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Chemical Formula: TiO_2

Chemical Name: Titanium dioxide

Forms of TiO_2

Titanium dioxide is produced in two main forms.

1. **Pigment grade titanium dioxide:** The primary form, comprising over 98 percent of total production. The pigmentary form makes use of titanium dioxide's excellent light-scattering properties in applications that require white opacity and brightness.
2. **Ultrafine (nanomaterial) form:** This form is selected when different properties, such as transparency and maximum ultraviolet light absorption, are required, such as in cosmetic sunscreens.

Use case:

a. What is the use of this compound?

1) **Pigment grade titanium dioxide:** used in a range of

applications that require high opacity and brightness like

- Paints and Coatings: provides opacity and durability, ensure the longevity, protection of the painted surface.
- Plastics, Adhesives and Rubber: minimizes the brittleness, fading and cracking that can occur in [plastics](#) and other materials as a result of light exposure.
- Cosmetics: used to aid in hiding blemishes and brightening the skin, allows for the use of thinner coatings of make-up material for the same desired effect.
- Paper: used to coat paper, making it whiter, brighter and more opaque.

- Food Contact Materials and Ingredients: protects food, beverages, supplements and pharmaceuticals from premature degradation, enhancing the longevity of the product.

2) Ultrafine-grades of titanium dioxide are most commonly used in the following specialty applications:

- Sunscreen: Nanoscale titanium dioxide becomes transparent to visible light while serving as an efficient UV light absorber. Because the particle size is so small, nano-titanium dioxide does not reflect visible light, but does absorb UV light, enabling a transparent barrier that protects the skin from the sun's harmful rays. According to the Skin Cancer Foundation, using [sunscreens containing titanium dioxide](#) can help prevent the occurrence of skin cancer.
- Catalysts: used as a support material for catalyst applications. Major uses include in the automotive industry to remove harmful exhaust gas emissions and in power stations to remove nitrous oxides.

b. Are there any alternatives to this compound? Name a few.

Alternatives like Precipitated Barium Sulphate, Precipitated Calcium Carbonates, Calcined Clays, Zinc oxide are used in paint industry. Starch-based options, either rice or corn based, are commonly used to replace titanium dioxide as an opacity agent

c. Why is this compound superior to its alternatives?

While each of these potential substitutes has its advantages and drawbacks, they typically don't perform as well as TiO₂ in delivering brightness, opacity, or longevity. Often, a combination of these substitutes is employed to try to mimic TiO₂'s performance, but they usually lack in one or more areas.

d. Is this compound imported in India? What is the magnitude of imports?

- Products worth \$681,132,359 under HS code 32061110 have been imported
- Average import price for Products under HS Code 32061110 was \$1.59.
- Products under HS Code 32061110 were imported from 31 countries.
- China was the largest exporter of Products under HS Code 32061110 accounting for 36.95% of the total imports of Products under HS Code 32061110
- USA was the second largest exporter of Products under HS Code 32061110 accounting for 18.11% of the total imports of Products under HS Code 39076090

Economic feasibility:

- a. What input raw materials are needed for its synthesis (same as reported in the Patent application)?

Precipitation Method:

- Titanium (IV) chloride (TiCl₄)
- Ammonium hydroxide (NH₄OH)
- Distilled water (H₂O)

- b. Provide preliminary economic feasibility based on cost of raw materials, solvents and product selling price.



Compound	Rate(in Rs/kg)	Rate(in Rs/Kmol)	Quantity(in Kmol)	Amount(in Rs)
Titanium (IV) chloride (TiCl ₄)	450/250	341.4222	100	34,142.22
Ammonium hydroxide (NH ₄ OH)	159	5,568.1	200	11,13,620
Distilled water (H ₂ O)	1	18.02	solvent	solvent
TiO ₂	275	21,963.15	100	21,96,315

- Total input costs of raw materials for producing 1 kmol TiO₂ = Rs (11,13,620+34,142.22)

=Rs 11,47,762.22

- Net Profit in producing 1 Kmol TiO₂ =Rs(21,96,315-11,47,762.22)

=Rs 10,48,552.78

Profit Percentage=(10,48,552.78/21,96,315)*100=47.74%

Market Analysis Report

References:

<https://learn.ddwcolor.com/alternatives-to-titanium-dioxide/>

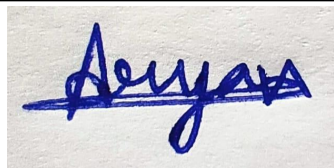
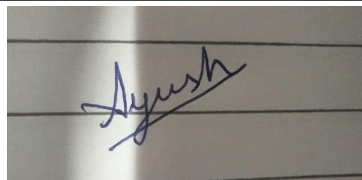
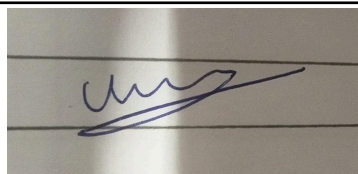
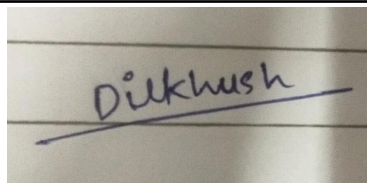
<https://www.linkedin.com/pulse/10-surprising-alternatives-titanium-dioxide-paints-farash-achi-pray/>

<https://www.indiamart.com/proddetail/distilled-water-25003582491.html>

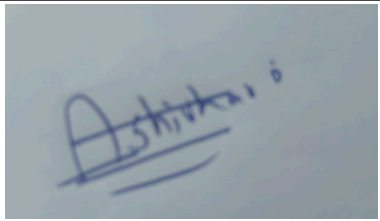
<https://www.indiamart.com/proddetail/titanium-tetrachloride-ticl4-99-99-high-purity-22620712773.html>

<https://www.indiamart.com/proddetail/ammonium-hydroxide-11419596788.html>

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Market Analysis Report

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