CLAIMS

1. A treatment operating unit, comprising:

a plurality of enclosure systems, each enclosure system including one or more vaults, and

within each vault, an irradiation device and a treatment conveyor, wherein a biomass material is treated in each vault utilizing the irradiation device and the treatment conveyor.

2. The operating unit of claim 1, wherein the enclosure systems are arranged in rows.

3. The operating unit of claim 2, wherein the rows extend in a first direction, and wherein each enclosure system comprises two or more vaults extending in a direction generally perpendicular to the first direction.

4. The operating unit of claim 3, wherein the first and second vaults of each enclosure share a common wall.

5. The operating unit of claim 4, wherein each first vault is configured to accept untreated biomass from a storage facility.

6. The operating unit of claim 5, wherein the first vault of each enclosure system further encloses equipment configured to transfer treated biomass from the first vault to the second vault of the enclosure system.

7. The operating unit of claim 1, wherein the irradiation device comprises an electron accelerator.

8. The operating unit of claim 1, wherein the treatment conveyor comprises a vibratory conveyor.

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within each vault, an irradiation device and a treatment conveyor.

2. The operating unit of claim 1, wherein the enclosure systems are arranged in rows.

3. The operating unit of claim 2, wherein the rows extend in a first direction, and wherein each enclosure system comprises two or more vaults extending in a direction generally perpendicular to the first direction.

4. The operating unit of claim 3, wherein the first and second vaults of each enclosure share a common wall.

5. The operating unit of claim 4, wherein each first vault is configured to accept untreated biomass from a storage facility, and wherein the biomass material is treated in each vault utilizing the irradiation device and the treatment conveyor.

6. The operating unit of claim 5, wherein the first vault of each enclosure system further encloses equipment configured to transfer treated biomass from the first vault to the second vault of the enclosure system.

7. The operating unit of any one of the previous claims, wherein the irradiation device comprises an electron accelerator.

8. The operating unit of any one of the previous claims, wherein the treatment conveyor comprises a vibratory conveyor.

9. A method for producing treated materials, the method comprising;

partitioning a material into a plurality of material portions,

conveying the material portions into a plurality of first vaults, each first vault accepting one of the material portions,

treating the material portions in the vaults,

conveying the material portions out of the first vaults, and

combining the material portions.

10. The method of claim 9, wherein treating comprises a treatment method selected from the group consisting of dosing with ionizing radiation, sonication, oxidation, pyrolysis, steam explosion, chemical treatment, mechanical treatment, freeze grinding and combinations thereof.

11. The method of claim 10, wherein dosing with ionizing radiation comprises irradiation with an electron beam.

12. The method of claim 10 or 11, wherein each material portion is treated with a dose between about 10 Mrad and about 150 Mrad of radiation.

13. The method of any one of claims 10 through 12, wherein within each first vault the material is treated with a dose between about 10 and about 50 Mrad of radiation.

14. The method of any one of claims 9 through 13, wherein each conveying step comprises pneumatically conveying.

15. The method of any one of claims 9 through 14, further comprising conveying the material with a vibratory conveyor while treating the material portions.

16. The method of any one of claims 9 through 15, further comprising continuously partitioning the material, continuously conveying the material portions into the first vaults, continuously treating the material portions and continuously combining the material portions, to continuously produce a treated material.

17. The method of any one of claims 9 through 16, wherein the temperature of each material portion does not exceed 150 °C during the treating step.

18. The method of any one of claims 9 through 17, further comprising cooling each material portion while treating and/or cooling between irradiations (e.g., utilizing a screw cooler).

19. The method of any one of claims 9 through 18, further comprising, after conveying the material portions out of the first vaults, conveying the material portions to a plurality of second vaults, each second vault accepting one of the material portions,

treating the material portions in the second vaults,

conveying the material portions out of the second vaults.

20. The method of claim 19, wherein each first and second vaults share a common wall.

21. The method of claim 19 or 20, further comprising cooling the material portions between the first treating step and second treating step.

22. The method of any one of claims 9 through 21, wherein the material is a biomass material and treating reduces or further reduces the recalcitrance of the biomass material.

23. The method of claim 22, wherein the biomass material is a cellulosic or lignocellulosic material.

24. The method of claim 23, 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, arracacha, buckwheat, banana, barley, cassava, kudzu, ocra, sago, sorghum, potato, sweet potato, taro, yams, beans, favas, lentils, peas, and mixtures of any of these.

25. The method of any one of claims 9 through 24, wherein the treated material is produced at a rate of at least 500 lb/hr per vault.