

WHAT IS CLAIMED:

1. A method for preparing a photocatalytic, neutral titanium dioxide sol, the method comprising:
 - washing and dewatering a hydrous titanium dioxide gel with an aqueous solvent having a cation concentration of about 500 ppm or less until achieving a filtrate conductivity of about 750 $\mu\text{S}/\text{cm}$ or less and forming a titanium dioxide filter cake;
 - peptizing the titanium dioxide filter cake by adding the filter cake to an alkaline peptizing agent to provide a peptized alkaline titanium dioxide sol with a TiO_2 concentration of about 30% by weight or greater;
 - neutralizing the peptized alkaline titanium dioxide sol with a concentrated acid to provide a photocatalytic, neutral titanium dioxide sol with a pH of about 7 to about 9 and a TiO_2 concentration of about 30% by weight or greater.
2. The method according to claim 1, wherein the washing and dewatering comprises processing the hydrous titanium dioxide gel in a filter press.
3. The method according to claim 1, wherein the aqueous solvent is demineralized water.
4. The method according to claim 1, wherein the aqueous solvent has a cation concentration of about 100 ppm or less.
5. The method according to claim 1, wherein the aqueous solvent has a Ca^{2+} concentration of about 50 ppm or less.
6. The method according to claim 1, wherein the washing and dewatering is carried out until achieving a filtrate conductivity of about 600 $\mu\text{S}/\text{cm}$ or less.
7. The method according to claim 1, wherein the alkaline peptizing agent is selected from the group consisting of an alkylamine, a quaternary ammonium hydroxide, and combinations thereof.

8. The method according to claim 7, wherein the alkaline peptizing agent is selected from the group consisting of diethylamine (DEA), tetraethyl ammonium hydroxide (TEAOH), and combinations thereof.
9. The method according to claim 1, wherein the titanium dioxide filter cake is added under mixing.
10. The method according to claim 9, wherein peptizing is substantially completed in a time of about 90 minutes or less.
11. The method according to claim 1, wherein the peptized alkaline titanium dioxide sol has a TiO_2 concentration of about 40% by weight or greater.
12. The method according to claim 1, wherein the peptized alkaline titanium dioxide sol has a pH of about 11 or greater.
13. The method according to claim 1, wherein the concentrated acid comprises phosphoric acid.
14. The method according to claim 13, wherein the phosphoric acid has a concentration of about 75% w/w or greater.
15. The method according to claim 1, wherein the neutralizing is carried out in a time of about 120 minutes or less.
16. The method according to claim 1, wherein the neutral titanium dioxide sol has a pH of about 8 to about 9 and a TiO_2 concentration of about 35% by weight or greater.
17. The method according to claim 1, wherein the TiO_2 particles in the neutral titanium dioxide sol have an average size of about 50 nm or less.
18. The method according to claim 1, wherein about 90% or greater of the TiO_2 particles in the neutral titanium dioxide sol are in the anatase form.

19. The method according to claim 1, wherein the neutral titanium dioxide sol has a viscosity of about 40 centipoise to about 100 centipoise.

20. A method for preparing a photocatalytic, neutral titanium dioxide sol, the method comprising:

processing a hydrous titanium dioxide gel in a filter press with demineralized water having a Ca^{2+} concentration of about 50 ppm or less until achieving a filtrate conductivity of about 500 $\mu\text{S}/\text{cm}$ or less and forming a titanium dioxide filter cake;

peptizing the titanium dioxide filter cake by adding the filter cake to an alkaline peptizing agent with mixing to provide a peptized alkaline titanium dioxide sol with a TiO_2 concentration of about 30% by weight or greater, said peptizing being substantially completed in a time of about 60 minutes or less;

neutralizing the peptized alkaline titanium dioxide sol with phosphoric acid at a concentration of about 85% w/w or greater to provide a photocatalytic, neutral titanium dioxide sol with a pH of about 8 to about 9 and a TiO_2 concentration of about 35% by weight or greater.

21. A photocatalytic, neutral titanium dioxide sol prepared by the process of claim 1.

22. A photocatalytic, neutral titanium dioxide sol prepared by the process of claim 20.