CLAIMS

What is claimed is:

1. A method for making ~~a~~ sugar alcohols, the method comprising:

combining a slurry of ~~cellulosic or~~ saccharified lignocellulosic biomass that contains a sugar solution comprising glucose and xylose derived from the biomass~~one or more sugars~~ with a microorganism selected from the group consisting of CBS 461.67 *(Moniliella pollinis)* and CBS 567.85 *(Moliniella megachiliensis)*, the recalcitrance of the lignocellulosic biomass having been reduced by bombardment with electrons; and

utilizing ~~jet mixing to agitate the slurry while maintaining a dissolved oxygen level of at least 10% while allowing~~ the microorganism to ferment ~~a first~~the sugar solution to ~~a sugar alcohol~~produce erythritol, ~~the jet mixing~~while providing ~~agitation~~ aeration from 0.3 to 1.0 VVM and mixing the slurry with a jet mixer~~effective to increase production of the sugar alcohol, yielding at least 80 g/L of the sugar alcohol from 300 g/L of the first sugar~~.

~~2. The method of claim 1 further comprising reducing the recalcitrance of the cellulosic or lignocellulosic biomass prior to contacting the biomass with the microorganism.~~

~~3~~2. The method of claim 1 ~~or 2~~, further comprising saccharifying the ~~cellulosic or~~ lignocellulosic biomass.

~~4. The method of any one of claims 1-3, wherein the sugar alcohol is selected from the group consisting of: glycol, glycerol, erythritol, threitol, arabitol, xylitol, ribitol, mannitol, sorbitol, galactitol, iditol, inositol, volemitol, isomalt, maltitol, lactitol, maltotriitol, maltotetraitol, and polyglycitol.~~

~~5. The method of claim 4, wherein the sugar alcohol comprises erythritol.~~

~~6. The method of any one of the above claims wherein the microorganism is selected from the group consisting of *Moniliella pollinis, Moniliella megachiliensis, Yarrowia lipolytica, Aureobasidium sp., Trichosporonoides sp., Trigonopsis variabilis, Trichosporon sp., Moniliellaacetoabutans, Typhula variabilis, Candida magnoliae, Ustilaginomycetes,*~~

~~*Pseudozyma tsukubaensis;* yeast species of genera *Zygosaccharomyces, Debaryomyces, Hansenula and Pichia*; and fungi of the dematioid genus *Torula*.~~

~~7. The method of claim 6, wherein the microorganism is a species of *Moniliella*.~~

~~8. The method of claim 7, wherein the microorganism is *M. pollinis*.~~

~~9. The method of claim 8, wherein the microorganism is *M. pollinis* strain CBS 461.67.~~

~~10. The method of claim 7, wherein the microorganism is *M. megachiliensis*.~~

~~11. The method of claim 10, wherein the microorganism is *M. megachiliensis* strain CBS 567.85.~~

3. The method of claim 2, further comprising adjusting the concentration of the glucose to at least 5 wt. %.

4. The method of claim 2, wherein the biomass is saccharified with one or more cellulases.

~~12~~5. The method any one of the above claims, wherein the ~~cellulosic or~~ lignocellulosic biomass is selected from the group consisting of: paper, paper products, paper waste, paper pulp, pigmented papers, loaded papers, coated papers, filled papers, magazines, printed matter, printer paper, polycoated paper, card stock, cardboard, paperboard, cotton, wood, particle board, forestry wastes, sawdust, aspen wood, wood chips, grasses, switchgrass, miscanthus, cord grass, reed canary grass, grain residues, rice hulls, oat hulls, wheat chaff, barley hulls, agricultural waste, silage, canola straw, wheat straw, barley straw, oat straw, rice straw, jute, hemp, flax, bamboo, sisal, abaca, corn cobs, corn stover, soybean stover, corn fiber, alfalfa, hay, coconut hair, sugar processing residues, bagasse, beet pulp, agave bagasse, algae, seaweed, manure, sewage, offal, agricultural or industrial waste, arracacha, buckwheat, banana, barley, cassava, kudzu, oca, sago, sorghum, potato, sweet potato, taro, yams, beans, favas, lentils, peas, and mixtures of any of these.

~~13. The method of claim 2, where the recalcitrance of the biomass has been additionally reduced by a treatment method selected from the group consisting of: bombardment with electrons, sonication, oxidation,~~

~~pyrolysis, steam explosion, chemical treatment, mechanical treatment, and freeze grinding.~~

~~14. The method of claim 13, wherein the treatment method is bombardment with electrons.~~

~~15~~6. The method of any one of the above claims wherein the biomass material is a lignocellulosic biomass.

~~16~~7. The method of any one of the above claims, further comprising mechanically treating the ~~cellulosic or~~ lignocellulosic biomass to reduce its bulk density and/or increase its surface area.

~~17~~8. The method of claim ~~16~~1, further comprising comminuting ~~wherein~~ the ~~cellulosic or~~ lignocellulosic biomass ~~is comminuted~~.

~~18~~9. The method of claim ~~17~~8, wherein ~~the~~ said ~~comminution~~ comminuting is dry milling.

~~19~~10. The method of claim ~~17~~8, wherein ~~the~~ said ~~comminution~~ comminuting is wet milling.

~~20. The method of claim 3, wherein the biomass is saccharified with one or more cellulases.~~

~~21. The method of any one of the above claims, further comprising isolating one or more of the one or more sugars prior to combining the slurry of cellulosic or lignocellulosic biomass with the microorganism.~~

~~22. The method of any one of the above claims, further comprising concentrating the one or more sugars prior to combining the slurry of cellulosic or lignocellulosic biomass with the microorganism.~~

~~23~~11. The method of any one of the above claims, further comprising culturing the microorganism in a cell growth phase before combining the ~~slurry of cellulosic or~~ lignocellulosic biomass with the microorganism.

~~24. The method of claim 3, wherein the saccharified biomass is adjusted to have an initial glucose concentration of at least 5 wt%.~~

~~25. The method of any one of the above claims, further comprising purifying the biomass.~~

~~26. The method of claim 25, wherein purifying comprises the removal of metal ions.~~

~~27. The method of any one of the above claims, wherein the jet mixing is provided, at least in part, by a jet mixer comprising an impeller, the impeller rotating at a rate between 400 to 650 revolutions per minute.~~

12. The method of claim 1, wherein the bombardment with electrons is provided at a dose of at least 5 Mrad.

13. The method of claim 1, wherein the bombardment with electrons is provided at a dose of between 5 Mrad to 50 Mrad.

14. The method of claim 1, wherein the bombardment with electrons is provided at a dose of between 20 Mrad to 40 Mrad.

15. The method of claim 1, wherein the bombardment with electrons is provided at a dose rate of greater than 0.25 Mrad/sec.

16. The method of claim 1, wherein the bombardment with electrons is provided at a dose rate of between 0.25 to 2 Mrad/sec.

17. The method of claim 1, wherein the bombardment with electrons is provided at a dose rate of greater than 2 Mrad/sec.

18. The method of claim 1, wherein the jet mixer further comprises an impeller, the impeller rotating at a rate between 400 to 650 revolutions per minute while mixing.

19. The method of claim 1, wherein the jet mixer further comprises a shaft, and the method further comprising aerating the slurry through a bore in the shaft.

20. The method of claim 19, wherein the bore provides aeration at 0.6 VVM.