THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of producing ethanol from syngas, said method comprising:

(a) feeding syngas to an alcohol-synthesis reactor that contains a sulfided metal catalyst, under suitable conditions for converting said syngas into an intermediate stream comprising methanol, ethanol, and one or more sulfur-containing compounds;

(b) sending at least part of said intermediate stream to a separation unit, whereby at least a portion of said methanol is separated from said ethanol to form a methanol recycle stream and an ethanol product stream, and wherein at least a portion of said sulfur-containing compounds are contained in said methanol recycle stream;

(c) recycling some or all of said methanol recycle stream back to said alcohol-synthesis reactor to add sulfur to, or reduce sulfur loss from, said sulfided metal catalyst, wherein said methanol recycle stream has a sulfur-atom concentration of at least 10 ppm S; and

(d) optionally introducing one or more additional sulfur compounds, into said alcohol-synthesis reactor and/or into said methanol recycle stream, to add sulfur to, or reduce sulfur loss from, said sulfided metal catalyst.

2. The method of claim 1, wherein said sulfided metal catalyst is a base-promoted cobalt-molybdenum-sulfur catalyst.

3. The method of claim 1 or claim 2, wherein said separation unit includes one or more distillation columns,

4. The method of claim 3, wherein one of said distillation columns is adapted to separate both methanol and sulfur-containing compounds.

5. The method of any one of claims 1-4, comprising introducing one or more additional sulfur compounds into said alcohol-synthesis reactor to add sulfur to, or reduce sulfur loss from, said sulfided metal catalyst.

6. The method of any one of claims 1-5, comprising introducing one or more additional sulfur compounds into said methanol recycle stream to add sulfur to, or reduce sulfur loss from, said sulfided metal catalyst.

7. The method of any one of claims 1-6, wherein at least one of said sulfur-containing compounds is selected from the group consisting of methyl sulfide, dimethyl sulfide, dimethyl disulfide, di-tert-butyl disulfide, and any oligomers, polymers, and combinations thereof.

8. The method of any one of claims 1-3, 5, or 6, wherein at least one of said additional sulfur compounds is selected from the group consisting of methyl sulfide, dimethyl sulfide, dimethyl disulfide, di-tert-butyl disulfide, and any oligomers, polymers, and combinations thereof.

9. The method of any one of claims 1 to 8, wherein said sulfur-atom concentration is between about 50 ppm S and about 500 ppm S.

10. The method of any one of claims 1 to 8, wherein said sulfur-atom concentration is between about 100 ppm S and about 300 ppm S.

11. The method of any one of claims 1 to 8, wherein said sulfur-atom concentration is less than 200 ppm S.

12. A method of producing ethanol from syngas, said method comprising:

(a) feeding syngas to an alcohol-synthesis reactor that contains a sulfided metal catalyst, under suitable conditions for converting said syngas into an intermediate stream comprising methanol and ethanol;

(b) co-feeding hydrogen sulfide with said syngas to said alcohol-synthesis reactor, to add sulfur to, or reduce sulfur loss from, said sulfided metal catalyst;

(c) sending at least part of said intermediate stream to a separation unit, whereby at least a portion of said methanol is separated from said ethanol to form a methanol recycle stream and an ethanol product stream; and

(d) recycling some or all of said methanol recycle stream back to said alcohol-synthesis reactor, wherein said methanol recycle stream has a sulfur-atom concentration of at least 10 ppm S,

wherein said hydrogen sulfide is fed in step (b) at a concentration between about 50 ppm H_2S and about 400 ppm H_2S.

13. The method of claim 12, wherein said hydrogen sulfide is fed in step (b) at a concentration between about 50 ppm H_2S and about 250 ppm H_2S.

14. The method of claim 12, wherein said hydrogen sulfide is fed in step (b) at a concentration between about 75 ppm H_2S and about 150 ppm H_2S.

15. The method of claim 12, wherein said hydrogen sulfide is fed in step (b) at a concentration between about 90 ppm H_2S and about 130 ppm H_2S.

16. An apparatus adapted to carry out the method of any one of the preceding claims.