WHAT IS CLAIMED IS:

1. A method comprising:

saccharifying a ~~biomass~~ lignocellulosic feedstock in a vessel by mixing the lignocellulosic~~biomass~~ feedstock with a fluid medium and a saccharifying agent using a jet mixer to form a mixture, wherein the jet mixer comprises a jet-flow agitator and the vessel has an arcuate bottom surface, the jet mixer is mounted offset from a center axis of the vessel, and wherein saccharifying the feedstock comprises agitating the mixture with the jet-flow agitator.

2. The method of claim 1 wherein the feedstock has a bulk density of less than about 0.5 g/cm^3.

3. The method of claim 1 or claim 2 wherein the fluid medium comprises water.

4. The method of any of the above claims wherein the saccharifying agent comprises an enzyme.

5. The method of any of the above claims, wherein the ~~jet mixer comprises a~~ jet-flow agitator~~, and wherein saccharifying the feedstock comprises agitating the feedstock with the jet-flow agitator.~~

~~6. The method of claim 5 wherein the jet-flow agitator~~ comprises an impeller mounted at a distal end of a shaft, and a shroud surrounding the impeller.

~~7~~6. The method of claim ~~1~~5 ~~or claim 6~~, wherein the jet mixer comprises a plurality of jet-flow agitators, each jet-flow agitator being configured to operate reversibly, pumping fluid towards the top of the vessel in a first mode, and towards the bottom of the vessel in a second mode.

~~8~~7. The method of claim ~~7~~6 wherein, during at least part of mixing all of the jet-flow agitators are operated in the first mode.

~~9~~8. The method of claim ~~7 or claim 8~~6 wherein, during at least part of mixing some of the jet-flow agitators are operated in the first mode and, at the same time, others are operated in the second mode.

~~10~~9. The method of claim ~~7~~6, further comprising adding a microorganism to the vessel and fermenting the saccharified feedstock, wherein during at least part of fermentation all of the jet-flow agitators are operated in the first mode.

~~11. The method of any of the above claims wherein the vessel has an arcuate bottom surface.~~

~~12~~10. The method of any of the above claims wherein the jet mixer comprises a jet aeration type mixer having a delivery nozzle, and wherein saccharifying the feedstock comprises delivering a jet through the delivery nozzle.

~~13~~11. The method of claim ~~12~~ 10 wherein the jet mixer is operated without injecting air through the delivery nozzle.

~~14~~12. The method of claim ~~12~~10, wherein saccharifying comprises supplying a liquid to two inlet lines of the jet aeration type mixer.

~~15~~13. The method of any of the above claims wherein the jet mixer comprises a suction chamber jet mixer.

~~16~~14. The method of any of the above claims wherein the jet mixer comprises a nozzle in fluid communication with a first end of an ejector pipe, the first end of the ejector pipe being spaced from the nozzle, and the ejector pipe having a second end that is configured to emit a fluid jet.

~~17~~15. The method of any of the above claims wherein saccharifying comprises

adding the feedstock to the fluid medium in discrete increments; and

mixing each discrete increment of feedstock into the fluid medium with the jet mixer before adding another increment of feedstock.

~~18~~16. The method of any of the above claims further comprising monitoring a glucose level of a mixture of the feedstock, the fluid medium and the saccharifying agent during operation of the jet mixer.

~~19~~17. The method of any of the above claims further comprising adding additional feedstock and saccharifying agent to the vessel during saccharification.

~~20~~18. The method of any of the above claims wherein the vessel comprises a tank.

~~21~~19. The method of any of the above claims wherein the vessel comprises a tank of a rail car or a tanker truck.

~~22~~20. The method of claim ~~21~~ 19 wherein saccharification takes place partially or completely during transport of the mixture of feedstock, fluid medium and saccharifying agent.

~~23~~21. The method of any of the above claims wherein the feedstock comprises ~~a cellulosic or lignocellulosic material.~~

~~24. The method of claim 23 wherein the feedstock comprises~~ paper.

~~25~~22. The method of any of the above claims further comprising adding an emulsifier or surfactant to the mixture in the vessel.

~~26~~23. The method of any of the above claims further comprising adding a microorganism to the vessel and fermenting the saccharified feedstock.

~~27~~24. A method comprising:

saccharifying a ~~biomass~~ lignocellulosic material ~~feedstock by operation of a mixer that produces generally toroidal flow within~~in a vessel by mixing the lignocellulosic material with a fluid medium and an enzyme using a jet mixer to form a mixture, wherein the jet-mixer comprises a jet-flow agitator and the vessel has an arcuate bottom surface, wherein the jet mixer is mounted offset from a center axis of the vessel, and wherein saccharifying the lignocellulosic material comprises agitating the mixture with the jet-flow agitator~~in which the biomass feedstock has been placed with a fluid medium and a saccharifying agent~~.

28. The method of claim 27 wherein the mixer is configured to limit any increase in the overall temperature of the fluid medium to less than 5°C over the course of mixing.

29. A method comprising:

converting a low molecular weight sugar to a product by mixing the low molecular weight sugar with a microorganism in a fluid medium, using a jet mixer.

30. The method of claim 29 wherein the fluid medium comprises water.

31. The method of claim 29 or claim 30 wherein the microorganism comprises yeast.

32. The method of any of claims 29-31 wherein the jet mixer comprises a jet-flow agitator, and wherein converting comprises agitating the feedstock with the jet-flow agitator.

33. The method of any of claims 29-32 wherein the jet mixer comprises a jet aeration type mixer having a delivery nozzle, and wherein saccharifying the feedstock comprises delivering a jet through the delivery nozzle.

34. The method of any of claims 29-33 wherein the jet mixer comprises a suction chamber jet mixer.

35. A feedstock saccharification apparatus comprising:

a tank,

a biomass feedstock delivery device configured to deliver a biomass feedstock to the tank, and

a saccharifying agent delivery device configured to deliver a metered amount of a saccharifying agent to the tank, and

a jet mixer having a nozzle disposed within the tank and configured to mix the delivered biomass feedstock and saccharifying agent.

36. The apparatus of claim 35 wherein the jet mixer further comprises a motor, and the apparatus further comprises a torque monitor that monitors torque of the motor during mixing, and/or an amp monitor that monitors the full load amperage of the motor.

37. The apparatus of claim 35 or claim 36 further comprising a controller that adjusts the operation of the feedstock delivery device and/or the saccharifying agent delivery device based on input from the torque monitor.

38. The apparatus of any of claims 35-37 wherein the jet mixer comprises a motor and the apparatus further comprises a variable frequency drive configured to adjust the speed of the motor.

39. The apparatus of any of claims 35-38 wherein the tank has an arcuate bottom surface.

40. A method comprising:

saccharifying a biomass feedstock in a vessel to form a saccharified mixture;

inoculating the saccharified mixture in the vessel with a microorganism; and

allowing the inoculated saccharified mixture to ferment in the vessel.

41. The method of claim 40 further comprising, during fermentation, transferring the contents of the vessel to a transport vessel and allowing fermentation to continue in the transport vessel.

42. The method of claim 40 or claim 41 further comprising agitating the contents of the vessel with a jet mixer during saccharification and fermentation.

43. The method of any of claims 40-42 further comprising monitoring the oxygen content and ethanol and/or sugar content of the fermenting mixture.

44. A fermentation system comprising:

a vessel having a vent;

a source of oxygen in communication with the vessel;

an oxygen monitor configured to monitor the oxygen content of a liquid in the vessel; and

a controller configured to adjust the oxygen content of the liquid, using the vent and oxygen source, in response to input from the oxygen monitor.

45. The fermentation system of claim 44 wherein the controller is configured to oxygenate the vessel at a rate of less than 0.2 vvm.

46. The fermentation system of claim 44 or claim 45 further comprising a fermentation monitor configured to monitor the sugar concentration and/or ethanol concentration of the liquid in the vessel; and a controller configured to stop fermentation based on input received from the fermentation monitor.

47. The fermentation system of claim 46 further comprising a fermentation stopping module configured to stop fermentation in response to a signal received from the controller.