Claims

The claims of system and method for solid waste treatment are as follows.

1. An integrated and universal intelligent solid waste treatment system comprising the following that work together in synergy:

(a) A processor with memory that stores treatment methods for different wastes to meet environmental and/or material utilization standards or guidelines developed and simulated by artificial intelligence software, adopts artificial intelligence technology, and executes instructions for selection of suitable treatment strategies based on information about solid wastes and specific environmental and/or material utilization standards or guidelines; the processor includes a database stored in the memory that provides treatment strategies for various environmental pollutants and harmful substances in the environmental and/or material utilization standards or guidelines; and the processor analyzes the solid waste information to classify the solid waste materials into groups A, B, C, and D such that:

A is incineration bottom ash with material heterogeneity and particle size distribution 50 mm to 1 mm,

B is powdery or consists of lumps of powdery material and has particle size distribution below 1 mm,

C has moisture content 40% to 70% and particle size distribution 60 mm to 1 mm, and

D is harder particles such as slag and contaminated soil having particle size distribution below 30 mm and the particle sizes are uniform;

(b) Drying unit;

(c) Sieving unit that separates solid waste particles by size;

(d) Treatment chamber housing washing, ultrasonication, and scum removal functions;

(e) Chemical immobilization and/or decomposition unit;

(f) Sensor network and algorithm system that continuously monitor concentrations of pollutants including soluble salts, heavy metals, and organic pollutants and automatically adjust washing liquid, and dosages of chemical immobilization and/or decomposition agents in the treatment chamber;

(g) Magnetic separator and eddy current separator units;

(h) Wastewater treatment unit; and

(i) Solid waste particle re-composition unit.

2. Method of treating solid waste of groups A, B, C, and D using the system as specified in claim 1 wherein the drying unit dries the solid waste material by warm air blower to a maximum moisture content of 30% to 40% for groups B and C and that is switched off for groups A and D.

3. The method of treating solid waste in claim 2 wherein the sieving unit sieves solid waste particles such that for group A fine particles are below 3 mm, medium-sized particles are 3 to 20 mm, and coarse particles are 20 to 50 mm and that for groups B, C, and D the sieving unit is bypassed.

4. The method of treating solid waste in claims 2 and 3 wherein for groups A and D inside the treatment chamber, washing liquid is water, an aqueous solution of inorganic acid, an aqueous solution of an organic acid, a complexing agent, and combinations thereof, the inorganic acid is hydrochloric acid, sulfuric acid, nitric acid, phosphoric acid, and combinations thereof, the organic acid is citric acid, oxalic acid, or acetic acid, and combinations thereof, and complexing agent is ethylenediaminetetraacetic acid, ethylenediamine-N,N'-disuccinic acid, nitrilotriacetic acid, ethylenediamine, dimercaprol, ammonium citrate, and combinations thereof, and for groups B and C the washing function is switched off.

5. The method of treating solid waste in claims 2 to 4 wherein ultrasonication frequency inside the treatment chamber is 65 to 85 MHz for group A, 5 to 25 MHz for group D, and the ultrasonication function is switched off for groups B and C.

6. The method of treating solid waste in claims 2 to 5 wherein

> For group A fine particles, 10% to 20% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit;
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> For group A medium-sized particles, 5% to 15% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit;
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> For group A coarse particles, 0.1% to 10% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit;
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> For group B, 5% to 50% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit;
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> For group C, 1% to 20% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit; and

For group D, 2% to 10% of chemical agents selected from group consisting organic sulfurs, inorganic sulfurs, hydroxides, phosphates, carbonates, bicarbonates, oxidants, or combinations thereof are added to the chemical immobilization and/or decomposition unit.

7. The method of treating solid waste in claims 2 to 6 wherein the sensor network and algorithm system continuously monitor concentration of environmental pollutants and harmful substances, and automatically adjust volume of washing liquid until concentration of environmental pollutants and harmful substances is below value determined by the database of claim 1 (a).

8. The method of treating solid waste in claims 2 to 7 wherein the magnetic separator removes ferrous particles and the eddy current separator removes aluminum and other nonferrous particles for group A and for groups B, C, and D the magnetic separator and eddy current separator are switched off.

9. The method of treating solid waste in claims 2 to 8 wherein for groups A and D the wastewater treatment unit comprises a flocculating or coagulating step using a chemical that is selected from group consisting of aluminum sulfate, ferric chloride, ferric sulfate, ferrous sulfate, polyacrylamide, polyaluminum chloride, polyaluminum chlorosulfate, polyaluminum silicatesulfate, sodium alginates, polyelectrolytes, and combinations thereof and for groups B and C the wastewater treatment unit is switched off.

10. The method of treating solid waste in claims 2 to 9 wherein,

For groups A and D, the solid particle re-composition unit reassembles the treated solid waste particles such that coarse particles are 2 to 20 mm and fine particles are <2 mm, and treated coarse particles of 2 to 20 mm in size substitute 5% to 50% of stones and fine particles of size <2 mm substitute 10% to 50% of sand in concrete marking formulation;

For group B, the solid particle re-composition unit is switched off;

For group C, the solid particle re-composition unit separates treated solid waste particles that are of size <2 mm to substitute 5% to 10% of sand in concrete making formulation.