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passing into the catalyst bed where they could react with the metal of the catalyst and destroy its catalytic capability.

Using the continuous-flow reactor system described above, tests were completed with stillage from corn ethanol production and with insoluble solids following starch extraction from wheat millfeed (wheat flour byproduct). A run of at least 10 hours was completed with the stillage and ended when the feedstock was exhausted. The liquid hourly space velocity was 1.5 L/L/hr and the conversion of chemical oxygen demand (COD) was 99.7 to 99.9% throughout the test. Gas yield was 0.84 L/g dry solids with a composition of 57% methane, 41% carbon dioxide and 2% hydrogen. Other hydrocarbon gas products amounted to less than 1% and the carbon monoxide was undetectable at less than 100 ppm. The mineral recovery system recovered a solid with 91% ash content and which accounted for less than 1% of the carbon in the feedstock. Phosphate in the feedstock at about 2700 ppm was found to be absent, <1 ppm, following the processing.

A 9.5-hour run was completed with the solids from wheat millfeed which had the starch extracted from it. The test was ended when the catalyst was showing significant deactivation. The liquid hourly space velocity was 1.5 L/L/hr and the conversion of COD was 99.9% through most of the test. Gas yield was 0.80 L/g dry solids with a composition of 56% methane, 42% carbon dioxide and 2% hydrogen. Other hydrocarbon gas products amounted to less than 1% and the carbon monoxide was undetectable at less than 100 ppm. The mineral recovery system recovered a solid with 70 to 80% ash content and which accounted for 1 to 2% of the carbon in the feedstock. Phosphate in the feedstock at about 940 ppm was found to be absent, <1 ppm, following the processing. Sulfate was also present in the feed at 35 ppm but was found in the range of 2 to 10 ppm in the effluent.

While a number of embodiments of the present invention have been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its broader aspects. The appended claims, therefore, are intended to cover all such changes and modifications as they fall within the true spirit and scope of the invention.

We claim:

1. A catalytic hydrothermal process characterized by: heating under pressure a wet biomass feedstock to a temperature sufficient for organic constituents in the feedstock to decompose, for precipitates of inorganic wastes to form, and for preheating the wet feedstock in preparation for subsequent separation of sulfur contaminants, the temperature and pressure less than the critical temperature and pressure of water; separating the precipitates out of the wet feedstock, removing sulfur contaminants from the wet biomass feedstock, at a temperature and pressure less than the critical temperature and pressure of water; and

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exposing the wet biomass feedstock to a heterogeneous metal catalyst and gasifying at least a portion of the organic constituents after said separating, said exposing occurs at temperatures and pressures below the critical point of water;

wherein the process is operated in continuous mode and wherein water in the feedstock is in a liquid phase during said heating, separating, and exposing steps.

2. The process of claim 1, wherein the heating comprises heating the wet biomass feedstock to at least 300° C.

3. The process of claim 1, wherein the separating the precipitates comprises an operation selected from the group consisting of gravity separation, hydrocyclonic separation, filtration, or combinations thereof.

4. The process of claim 1, wherein the heterogeneous metal catalyst comprises Ru, Ni, or Ni with added Na.

5. The process of claim 1, wherein the heterogeneous catalyst comprises Ru on a carbon support.

6. The process of claim 1, wherein the removing sulfur contaminants comprises capturing sulfur contaminants in an adsorbent bed by reaction with a metal or a metal oxide.

7. The process of claim 1, wherein the wet feedstock is selected from the group consisting of high-moisture biomass slurries, biosludge from wastewater treatment systems, sewage sludge from municipal treatment systems, wet byproducts from biorefinery operations, wet byproducts/residues from food processing, animal waste and waste from centralized animal raising facilities, organic chemical manufacturing wastewater streams, industrial wastewater contaminated with organics, and combinations thereof.

8. The process of claim 1, wherein the exposing occurs at 340-360° C. and 18-21 MPa.

9. The process of claim 1, wherein said gasifying of the organic constituents yields a hydrogen-containing feedstock for catalytic reformation.

10. A catalytic hydrothermal process characterized by: heating under pressure a wet biomass feedstock to a temperature sufficient for organic constituents in the feedstock to decompose, for precipitates of inorganic wastes to form, and for preheating the wet feedstock in preparation for subsequent separation of sulfur contaminants; separating the precipitates out of the wet feedstock, removing sulfur contaminants from the wet biomass feedstock; and

exposing the wet biomass feedstock to a heterogeneous metal catalyst and gasifying at least a portion of the organic constituents after said separating, said exposing occurs at temperatures and pressures below the critical point of water;

wherein the process is operated in continuous mode and wherein water in the feedstock is in a liquid phase at a temperature less than or equal to 360° C. during said heating, separating, and exposing steps.

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