CLAIMS

1. A method of processing a biomass material, the method comprising;

providing a biomass material to a first treatment cell equipped with a first electron beam device, irradiating the biomass material with electron beams using the first electron beam device, and cooling and conveying the biomass material with a screw conveyor from the first treatment cell;

conveying the biomass material to a second treatment cell equipped with an second electron beam device and irradiating the biomass material with an electron beam using the second electron beam device.

2. The method of claim 1, wherein the screw conveyor comprises interior portions that are cooled.

3. The method of claim 2, wherein the interior portions are cooled using a chilled liquid.

4. The method of any one of claims 1-3, wherein the cooling reduces the temperature of the biomass material by between about 1°C and 110 °C.

5. The method of any one of claims 1-3, wherein the cooling reduces the temperature of the biomass material by between about 10°C and about 75 °C.

6. The method of any one of claims 1-3, wherein the cooling reduces the temperature of the biomass material by between about 10°C and about 50 °C.

7. The method of any one of claims 1-6, wherein a total dose delivered is between about 1 and 200 Mrad.

8. The method of any one of claims 1-6, wherein a total dose delivered is between about 10 Mrad and about 50 Mrad.

9. The method of any one of claims 1-6, wherein a total dose delivered is between about 20 Mrad and about 40 Mrad.

10. The method of any one of claims 1-9, wherein the temperature of the biomass material during the irradiation does not exceed about 160 °C.

11. The method of any one of claims 1-9, wherein the temperature of the biomass material during irradiation increases by between about 75 °C and about 150 °C.

12. The method of any one of claims 1-11, wherein the biomass comprises a lignocellulosic material.

13. The method of any one of claims 1-11, wherein the biomass is selected from the group consisting of wood, particle board, sawdust, agricultural waste, sewage, silage, grasses, rice hulls, bagasse, cotton, jute, hemp, flax, bamboo, sisal, abaca, straw, corn cobs, corn stover, switchgrass, alfalfa,hay, coconut hair, seaweed, algae, and mixtures thereof.

14. The method of any one of claims 1-13, wherein the screw conveyor comprises two or more screws.

15. The method of any one of claims 1-14, wherein irradiating with the first electron beam delivers a dose at a rate of at least 1 Mrad per second to the biomass material.

16. The method of any one of claims 1-15, wherein irradiating with the second electron beam device delivers a dose at a rate of at least 1 Mrad per second to the biomass material.

17. The method of any one of claims 1-16, wherein the screw conveyor has a material inlet and a material discharge, and wherein a difference in temperature of the biomass material between the material at the inlet and at the discharge is less than about 110 °C.

18. The method of any one of claims 1-17, wherein the biomass material is comminuted while it is conveyed.

19. The method of claim 3, wherein the interior portions are cooled using water or glycol water mixtures.