CLAIMS

1. A method comprising:

    a. gasifying a gasification feedstock to produce syngas comprising at least carbon monoxide, hydrogen, water, and tars;

    b. cooling the syngas to separate water and at least one tar by condensation and provide a remainder of the syngas depleted in water and at least one tar;

    c. disposing of the at least one tar by:

        i. combusting the at least one tar using a flame produced by the combustion of fuel gas, natural gas, syngas, tail gas from a gas fermentation process, or any combination thereof; or

        ii. passing the at least one tar to a wastewater treatment process;

    d. treating the remainder of the syngas by adsorbing on an adsorbent a component comprising at least one of a hydrocarbon, an oxygenate, a sulfur compound, a nitrogen compound, or any combination thereof and generating a treated stream;

    e. fermenting at least a portion of the treated stream in a bioreactor using a microorganism to generate an effluent comprising at least one product and a tail gas stream comprising at least carbon dioxide;

    f. regenerating the adsorbent by at least partially desorbing the component using at least a portion of the tail gas stream to provide an enriched tail gas stream comprising the carbon dioxide and the desorbed component; and

    g. utilizing the enriched tail gas stream in at least one of:

        i. combusting in a steam boiler to produce steam;

        ii. generating power;

        iii. recycling to the gasification process; or

        iv. passing to a product recovery zone.

2. The method of claim 1 wherein the tail gas further comprises methane, carbon monoxide, and hydrogen.

3. The method of claim 1 wherein the microorganism is one or more C1-fixing microorganisms.

4. The method of claim 3 wherein C1-fixing microorganism is selected from *Moorella*, *Clostridium*, *Ruminococcus*, *Acetobacterium*, *Eubacterium*, *Butyribacterium*, *Oxobacter*, *Methanosarcina*, and *Desulfotomaculum.*

5. The method of claim 1 wherein the steam is high pressure steam.

6. The method of claim 1 further comprising employing the steam for distillation of fermentation products, operation of an adsorption chiller, steam driven compression, evaporation of waste water, drying of biomass, steam in place operations, clean in place operations, drying of feedstock, steam driven feedstock conveyors, heating of buildings, generation of power, and generating power to power a compressor of the fermentation process.

7. The method of claim 1 wherein the syngas is produced from the gasification of coal, gasification of refinery residues, gasification of biomass, gasification of lignocellulosic material, gasification of black liquor, gasification of municipal solid waste, gasification of industrial solid waste, gasification of sewerage, gasification of sludge from wastewater treatment, or any combination thereof.

8. The method of claim 1 wherein the generating power is cogeneration or direct generation.

9. The method of claim 1 wherein the tail gas stream, as compared to the syngas stream from a gasification process or the industrial waste gas, is
   a. enriched in N_2;
   b. enriched in CO_2;
   c. depleted in impurities; or
   d. any combination of (a) (b) or (c).

10. The method of claim 9 wherein the desorbing the component using at least a portion of the tail gas stream is improved as compared to desorbing the component using a syngas stream.