

Note: To access an embedded link, roll your cursor over the cell and a box with the links that are embedded in that cell will appear. If the links do not appear, try selecting a different cell and re-selecting the cell you are trying to access the links for.

Chemical	Health Risks	Use / Product types	EU Status (Additive list)	US Status	Limits in Store Brands/Chains	Alternatives	Cost comparisons for alternatives
Titanium dioxide (E 171)	<p>Risks: nanoparticles (often present in titanium dioxide) can damage DNA, which can lead to cancer</p> <p>- European Food Safety Authority (EFSA), Safety assessment of titanium dioxide (E171) as a food additive, EFSA Journal (pub. May 6, 2021).</p> <p>- Bettini et al., Food-grade TiO2 impairs intestinal and systemic immune homeostasis, initiates preneoplastic lesions and promotes aberrant crypt development in the rat colon (pub. 2016).</p> <p>- Javanovic B., Critical Review of Public Health Regulations of Titanium Dioxide, a Human Food Additive, Integrated Environmental Assessment and Management (pub. Aug. 4, 2014).</p>	<p>Used as a white colorant either on its own or to brighten other colors. Sometimes used to enhance texture.</p> <p>Found in a variety of processed foods, including Mars Skittles, Kraft Cheddar Shredded Cheese, Little Secrets Peppermint Dark Chocolate Pieces, First Street (Smart & Final brand) Pink and Yellow Frosted Sugar Cookies, Island Snacks Yogurt Nut Mix</p>	Banned from food in 2022. Commission Regulation (EU) 2022/63	<p>Allowed color additive: 21 CFR 73.575.</p> <p>Hasn't been meaningfully reviewed by FDA since 1966.</p>	<p>Wild Oats (all foods) Supervalu (Wild Harvest brand) Food Lion/Giant (Nature's Promise brand (fka Nature's Place))</p> <p>Papa John's (all foods) Panera (all foods) Dunkin' Donuts (removed titanium dioxide from powdered donuts in 2015. Notably, Dunkin' Donuts already started testing TiO2-free formulations in 2014, and the company's powdered donuts sold in the UK already did not have titanium dioxide.)</p>	<p>Alternatives include: products made from rice and corn starches and flours, products made from other minerals such as calcium carbonate. Proprietary products marketed as titanium dioxide replacers exist, such as Avalanche products from Sensient.</p> <p>Sources (all food industry): Ingredion, NCC Ingredients, ROHA</p>	<p>Titanium dioxide: \$12.27/lb (USP, Ingredient Depot, 3kg) \$22.99/lb (Pantai Store (on Amazon), 1lb) \$24.32/lb (Bake & Deco Warehouse, 1kg)</p> <p>—</p> <p>Calcium carbonate: \$1.04/lb (FCC, DudaDiesel, 50lb)</p> <p>Tricalcium phosphate: \$10.24/lb (FCC, ChemCentral Marketplace, 50lb) \$23.20/lb (FCC, MarkNature, 20lb)</p>
FD&C Red No. 3 (E 127)	<p>Risks: cancer, neurobehavioral changes in children</p> <p>-California Office of Environmental Health Hazard Assessment, Potential Neurobehavioral Effects of Synthetic Food Dyes in Children (pub. April 2021).</p> <p>- CSPI petition to FDA (Oct. 2022)</p>	<p>Used for coloring.</p> <p>Found in candies and other processed foods, including Brach's Pumpkin Mellowcreme Candy, Pez Cherry candy, Favorite Day (Target brand) Hand-Decorated Sugar Cookie, Betty Crocker Red Decorating Icing.</p>	Not allowed in food, except cocktail/candied cherries.	<p>Red 3 is allowed in food, but has been banned in cosmetics and externally-applied drugs since 1990.</p> <p>Red 3 has not been reviewed by FDA since 1982.</p>	<p>Trader Joe's (Trader Joe's brand) Whole Foods (all foods) Kroger (all foods) H-E-B (Select Ingredients brand) Harris Teeter (Free From shelf-label (not a brand)) Wild Oats (all foods) Publix (GreenWise brand and Made Without shelf label) Aldi (exclusive brand foods) Wegmans (Food You Feel Good About brand) ShopRite (Wholesome Pantry brand) Target (Good & Gather brand) Supervalu (Wild Harvest brand) Meijer (True Goodness brand) Food Lion/Giant (Nature's Promise brand (fka Nature's Place)) Hy-Vee (Hy-Vee brand items with Simple Source label)</p> <p>Papa John's (all foods) Chipotle (no artificial colors) Panera (all foods)</p>	<p>Plant-derived colorants, including those from various vegetables (beets, carrots, marigold, annatto, saffron, turmeric, chlorophyll, gardenia)</p> <p>Source: Alternatives to Those Artificial FD&C Food Colorants (2012), authors from OSU and PepsiCo</p> <p>Beetroot and carminic acid (from cochineal bugs) are common natural red colorants. Natural Food Colors Association</p>	<p>FD&C Red 3 (granular) \$0.14 - 0.28/lb (multiple suppliers, Made-in-China, 1kg) \$15.98/lb (Olivention (at Walmart), 8oz) \$253.34/lb (Spectrum Chemical, 5kg)</p> <p>—</p> <p>Beet powder \$6.49/lb (North Bay Trading, 50lb)</p> <p>Carminic Acid (CAS 1260-17-9) \$10-100/kg (multiple suppliers, Made-in-China, 10kg)</p>

Propyl paraben (E 217)	<p>Risks: endocrine disruption and reproductive effects at all levels tested</p> <p>- EFSA, Opinion of the Scientific Panel on food additives, flavourings, processing aids and materials in contact with food (AFC) related to para hydroxybenzoates (E 214-219), EFSA Journal (pub. Sept. 28, 2004).</p> <p>- Wróbel & Gregoraszczyk, Actions of methyl-, propyl- and butylparaben on estrogen receptor -alpha and -beta and the progesterone receptor in MCF-7 cancer cells and non-cancerous MCF-10A cells, Toxicology Letters (pub. 2014).</p> <p>- Smith et al., Urinary paraben concentrations and ovarian aging among women from a fertility center, Environmental Health Perspectives (Nov.-Dec. 2013).</p>	<p>Used as a preservative in processed foods including tortillas, other baked goods, and shelf-stable icing.</p> <p>Examples: Signature Select (Safeway brand) Gourmet Club Chicken Enchiladas, Mi Panchito Mexican White Corn Tortilla, Betty Crocker Decorating Icing.</p>	<p>Banned from food in 2006. Directive 2006/52/EC, Annex I (3)(a)(i)</p>	<p>Considered GRAS.</p> <p>FDA affirmed as GRAS in 1977.</p>	<p>Whole Foods (all foods) Trader Joe's (Trader Joe's brand (no "artificial preservatives" except sulfur dioxide and potassium sorbate)) Kroger (all foods) H-E-B (Select Ingredients brand) Harris Teeter (Free From shelf-label (not a brand)) Wild Oats (all foods) Aldi (Simply Nature brand) Publix (GreenWise brand and Made Without shelf label) ShopRite (Wholesome Pantry brand) Supervalu (Wild Harvest brand) Meijer (True Goodness brand) Food Lion (Nature's Promise brand (fka Nature's Place)) Hy-Vee (Hy-Vee brand items with Simple Source label) Chipotle (no artificial preservatives) Panera (all foods)</p>	<p>In baked goods, common preservatives include sorbic acid, potassium sorbate, calcium propionate, and phosphoric acid.</p> <p>Cultured dextrose is sold as a natural preservative, marketed for use in various foods including baked goods as a replacer for sorbates and benzoates. Potassium sorbate and sorbic acid are two preservatives traditionally found in tortillas.</p> <p>Many tortilla products also simply do not contain added preservatives. (Ex: products from Tortilla Land, Whole Foods brand, Mi Rancho). Other tortilla brands use different types of preservatives (ex: phosphoric, benzoic, and propionic acids in Guerrero tortillas, calcium propionate and sorbic acid in Mission tortillas)</p>	<p>Propylparaben: \$10/lb (USP-NF, Level 7 Chemical Supply, 55lbs) \$97.10/lb (FCC, Grainger, 2.5kg (analytical reagent))</p> <p>---</p> <p>Sorbic acid (antimicrobial used in many different foods, including baked goods) \$5.75/lb (FCC, ChemCentral Marketplace, 50lb) \$9.50/lb (FCC, Level 7 Chemical & Supply, 1000lb)</p> <p>Potassium sorbate (used in various foods including baked goods) \$9.31/lb (FCC, ChemCentral Marketplace, 50lb) \$10.90/lb (FCC/USP, Lab Alley, 50lb)</p> <p>Calcium propionate (used in various foods including baked goods) \$2.54/lb (Baker's Authority, 50lb)</p> <p>Phosphoric acid (used in various foods including baked goods) \$2.35/lb (NSF, Ingredi, 70lb)</p> <p>Cultured dextrose \$5.95/lb (Mezzoni Foods, 50 lb)</p>
BVO (E 443)	<p>Risks: harm to nervous system, thyroid, and reproduction</p> <p>- Woodling et al. (FDA researchers), Toxicological evaluation of brominated vegetable oil in Sprague Dawley rats, Food and Chemical Toxicology (pub. May 16, 2022).</p> <p>- Vorhees et al., Behavioral and reproductive effects of chronic developmental exposure to brominated vegetable oil in rats, Behavioral Teratology (pub. Dec. 1983).</p> <p>- Munro et al., Toxic effects of brominated vegetable oils in rats, Toxicology and Applied Pharmacology (pub. July 1972).</p>	<p>Used as an emulsifier, primarily in citrus-flavored beverages to keep flavor oils from separating.</p> <p>Found in sodas including H-E-B (store brand) Pure Cane Sugar Orange Burst Soda, Food Lion (store brand) Diet Ormazing Orange Soda, Refreshe (Safeway brand) Punch, Sun Drop Citrus Soda</p>	<p>Not permitted (not listed).</p> <p>*Note: While I could not find the primary source legislation removing BVO from the EU list of allowed additives, the fact that it has an assigned E number (a unique identifying number assigned to every EU food additive) suggests that it was once an allowed additive that became disallowed. In any case, it is not permitted in food today.</p>	<p>Approved for use in fruit-flavored beverages in 1977, on an interim basis (never updated).</p>	<p>Panera (all foods) Whole Foods (all foods) Kroger (all foods) H-E-B (Select Ingredients brand) Harris Teeter (Free From shelf-label (not a brand)) Wild Oats (all foods) Publix (GreenWise brand and Made Without shelf label) Aldi (Simply Nature brand) ShopRite (Wholesome Pantry brand) Supervalu (Wild Harvest brand) Meijer (True Goodness brand) Food Lion/Giant (Nature's Promise brand (fka Nature's Place)) Hy-Vee (Hy-Vee brand items with Simple Source label)</p>	<p>Alternatives include: sucrose acetate isobutyrate (SAIB), glycerol ester of wood rosin (aka ester gum).</p> <p>Source: Hong Kong Government, Center for Food Safety (2014)</p> <p>SAIB is commonly described as a replacer for BVO and is currently used in Gatorade.</p>	<p>BVO: \$21.51-47.85/lb (FCC, Spectrum Chemical Manuf., 200L-4L (converted using olive oil density))</p> <p>---</p> <p>Ester gum \$3.64/lb (ester gum, Made-In-China, 25kg) \$10.44/lb (ester gum solution, NF, Nature's Flavors, 1 gal (converted using olive oil density))</p> <p>SAIB-100 (100% SAIB) \$4.55-9.09/lb (Made-In-China, 1kg)</p>
Potassium bromate (E 924)	<p>Risks: cancer</p> <p>- International Agency for Research on Cancer (IARC), Potassium Bromate – Summary of Data Reported and Evaluation (pub. 1999) (designating potassium bromate as a Group 2B chemical that is "possibly carcinogenic to humans").</p> <p>- U.S. Environmental Protection Agency, Toxicological Review of Bromate (pub. Mar. 2001).</p> <p>- Spassova et al., Dose-response analysis of bromate-induced DNA damage and mutagenicity is consistent with low-dose linear, nonthreshold processes, Environmental and Molecular Mutagenesis (pub. Jan. 2013).</p>	<p>Added to flour as a dough conditioner to strengthen dough and increase leavening (rising).</p> <p>Found in flour-containing goods, including Liscio Hamburger Rolls, Reineker's Bobka or Paska Bread, Teixeira's Bakery French Bread, Walnut Creek Foods White Dinner Rolls.</p>	<p>Not permitted (not listed).</p> <p>*Note: While I could not find the primary source legislation removing potassium bromate from the EU list of allowed additives, the fact that it has an assigned E number (a unique identifying number assigned to every EU food additive) suggests that it was once an allowed additive that became disallowed. Secondary sources have stated that it was banned in Europe in 1990 or 1992. In any case, it is not permitted in food today.</p>	<p>Allowed in flours and standardized breads (21 CFR 137.21 CFR 136) and malted barley (21 CFR 172.730).</p> <p>FDA hasn't reviewed since 1973. CA requires Prop 65 warning label since 1990</p>	<p>Whole Foods (all foods) Kroger (all foods) H-E-B (Select Ingredients brand) Harris Teeter (Free From shelf label (not a brand)) Wild Oats (all foods) Aldi (Simply Nature brand) Publix (GreenWise brand and Made Without shelf label) Wegmans (Food You Feel Good About brand) ShopRite (Wholesome Pantry brand) Supervalu (Wild Harvest brand) Meijer (True Goodness brand) Food Lion/Giant (Nature's Promise brand (fka Nature's Place)) Hy-Vee (Hy-Vee brand items with Simple Source label) Panera (all foods)</p>	<p>Alternatives include: sodium and calcium stearoyl lactylate (SSL and CSL), enzyme-based replacers, and ascorbic acid (aka Vitamin C).</p> <p>Source: Bakerpedia</p>	<p>potassium bromate: \$1.82 - 9.09/lb (Shanghai Zoran New Material Co. (on Alibaba), volume dependent) \$135.92/lb (FCC, Advance Scientific & Chemical, 2.5kg) \$145.03/lb (FCC, Avantor, 2.5kg) \$161.36/lb (FCC, Spectrum Chemical, 2.5kg)</p> <p>sodium stearoyl lactylate (SSL): \$5.55/lb (Ingredients to Die For, 50lb) \$6.06/lb (FCC, Ingredi.com, 50lb)</p> <p>calcium stearoyl lactylate (CSL): \$0.14 - \$13.64 (multiple suppliers on Made-in-China, volume dependent) \$1.02/lb (Echemi, 1000kg)</p>