Frequently Asked Questions about Food Grade Titanium Dioxide (TiO_2)

The International Association of Color Manufacturers (IACM) is frequently asked to comment on the safety of use of food grade TiO_2 as a colorant in foods. Questions arise due to misconceptions that associate the food grade pigment form of TiO_2 with engineered nanoscale TiO_2. IACM would like to provide clarifications regarding the different types of titanium dioxide or TiO_2 and some facts regarding the use of TiO_2 in foods.

What is food grade TiO_2?
Food grade TiO_2 pigment is derived from natural sources and used as a white color in some foods. In the US, it is classified with other natural colors as "*Color additives exempt from certification*" listed in the Code of Federal Regulations Part 73 (21CFR §73.575).

Is food grade TiO_2 safe?
Yes. The safety of food grade TiO_2 pigment was thoroughly tested prior to approval of its use as a food color (FDA, EFSA, JECFA). Studies showed that it is not absorbed into the body, but is simply completely excreted in the feces. No adverse effects are observed at levels much higher than are consumed from use in foods. A recent human study has confirmed that absorption of food pigment TiO_2 into the body was non-detectable using highly sensitive technology.

If food grade TiO_2 is safe, why is it listed on California's Proposition 65?
While the Office of Environmental Health Hazard Assessment (OEHHA) within the California Environmental Protection Agency has added titanium dioxide (airborne, unbound particles of respirable size) to the list of chemicals known to the State of California to cause cancer for purposes of the Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65), the listing does not cover titanium dioxide when it remains bound within a product matrix. This qualified listing of titanium dioxide limits the regulation of the chemical to primarily workplace and respiratory intake and excludes oral ingestion of the chemical.

Do all white foods contain TiO_2?
No. Many foods are naturally white in color, such as plain milks and yogurts. Titanium dioxide is not allowed in plain milks and yogurts. So, not all white foods contain added TiO_2 food color. US FDA and international regulations require that TiO_2 be clearly labeled in the ingredient line when it is added as a color.

Does all titanium found in foods come from TiO_2 added to the food as a color?
No. Titanium is one of the most commonly found elements on earth so it is naturally occurring in some foods. Therefore, titanium may be present in foods that do not contain any added food color. There have been several misleading reports suggesting that simply the presence of titanium in food products was evidence of addition of titanium dioxide.

Is food grade TiO_2 pigment a nanomaterial?
No. There are many definitions of a "nanomaterial", but in general nanomaterials are considered to contain the majority of particles with a size less than 100 nanometers (nm). Although particles below 100 nm can also occur naturally to some extent, special engineering is required for the majority of particles to reach this range of particle size.

In order for TiO_2 to act as a pigment and give a white color, the particles must be large enough to scatter visible light, so pigment grade TiO_2 is manufactured to maximize the number of particles in the size range between 200 and 350 nm.

Therefore, pigment TiO_2 is distinct from forms of TiO_2 engineered to be nanomaterials. These nanomaterials contain particles that range from less than 2 nm to 60-70 nm and are designed to have very different properties. Although useful in other applications, these small particles are clear and colorless and are NOT used as a food color.

What about the incidental particles in pigment TiO_2 that may be smaller than 100nm?
Many naturally occurring minerals and foods contain particles of a size below 100 nm. Some minerals are essential elements for human metabolism and are taken directly from foods or as supplements, such as iron, zinc, calcium, etc. Furthermore, many natural components of meat, fish and plant foods, as well as milk (including human milk) form or contain "nanoparticles". The fact that an ingredient may contain particles that are formed naturally in the nanoscale range does not define it as a nanomaterial. Therefore, the incidental presence of some particles in the nanoscale range in food pigment grade TiO_2 is not a predictor of safety of the ingredient or the food containing it.

Are all the media stories about health risks from TiO_2 wrong?
There are many inaccuracies in the literature, in the media and other reports regarding the properties of TiO_2 that are interpreted incorrectly and contribute to the confusion among consumers. Scientists with expertise in the fields of toxicology, material science and risk science can easily spot the inaccuracies that may not be as easy to decipher by the average consumer. Examples of expert responses to inaccuracies can be found here.

We hope this information clarifies the current confusion regarding the safety of the low levels of TiO_2 added to foods as a food color. For more information, please contact IACM or visit the following websites:

- United States Food and Drug Administration (US FDA)
- European Food Safety Authority (EFSA)
- International Standards: General Standard for Food Additives (GSFA) Database
- Titanium Dioxide Manufacturers Association (TDMA) – About Titanium Dioxide