt%, ≥ 15 wt%, ≥ 20 wt%, ≥ 25 wt%, ≥ 30 wt%, ≥ 35 wt%, ≥ 40 wt%, ≥ 45 wt%, ≥ 50 wt%, ≥ 55 wt%, ≥ 60 wt%, ≥ 65 wt%, ≥ 70 wt% or ≥ 75 wt% metal oxide, based on the total weight of the support.~~

~~19. The adsorbent composition according to any of the preceding claims~~claim 1, wherein the support has a surface area of from about 10 m^2/g to about 600 m^2/g.

~~20~~6. The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the composition further comprises ≤ 20 wt% lead oxide, based on the total weight of the composition.

~~21~~7. The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the adsorbent composition is substantially free of lead.

~~22~~8. The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the composition is in a form selected from a group consisting of tablets, extrudates, pellets, rods, moldings and monoliths~~.~~

~~23. The adsorbent composition according to any of the preceding claims,~~, and wherein the composition further comprises one or more compounds selected from a group consisting of silver oxide, iron oxide, manganese oxide, cerium oxide, vanadium oxide, tin oxide and niobium oxide.

~~24~~9. The adsorbent composition according to ~~any of the preceding claims~~claim 1, wherein the support has a pore volume of from about 0.01 cm^3/g to about 5.0 cm^3/g~~.~~

~~25. The adsorbent composition according to any of the preceding claims,~~, and wherein the support contains pores having an average pore size of from about 1 Å to about 750 Å.

~~26~~10. The adsorbent composition according to claim 1, wherein the promoter is tungsten oxide and the support is titania.

11. The adsorbent composition according to ~~any of the preceding claims, comprising~~
~~from about 2 wt% to about 20 wt% bismuth oxide on a bismuth metal basis;~~
~~from about 1 wt% to about 11 wt% tungsten oxide; and~~
~~from about 69 wt% to about 94 wt% titania.~~

~~27. The adsorbent composition according to any of the preceding claims~~claim 1, having an arsine removal efficiency of ≥ 90%, as measured by a dry colorimetry method using an arsine analyzer.

~~28~~12. The adsorbent composition according to ~~any of the preceding claims~~claim 1, which exhibits an improved arsine removal efficiency of ≥ 15% compared to the same composition not containing the promoter, as measured by a dry colorimetry method using an arsine analyzer.

~~29~~13. A method of preparing an adsorbent composition comprising a bismuth material ~~and,~~ a promoter, and a support, the method comprising ~~combining a bismuth material or a~~ dispersing a bismuth precursor~~, a promoter or~~ and a promoter precursor ~~and optionally a support to form~~ into pores of the ~~composition.~~

~~30. The method according to claim 29~~support via incipient wetness impregnation, wherein the ~~combining~~promoter or the promoter precursor comprises a ~~process selected from a group consisting of co-precipitating, dispersing and physically mixing.~~

~~31. A method of adsorbing an arsenic~~silicon material or a tungsten material~~, the method comprising contacting a process stream containing an arsenic material with an~~.

14. An adsorbent composition ~~comprising a~~ consisting essentially of bismuth ~~material~~oxide, tungsten oxide, and ~~a promoter.~~

~~32. The method according to claim 31, the method resulting an arsine removal efficiency of ≥ 90%, as measured by a dry colorimetry method using an arsine analyzer.~~

~~33. The method according to claim 31 or 32~~titania support particles, wherein ~~the process stream~~a particle size of the titania support particles is ~~a stream of a process selected from a group consisting of a petroleum process, a petrochemical process, a polymerization process, a synthesis gas process and a semiconductor process~~from about 1 μm to 10 mm.

~~34. The method according to claim 31 or 32, wherein the process stream is a stream of a process selected from a group consisting of refinery off-gas, fluid catalytic cracking off-gas, steam cracker off-gas, shale gas and combinations thereof.~~

~~35. The method according to claim 31 or 32, wherein the process stream comprises acetylene, methyl acetylene or propadiene or a combination thereof.~~

~~36. The method according to claim 31 or 32, wherein the process stream comprises ethylene and/or propylene.~~

~~37. The method according to claim 31 or 32, wherein the process stream comprises natural gas.~~