Fruit Juice, Packaging Materials

Revised 2024

Packaging Materials

Fruit juice concentrates are normally treated with enzyme processing to reduce the fruit pectin content and improve production yields and therefore can be concentrated to 68 to 72° Brix finished levels. Weights per U.S. gallon of the 68 to 72° Brix fruit juice concentrates range from 11.130 to 11.339 lbs (5.048 to 5.142 kg), respectively. The expansion of high Brix concentrates in refrigerated or frozen storage will not exceed 2% because of the high concentration of fruit sugars. The high Brix concentrate will not freeze solid but will maintain a heavy viscosity.

The net weight fill of the drum container will vary depending on the overall logistics of the container in the area of processing and the marketing requirements of the product as sold in the world market. In general, the concentrate packer will allow some head space but will make every effort to fill as full as handling, storage, and shipment requirements allow. An open head drum may have more head space after filling than an aseptically filled closed bung drum because of the additional possibility of seepage in handling. The tare weights of metal drums vary greatly. The tare weights may vary from 26 to 45 lbs (11.8 to 20.4 kg) for a 55 to 60 gal (208 to 227 L) capacity metal drum. The wall thickness of the drum can vary extensively based on the net weight of the drum. A drum that has been reconditioned can also have some weight reduction as caused by height reduction, shot cleaning, and ring expansion or addition. In many situations, a reconditioned metal drum may not have the same stacking strength as a new metal drum.

Many conditions contribute to how high a stack storage level can be obtained in a frozen or cold storage facility. Normal heights used in storage are 6 to 7 pallets high for drum tare weights of 35 to 50 lbs (15.9 to 22.7 kg). Drum containers of 35 lbs (15.9 kg) or less should be used for filling of single strength or sugar added packs of fruit which will freeze solid at a final pack of 8 to 35° Brix. Stacking to a desired 6 to 7-tier level may require freezing of the fruit to a solid phase before moving it to final storage at the full stack height.

Plastic nestable drums are being used more frequently in limited packaging of fruit juices and fruit items. These drums are nestable on receipt to allow increased freight economics and to allow reuse freight economics for empty shipment return to a processor. The nestable plastic drums require close attention to maintaining a minimal limited headspace during filling and freezing to prevent folding or collapse of the plastic drum under conditions of high storage stacking. Plastic nestable drums require close attention to the condition of the closure and shape of the drum. Handling of concentrate drums with normal forklift equipment may force the drums out of round and reduce the structural stability of the drums.

The plastic drum does not have the same nominal volume as a standard metal drum. At the same height, a plastic drum will have about 8% less volume due to the taper of the drum. Drum fill weight

reduction of more than the difference in nominal volume may be required due to distention of the drum during freezing, the lack of bottom chime, and the manner in which one drum is stacked upon another. Metal drums are stacked chime-to-chime allowing 2 to 3 in (5 to 8 cm) of space between drums, whereas the plastic drums have no space between the units.

Plastic drums also have less total structural strength than metal drums. The best drums can only handle about 2,500 lbs (1,100 kg) of total weight above them. Plastic drums of juice concentrate should never be stacked 6 to 7 high. Stacking at no more than 4 high is recommended. The plastic nestable drums do not provide the same overflow capacity as metal drums and therefore will have a lower net filled weight. This difference is due to the reduced design overflow capacity of the drum. The plastic nestable drum heights are also increased over the metal drums and will result in reduced cold storage stack capability.

Pasteurization and/or concentration usually results in the destruction of most microorganisms and the inactivation of enzymes. Membrane clarification can effectively remove enzyme molecules and microorganisms (larger than viruses) from a juice. There are, however, non-enzymatic degradative reactions that continue to occur. These include Maillard browning and anthocyanin (red-purple pigment) discoloration and eventual formation of brown pigments. These reactions proceed inexorably, and the kinetics are temperature dependent. A good rule of thumb is that these reactions double in speed with every 10°C (18°F) rise in temperature. Even at 0°C (32°F), a year's storage will show some degradation of color and flavor.

Most fruit concentrates are filled into 55 to 60 U.S. gallon (208 to 227 L) capacity metal drums. Based on the logistics of marketing in world global trade, the fruit concentrates may be handled under refrigerated conditions or under an aseptic classification if aseptically filled and closed.

Aseptic Totes

Modern packaging of purees and puree concentrates utilizes some form of aseptic totes. There are several different styles, including stainless steel totes that can be sterilized and reused; reusable plastic totes with disposable aseptic liners; or large (275 to 300 gallons or 1,041 to 1,135 liters) fiberboard disposable totes. It is important to note that none of these container types are designed for frozen use. Freezing and thawing destroys the integrity of the disposable fiberboard totes, and the plastics can become brittle and/or break. Stainless steel totes can burst with freezing due to internal gas pressure. As a result, containers should be stored in either ambient or refrigerated areas using similar storage length as drums under the same conditions. This limits their use to aseptic products. After opening, the items either need to be used immediately or transferred into another container for refreezing and storage.

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