US 20070261295A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2007/0261295 A1

Tolmie (43) Pub. Date: Nov. 15, 2007

(54) **WATER RESISTANCE, DENSITY, AND DURABILITY OF BIOMASS FUELS**

(76) Inventor: **Richard W. Tolmie**, Kalama, WA (US)

Correspondence Address:
CHERNOFF, VILHAUER, MCCLUNG & STENZEL
1600 ODS TOWER
601 SW SECOND AVENUE
PORTLAND, OR 97204-3157 (US)

(21) Appl. No.: **11/432,114**

(22) Filed: **May 11, 2006**

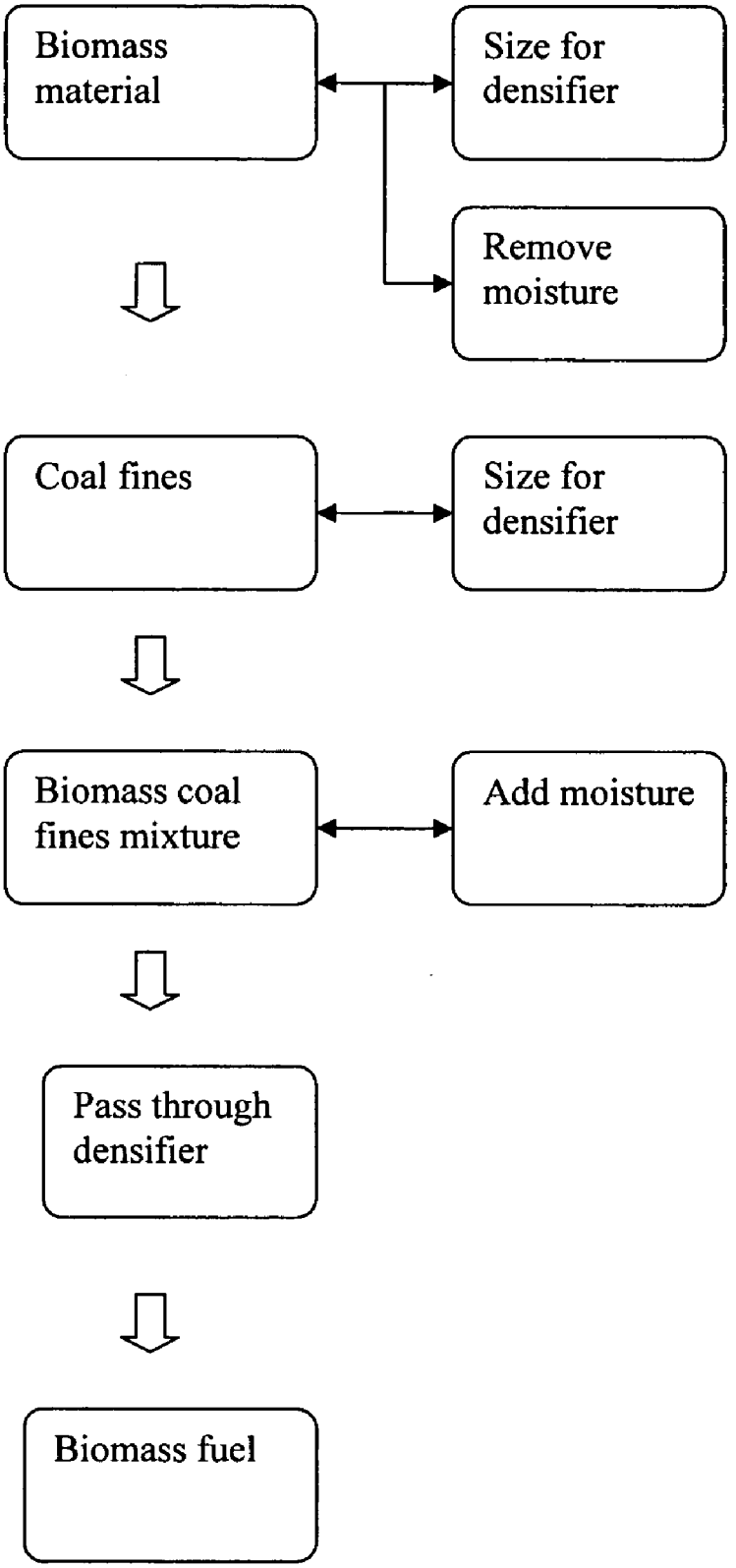
Publication Classification

(51) **Int. Cl.**
C10L 5/00 (2006.01)

(52) **U.S. Cl.** **44/550**

(57) **ABSTRACT**

Given the current world situation of fuel shortages and conflict over the finite amount of fuels available, it is very prudent to utilize every avenue available to increase the amount and quality of fuels available to use in power generation as well as other applications of steam. There are hundreds of thousands of tons of natural fuels, available for use here as well as other parts of the world. The BTU value of these waste materials is immeasurable. While most of these alternative fuels do not contain the highest BTU value, the amount of them available is beyond belief. The biggest drawback to alternative fuels has been the ease of utilization and quality of the product introduced into the combustors. Many years of testing and research by this individual have resulted in a variety of fuels that in addition to adding to the fuel supply of the world's consumers, will help to clean up the emission problems that are coming to the forefront of environmental concerns.


Biomass material
Size for densifier
Remove moisture
Coal fines
Size for densifier
Biomass coal fines mixture
Add moisture
Pass through densifier
Biomass fuel

WATER RESISTANCE, DENSITY, AND DURABILITY OF BIOMASS FUELS

BACKGROUND OF THE INVENTION

[0001] Biomass fuel proponents have struggled to find ways to maximize density, uniformity, and moisture-resistance of biomass fuel.

[0002] Most biomass fuels lack the density or uniformity that traditional combustors are fit to utilize, making them commercially unworkable.

[0003] Another major problems facing biomass fuel users is that the biomass fuel cubes or pellets are not resistant to water or moisture. Cubes or pellets begin to lose their integrity almost instantly when exposed to moisture, rain, dew, or in some cases high humidity. This breakdown necessitates covered storage and transport facilities and special handling, thereby increasing the cost of biomass fuel cube utilization.

BRIEF SUMMARY OF THE INVENTION

[0004] By blending biomass fuels with coal fines prior to their introduction into a densification machine, the resulting product will be resistant to water damage.

[0005] In addition, using a blend of biomass and coal fines in biomass fuel production results in a product that has an increased density and durability when compared to biomass fuels which do not contain coal fines. This increased density and durability is very important for the economics of transportation, handling, and the introduction of the biomass fuel into a combustion system.

[0006] The foregoing and other objectives, features, and advantages of the invention will be more readily understood upon consideration of the following detailed description of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0007] FIG. **1** is a schematic diagram illustrating the process of one embodiment of the process.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

[0008] By carefully blending biomass fuels with coal fines prior to their introduction into a densification machine, the resulting biomass fuel product is resistant to water damage. In some cases, depending on the percentage of coal fines utilized, it is possible to obtain a resulting biomass fuel which is almost totally waterproof.

[0009] By using a blend of biomass and coal fines in biomass fuel production, the density and durability of the biomass fuel product is increased as compared to biomass fuel products which do not contain coal fines. It is believed that this increased density and durability is very important for the economics of transportation, handling, and the introduction of the fuel cube into a combustion system.

[0010] Mechanical processes for making biomass fuels are well known. The biomass material may be grass, grain, paper, animal wastes, wood waste, sewer sludge or other naturally occurring biological waste. A manufacturer may pass this biomass material through one of a variety of known densification machines such as a cuber, pellet mill, briquettor, or extruder, to result in a biomass fuel product which is a cube, pellet, briquette, tablets, or similarly small structured small particles. Known densification machines may result in a product which is sized for a particular combustion system.

[0011] The object of this invention is to produce a fuel which is a biomass and coal combination and which is an improvement over non-coal containing biomass fuels as it will have greater weight, improved water resistance, increased density, and greater durability.

[0012] The fuel combination may be manufactured by the following steps:

[0013] 1. sizing of the biomass: solids in the biomass are sized to small particles.

[0014] 2. adjusting the moisture content of the biomass: by drying or adding desiccants, to reach a moisture content most appropriate for the densifier.

[0015] 3. adding coal fines: the ratio of coal to biomass by mass may vary according to the needs of the user. Higher coal content may result in diminished durability of the biomass fuel.

[0016] 4. Re-adjusting the moisture content of the biomass and coal combination if necessary for the densifier.

[0017] 5. passing the biomass and coal combination through the densifier.

[0018] Some embodiments of the process described herein utilize biomass material of various sources, of various moisture contents, and of various sizes, which is mixed with coal fines in a variety of ratios, and then densified at various pressures. These embodiments are summarized in the table below. The ranges given accommodate the fact that every seam of coal has its own characteristics with respect to its actual hardness or grind, and volatile organic compound levels.

Biomass fuel	Moisture content by weight	Biomass Size	Coal Fine Size	Percentage of coal fines	Coal Moisture	Pressure
Straw-type	5-25%	1 inch minus	¼ inch minus	5-75%	5-25%	200-15,000 psi
Sewer sludge, paper, animal waste	5-25%	No pre-sizing necessary	¼ inch minus	5-75%	5-25%	200-15,000 psi
Wood waste	5-25%	½ inch minus	¼ inch minus	5-75%	5-25%	200-15,000 psi

[0019] Biomass material may be delivered to a manufacturer with a variety of moisture content, ranging in biomass material which is dry to that which is in liquid suspension or sludge. A manufacturer may have to adjust the moisture content of a biomass material either by adding moisture or drying it, usually to a moisture range of 5-25% depending on the type of densifier and size of die to be used).

[0020] In addition, biomass material needs to be sized to pass through the various dies and agglomerate correctly. All of the bio-solids must be thoroughly mixed with the coal fines to ease the densification process by avoiding slugs of pure coal fines that can plug the machine, and to achieve a better quality final product. In the case of paper, 1½ inch minus, wood waste ½ inch minus or shavings, biological sludges do not have to be mechanically sized prior to blending. Straw and grasses should be sized to 1 inch minus.

[0021] The die temperature will increase if the manufacturer lowers the amount of moisture added just prior to entering the densifier. As the die temperature increases so does the quality, durability, and water resistance of the finished product.

[0022] The coal fine will be in the 1/4 inch minus range.

[0023] The amount of coal fines utilized (expressed by percentage of the total weight) can range from 5% to 75% of the total weight. Above 75% of coal fines by weight, there is difficulty in maintaining cube or pellet integrity resulting in a high percentage of "fines" in the finished product.

[0024] In another embodiment of the process, the moisture resistance of the biomass fuel product is increased by increasing the percentage of coal fines used in the process.

[0025] In another embodiment of the process, the durability and density of the biomass fuel product is increased by increasing the friction, that is increasing the amount of pressure used to pass the material through the die. Additionally, durability and density can be increased by increasing the die temperatures from ambient temperatures to 300 degrees Fahrenheit. In another embodiment of the process, the ease of handling biomass fuel material in the densification process is increased by the presence/absence of coal fines. When the material is passed through the densifiers mentioned above, the bulk density of the material is greatly increased, allowing for easier handling and transportation with significantly lower amounts of fines generated by handling. In certain types of combustors, these fines cause a serious problem by not burning in the heat zone and by becoming a fly ash material that plugs economizers and mulitclones, and overworks the electrostatic precipitators.

[0026] Another embodiment is the creation of a biomass fuel product which is characterized by a zone which is resistant to or impervious to moisture. This zone is formed by passing a combination of biomass fuel material and coal fines through a densification machine, such that oils in the coal fines migrate to the exterior surface of the biomass fuel product. This zone can sometimes be seen when the biomass fuel product is broken, where it will appear as a fine line around the perimeter of the surface of the break.

[0027] Another embodiment of the process is the creation of a biomass fuel product which is lower in mercury, lead, cadmium, sulfur, and other harmful metals than other non-biomass fuels, by blending biomass fuel material with coal fines. This biomass fuel product, when combusted, will lower the emission of harmful metals as compared to combustion of other coal fuel.

[0028] The terms and expressions which have been employed in the forgoing specification are used therein as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding equivalence of the features shown and described or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

I claim:

1. A process for forming a combustible fuel from biomass material comprising the steps of:

(a) adjusting a moisture content of a biomass material;

(b) adding coal fines to the biomass material to form a mixture; and

(c) compressing the mixture to form a biomass fuel.

2. The process of claim 1 additionally comprising the step of sizing the biomass material.

3. The process of claim 1 additionally comprising the step of adjusting the moisture content of the mixture.

4. The process of claim 1 wherein the moisture content of the biomass material is adjusted to the range of 5 to 25%.

5. The process of claim 1 wherein the coal fines are a percentage 5 to 75% of the total weight of the mixture.

6. The process of claim 1 where the compression of the mixture is at 200psi to 15,000psi and temperatures ranging from ambient to 300 degrees Fahrenheit (pressure/temperature)

* * * * *