[0011] One aspect of the present invention is production of bio-based polyolefins, basic chemicals, and hydrogen. Bio-based ethylene may be obtained from dehydration of ethanol. More recently, U.S. Patent No. 7,288,685 has reported that olefins may be obtained by fluidized catalytic cracking of vegetable oils—although at lower yields than from steam cracking of hydrocarbons. However these processes require construction of new and expensive plants. Furthermore, these olefin production routes are not believed to be competitive with steam cracking of hydrocarbons, which is the technology used in all world scale olefin plants today. Consequently, a method of producing bio-based olefins utilizing existing steam crackers is desired.

[0012] Another aspect of the present invention is the production of bio-based motor gasoline components, suitable for use as spark-ignition engine fuels. Although the biofuel prior art provides various methods and systems for producing such compositions, the prior art methods and systems do not address early adoption issues such as capital costs for building new plants. By providing a method wherein existing petrochemical plants can be used to produce such fuels, the present invention addresses this important need.

SUMMARY

[0013] A method for capture and storage of CO_2 is described herein. In one aspect, the present disclosure relates to a method for sequestering carbon dioxide, comprising the steps of: converting biomass into paraffinic hydrocarbons, steam cracking the paraffinic hydrocarbons into olefins; and polymerizing the olefins into non-biodegradable polyolefins.

The present disclosure is capable of being adapted for co-production of bio-based gasoline. An embodiment of the described method includes (a) photosynthetic conversion of CO_2 into biomass, (b) conversion of

biomass to paraffinic hydrocarbons, (c) cracking the paraffinic hydrocarbons into olefins in a steam cracker, and (d) polymerization of the light olefins into polyolefin plastics. Polyolefins such as polyethylene and polypropylene are the most widely used plastics in the world, with annual production well over 125 million metric tons. These plastics are 86% carbon by weight, non-biodegradable, and a major component of the world's landfills. If produced by the method described herein, each ton of carbon in the plastic would represent 3.67 tons of CO_2 removed from the atmosphere, stored within useful products, and ultimately sequestered in commercial landfills. Furthermore, the present method of carbon capture and storage is inherently market friendly and builds on existing manufacturing infrastructure.

[0014] The CCS method of the present disclosure also produces bio-based gasoline, hydrogen, and basic chemicals.

BRIEF DESCRIPTION OF THE DRAWING

[0015] FIG. 1 depicts a process for sequestering CO_2 generated from combustion of coal, according to one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The term "biodegradable" refers to a natural or synthetic chemical that can undergo aerobic or anaerobic decomposition into CO_2, CH_4, and other green house gases. The term "non-biodegradable" refers to synthetic chemicals that do not undergo aerobic or anaerobic decomposition into green house gases.

CLAIMS:

1. A method for sequestering carbon dioxide, comprising the steps of: converting biomass into paraffinic hydrocarbons, steam cracking the paraffinic hydrocarbons into olefins; and polymerizing the olefins into non-biodegradable polyolefins.

2. The method of claim 1 wherein the paraffinic hydrocarbons are produced by gasification followed by Fischer-Tropsch conversion.

3. The method of claim 2 wherein the biomass is wood chips.

4. The method of claim 1 wherein the paraffinic hydrocarbons are produced by hydrotreating of fatty acids and/or fatty acid esters.

5. The method of claim 4 wherein the fatty acids and/or fatty acid esters are oils from plants.

6. The method of claim 4 wherein the fatty acids and/or fatty acid esters are fats from animals.

7. The method of claim 4 wherein the fatty acids and/or fatty acid esters are oils from algae.

8. The method of claim 7 wherein the algae are grown in ponds and/or photo-bioreactors with CO_2 supplied from stationary emission sources.

9. The method of claim 8 wherein the stationary emission source is a coal-fired power plant.

10. The method of claim 1 wherein the olefins comprise of ethylene, propylene, butenes, and butadiene.

11. The method of claim 1 wherein bio-derived hydrogen is produced as byproduct of steam cracking.

12. The method of claim 1 wherein bio-derived pyrolysis gasoline is produced as byproduct of steam cracking.

13. The method of claim 12 wherein the pyrolysis gasoline is used as motor gasoline blend stock.

14. The method of claim 13 wherein the pyrolysis gasoline is hydrogenated prior to use as motor gasoline.

15. The method of claim 1 wherein bio-derived fuel gas is produced as byproduct of steam cracking.

16. The method of claim 15 wherein the bio-derived fuel gas is supplied to the steam cracker furnace.

17. The method of claim 1 wherein the pyrolysis fuel oil yield is less than 1 wt % of the bio-derived paraffinic hydrocarbon.