Claims

1. A method for heavy metal immobilization, the method comprising:
   - mixing organic-containing media comprising heavy metal with at least one additive to form a mixture; and
   - torrefying the mixture to form biochar, wherein the biochar immobilizes the heavy metal,

wherein the organic-containing media comprises ≥ 25 weight % organic content, wherein the at least one additive comprises a reducing agent, wherein the reducing agent comprises: sodium borohydride, hydrazine, aluminium powder, $LiAlH_4$, or a mixture thereof.

2. A method for heavy metal immobilization, the method comprising:
   - mixing organic-containing media comprising heavy metal with at least one additive to form a mixture;
   - torrefying the mixture to form biochar, wherein the biochar immobilizes the heavy metal; and
   - calcinating the biochar following the torrefying to form calcinated material, wherein the calcinating comprises calcinating in an oxidising atmosphere, further wherein the calcinating is at a temperature of 600-1200°C,

wherein the organic-containing media comprises less than 25 weight % organic content, wherein the at least one additive comprises an inorganic additive, wherein the inorganic additive comprises: lime, limestone, $FeCl_3$, $Fe_2(SO_4)_3$, $FeSO_4$, aluminium powder, iron powder, FeOOH, Fe_2O_3, $MgCO_3$, $MgCa(CO_3)_2$, NaOH, KOH, phosphate, monohydrogenphosphate, dihydrogenphosphate, rock phosphate, phosphoric acid, polyphosphate, hydroxyapatite, milorganite, bentonite, kaolinite, zeolite, manganese oxide, iron oxide, or a mixture thereof.

3. The method according to claim 1 or 2, wherein the torrefying comprises torrefying in presence of inert gas.

4. The method according to any preceding claim, wherein the torrefying is at a temperature of 25-450°C.

5. The method according to any preceding claim, further comprising treating flue gas produced during the torrefying.

6. The method according to any preceding claim, further comprising drying the mixture prior to the torrefying.

7. The method according to claim 6, wherein the drying comprises drying in presence of inert gas.

8. The method according to claim 6 or 7, wherein the drying is at a temperature of 1-280°C.

9. The method according to any preceding claim, further comprising cooling the biochar following the torrefying.

10. The method according to any of claims 2 to 9, further comprising treating flue gas produced during the calcinating.

11. The method according to any of claims 2 to 10, further comprising cooling the calcinated material.

12. The method according to any of claims 2 to 11, further comprising:

- mixing the biochar with at least one further additive to form a biochar mixture; and
- molding the biochar mixture,

wherein the mixing and the molding is prior to the calcinating.

13. The method according to claim 12, wherein the at least one further additive comprises: clay, sand, stone, fly ash, coal ash, furnace slag, incineration bottom ash, construction waste, egg shell, or a mixture thereof.