Claims

1. A method of recovering titanium dioxide and magnesium sulphate from a particulate material, said method comprising:
    a. contacting the particulate material with sulphuric acid and heating to form a sulphated mixture;
    b. filtering the sulphated mixture to produce a filter cake and a first permeate comprising sulphuric acid;
    c. contacting the filter cake with water to form a sulphated suspension comprising titanyl sulphate;
    d. filtering the sulphated suspension to produce a permeate comprising at least titanyl sulphate, and a retentate comprising insoluble residue;
    e. contacting the permeate comprising at least titanyl sulphate with water to produce a hydrolysis liquor; and
    f. hydrolysing the titanyl sulphate;
    g. separating titanium dioxide hydrate from the hydrolysis liquor to produce a permeate comprising magnesium sulphate, and a retentate comprising titanium dioxide hydrate; and
    h. precipitating magnesium sulphate from the permeate.
2. The method of claim 1 wherein the retentate comprising insoluble residue comprises at least one product selected from calcium sulphate and silica.
3. The method of claim 1 or 2 wherein the precipitation of magnesium sulphate comprises the steps of:
    a. increasing the acid concentration of the permeate comprising magnesium sulphate to form an acidified liquor; and
    b. filtering the acidified liquor to produce a retentate comprising precipitated magnesium sulphate.
4. A method as claimed in claim 3 wherein the acid concentration of the permeate comprising magnesium sulphate is increased by the addition of sulphuric acid.
5. A method as claimed in claim 3 or 4 wherein the pH of the permeate comprising magnesium sulphate is reduced to less than approximately pH1 by the addition of sulphuric acid.
6. A method as claimed in any one of claims 3 to 5 wherein the acid concentration of the permeate comprising magnesium sulphate is increased by heating the permeate to remove water.
7. The method of any one of the preceding claims wherein the particulate material comprises greater than 8m% titanium dioxide and greater than 7m% magnesium oxide.

8. The method of claim 7 wherein the particulate material comprises greater than 15m% titanium dioxide and greater than 10m% magnesium oxide.
9. The method of any one of the preceding claims wherein the particulate material comprises a ratio of titanium dioxide to magnesium oxide (TiO_2:MgO) of approximately 0.5 to 3.0.
10. The method of any one of the preceding claims wherein the step of precipitating magnesium sulphate comprises:
    a. cooling the permeate comprising magnesium sulphate or the acidified liquor to produce a cooled liquor comprising magnesium sulphate; and
    b. filtering the cooled liquor comprising magnesium sulphate to produce a retentate comprising precipitated magnesium sulphate, and a permeate.
11. The method of claim 10 wherein the permeate or liquor is cooled to between 0°C and 4°C.
12. The method of any one of the preceding claims, further comprising a step of precipitating aluminium sulphate from either:
    a. the permeate produced from the hydrolysis liquor; or
    b. the permeate comprising at least titanyl sulphate.
13. The method of any one of the preceding claims wherein the particulate material is selected from the group consisting of iron slag, melter slag, obtained from iron slag, obtained from melter slag, obtained from an iron manufacturing process, and obtained from a steel manufacturing process.
14. The method of any one of the preceding claims wherein the method further comprises the step of grinding raw material to form the particulate material of step a.
15. The method of claim 14 wherein the particulate material has a particle size between 10 and 180μm.
16. The method of any one of the preceding claims wherein the particulate material is contacted with 4-10 times its stoichiometric quantity of sulphuric acid.
17. The method of any one of the preceding claims wherein the step of filtering the sulphated mixture further comprises contacting the mixture with compressed air.
18. The method of claim 17 wherein the temperature of the compressed air is from 10°C to 85°C.
19. The method of any one of the preceding claims wherein the permeate comprising at least titanyl sulphate is heated to remove water and increase the free acidity.
20. The method of any one of the preceding claims wherein the hydrolysis liquor is contacted with water containing titanium dioxide particles.