

Table 2. Indirect Food Additives

Food additives can be divided into two primary areas of direct & indirect additives. Indirect additives are substances that become part of a food or beverage due to contact, methods of packaging or storage, unintentional addition, or other handling.

Additive Category	Primary Purpose to Use	Where Frequently Used in the Food Industry	Functions
Food Equipment Lubricants	Oils & Greases used on food and beverage equipment	Motor driven rotating devices such as fillers, conveyors, pumps, grinders, and gears on such devices. Most food products involve use of such devices.	Provide protection against wear, friction, corrosion, and oxidation, dissipate heat and transfer power, be compatible with rubber and other sealing materials, as well as provide a sealing effect
Food Equipment Cleaning & Sanitizing Agents	Clean and disinfect food processing equipment	All food production and food service facility equipment surfaces' that directly contact food and are not exempt due to temperature (e.g., ovens)	Cleaning and sanitizing agents are crucial to maintaining food safety and quality in foods during manufacturing and also for preparation at food service facilities like restaurants.
Residual Agricultural Treatment Agents Pesticides (Insecticides, Herbicides, Fungicides, Rodenticides), Fertilizers (synthetic and natural)	Enable improved growth or protection of agricultural products	Crops such as: grains, fruits, vegetables, nuts	Agricultural treatment agents have enabled tremendous increases in crop yields and reduced crop losses across the world in the last 100 years, providing food supply for the growing Population.
Direct Food Contact Surface Colorants & Pigments (Packaging, Conveyors & Food Handling Equipment such as production conveyors, processors and storage vessels, including home kitchen implements and devices.	Create color or finishes in or on papers, plastics and metals	Food packaging like paper, plastic and foil bags, beverage and food containers; food production equipment that repeatedly contacts food during production or preparation	Coloration of equipment can assist with part identification in manufacturing facilities, assist in identifying if proper sanitation of equipment has occurred, or hide unwanted staining of parts (e.g., coffee filter holders)

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Packaging Additives (Coatings, Binders, Slip Agents, Permeability Modifiers, Stabilizers)	Improve the functionality of packaging material for a specialized purpose such as metal can corrosion or sealing	Lined metal cans, Flexible plastic films, plastic containers, some paper fiber-based containers	<p>Coatings are used to create a layer to prevent food materials from contacting interior surfaces (e.g., metal cans) to extend the package shelf-life (particularly with acidic foods).</p> <p>Binders enable layered packaging (e.g., flexible films) to adhere to each other during use, providing protection from water migration into or out of a package.</p> <p>Slip Agents create a slippery surface on the package to aid in the handling of the packaging material and to keep food material from adhering to it when in use (i.e., removing the contents)</p> <p>Permeability Modifiers keep oxygen or water from entering (or leaving) a package, prolonging shelf-life.</p> <p>Stabilizers help keep plastic packaging molecules from breaking down from chemical reactions or ultraviolet light absorption</p>
Water Treatment Agents	Used to treat food process water to prevent food safety issues or protect equipment (e.g., steam boilers)	Used for direct food contact (washing, heating with steam) manufacturing processes like washing vegetables and fruits, eggs, meat products or heating up foods with culinary steam	<p>Processing Water: Inhibit growth of microbes in processing water or assist in removing or eliminating microbes or removing dirt during washing</p> <p>Steam Boilers: Used to protect steam boilers generating culinary steam from developing scaling or metal degradation that could be incorporated into the culinary steam delivery</p>
Packaging Anti-microbial Agents	Provide additional food safety in packaged foods	Plastic packaged foods susceptible to significant food safety issues such as meat and dairy products and certain beverage products	Packaging anti-microbial agents provide an additional layer of food safety protection by creating packaging surfaces that prevent or slow down microbe growth on the packaging material and are particularly useful with meat products, pre-packaged salad mixes and some dairy products

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Package Sealing Adhesives, Inks or Coating Agents	Enable hermetic sealing of food packaging to protect it from microbial or gas/vapor entry; provide coloration and printing to food packaging	Most packaged, prepared foods use adhesives to create package seals (cans, flexible packages, paperboard cartons); printing inks & coatings are used on all food packaging	Critical to food safety to have hermetically sealed packages for foods subject to microbial spoilage. Proper package sealing of food also protects against insects as well as oxygen intrusion for extending shelf-life. Coatings are important to protect against ultraviolet light damaging food (color & flavor). Inks are needed to communicate on package (nutrition and ingredient labels, claims, branding).
Packaging Anti-oxidants & Scavengers	Protection of food from oxidation by preventing oxygen migration into a food package or absorption of residual oxygen through chemical means	Oxygen sensitive food products such as pre-packaged fruits, salad mixes, salads, meats, dairy, cooking oils, dressings & mayonnaise	Food packaging antioxidants and scavengers extend food shelf-life and protect by absorbing or reacting with oxygen to protect flavor (rancidity, flavor loss or other undesirable flavor), reduce oxygen sensitive nutrients (e.g., vitamins), protect from color loss or enhance food safety by reducing available oxygen for bacteria or mold growth
Surface Anti-static & Anti-fogging Agents	Prevent static build up or fog / condensation on certain plastic packaging	Plastic films such as polyethylene, ethyl vinyl acetate or polypropylene films (most foods in flexible packages) or containers. Anti-statics are particularly useful for powdered products	Prevent fogging of containers due to moisture with temperature changes or build-up of static electricity during handling (particularly in manufacturing). Anti-static agents also prevent dust and mold spores from adhering to plastic packages
Gasket & Seal Polymers & Additives	Used to seal containers, piping or liquid process equipment (e.g., pumps & valves)	Food products in glass or plastic containers; liquid or semi-solid food manufacturing process equipment	Seals glass and plastic containers with lids from external environment incursion (microbial, oxygen, moisture) to protect food safety and shelf-life of products. Protects external environmental contamination in food processing systems and leakage of product out of system
Liquid Piping & Additives (Plastic or Metal)	Added to approved food grade resin or metal piping to change structural or appearance characteristics	Enables transport of liquid food products through food grade piping or tubing under various conditions	Enables food safe production system design and operation without concern for chemical migration into the food products
Food Contact Surface Plastic Additives & Catalysts	Materials added during the manufacture of plastic materials for food production to ensure proper plastic resin chemical reaction	Enables plastic container or film production directly from base resin material (e.g., blow molding new plastic milk or soda bottles on site of filling and sealing)	On-site blow molding minimizes transportation of empty bottles to food production site, reducing cost and carbon footprint

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Modified Atmosphere Package (MAP) head-space gasses	Gas compositions allowed for Modified Atmosphere Packaging (MAP)	Enables use of reduced / minimal oxygen sealed package environments to inhibit growth of spoilage microbes for sealed salad & vegetable mixes, various meat and seafood products	Extends shelf-life of food products that use MAP gasses (generally refrigerated products) by removal of most oxygen in the container and maintenance under refrigeration
Modified Celluloses for Paper Goods (Napkins, Paper Plates, forks, straws, etc.)	Food grade paper / cellulose based materials	Primarily used in food service or at home occasions as single serve goods that contact foods or are placed into mouth	Cellulose based (paper – cardboard) materials are biodegradable and more environmentally friendly than plastics as well as often less expensive and in some cases recyclable

References – Food Additives

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