The Connecticut Agricultural Experiment Station, New Haven

Sodium Benzoate and Potassium Sorbate Preservatives in Juices and Fruits

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Processed foods, such as apple cider, fruit juices, and other beverages often are sold with food additives to prevent spoilage. Typically, sodium benzoate and/or potassium sorbate are the preservatives that are used in juices. Under the provisions set forth by the U.S. Food and Drug Administration (FDA) in the Code of Federal Regulations (CFR), food additives can be used if they are generally recognized as safe (GRAS) and declared on the label. For instance, sodium benzoate may be used as a preservative in juices. However, its usage should not result in levels exceeding 0.1% in the beverage (Code of Federal Regulations, 1992). Similar guidelines are suggested for potassium sorbate, although no usage level is indicated (Code of Federal Regulations, 1992).

Consumers are concerned about food additives, since in some cases allergic reactions to GRAS additives have been observed (Lecos, 1988, and Foulke, 1993). As part of an overall food safety program, this Station, along with the Connecticut Department of Consumer Protection, has initiated a testing program to determine the presence of declared and/or undeclared preservatives in food products. This report presents information on preservative testing performed on processed fruit products that are sold in Connecticut.

METHOD

All samples were provided by inspectors from the Department of Consumer Protection. Samples of Connecticut manufactured apple cider and apple cider vinegar were collected from local farm markets. Samples of beverages from Connecticut and other states and countries were obtained at local grocery stores and supermarkets. All samples were tested for two preservatives, sodium benzoate, the sodium salt of benzoic acid, and potassium sorbate, the potassium salt of sorbic acid. The procedure we used was adapted from a method in the Association of Official Analytical Chemists (Official Methods of Analysis, 1990). Our procedure utilizes a high performance liquid chromatograph (HPLC) followed by UV diode array detection for quantitation of the preservatives, if they are present. Juice, cider, and beverage samples were prepared by diluting one milliliter of sample with ten milliliters of an acetonitrile/ammonium acetate buffer solution. Samples of processed and raw fruits were prepared by blending the sample with the same buffer solution in a 1:5 ratio. All samples were filtered to remove particulate matter prior to analysis. The HPLC determination of the preservatives was performed using a reverse phase C-18 column, and UV detection at 225 nm for sodium benzoate and 255 nm potassium sorbate. The percentage of preservative in the sample was calculated by external standard using authentic sodium benzoate and potassium sorbate. Juices spiked at 0.1 % for both sodium benzoate and potassium sorbate yielded recoveries of 98% and 96%, respectively. The method can detect 0.0002% (2 parts-per-million) of either preservative in a juice matrix.

RESULTS AND DISCUSSION

Results of all samples tested are listed in Tables 1 and 2. Table 1 lists all beverages that are consumed as sold. These include apple cider, orange juice, lemonade, and various other juices and nectars. Table 2 lists items that are not generally consumed as sold. These include beverage concentrates, vinegars, fruits, and sauces. Most of the products that we tested were in compliance with their label claims. For a product to be in compliance of a "no-preservatives" claim, the product, upon testing, must not have detectable amounts of preservatives. For a product to be in compliance of a

"contains less than one tenth of one percent sodium benzoate" label claim, the product, upon testing, must contain only sodium benzoate. The same compliance restriction applies to potassium sorbate. Deviations from these two claims are indicated in the tables. In all such cases, attempts were made to resample the products.

For example, one product, Autumn Apple brand apple cider, contained two preservatives. However, only sodium benzoate was declared on the label. As a result of testing, the product was embargoed by the Department of Consumer Protection until the bottles were relabeled. Another product, Switchel, an apple cider vinegar beverage, claimed no preservatives, but upon testing both potassium sorbate and sodium benzoate were found. The Department of Consumer Protection removed this product from sale. Several other products contained trace amounts of either sodium benzoate or potassium sorbate at levels below any anti-microbial benefits (Brause, 1993). In these cases the Department of Consumer Protection alerted the manufacturer to our results.

Of particular interest were juice beverages and products that contained cranberries or cranberry extract. Cranberries contain a natural amount of benzoic acid at approximately 0.0150 %, *when calculated as sodium benzoate* (Coppola and Starr, 1988). Thus, all products that contain cranberries or cranberry extracts will have detectable amounts of benzoic acid. The levels of sodium benzoate vary depending on the amount of cranberry or extract in the product. Amounts of sodium benzoate in various cranberry products are listed in Tables 1 and 2. Due to the natural occurrence of benzoic acid in cranberries, these juices and other cranberry products that we tested were not in violation of any labeling regulations.

In conclusion, of the 156 samples tested, 12.2% representing 19 samples, were found to be in variance with label claims or 5.8% when adjusted for resamples. Continued testing of beverages as well as processed food products is planned as part of an expanded effort by this Station and the Department of Consumer Protection to address the issue of food safety.

ACKNOWLEDGMENTS

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Table 1. Preservatives in juices sold in Connecticut.

Product	Description Brand Name	Potassium Sorbate (%)	Sodium Benzoate (%)
Apple cider	Allen's Cider Mill	0	0
Apple cider	Allyn's Red Barn	0	0
Apple cider	Autumn Apple	0.057**	0.057
Apple cider*	Autumn Apple	0.063**	0.061
Apple cider*	Autumn Apple	0.058**	0.058
Apple cider*	Autumn Apple	0.062**	0.060
Apple cider*	Autumn Apple	0.060**	0.059
Apple cider	Avon Cider Mill	0	0
Apple cider	Bordeaux Farm	0	0
Apple cider	Botti's Fruit Farm/Red Barn	0	0
Apple cider	Buell's Orchards	0.036	0
Apple cider	Bushy Hill Orchard	0	0
Apple cider	Crooke Orchards	0	0
Apple cider	Crow Hill	0.048	0
Apple cider	Davis Farms	0	0.036
Apple cider	E. Draghi & Sons	0	0
Apple cider	Ellsworth Hill Farm	0	0
Apple cider	FFA-EO Smith Vo-Ag	0	0
Apple cider	Ferrando Orchard	0	0
Apple cider	Finast	0.043	0
Apple cider	Flavor Crisp	0.064	0
Apple cider	Gotta's Farm & Cider Mill	0.028	0
Apple cider	Gotta's Farm & Cider Mill	0	0
Apple cider	Green Tree	0.042	0
Apple cider	Guida's Dairy	0	0
Apple cider	Guida's Dairy	0	0
Apple cider	Hallock Orchard/Starberry Farm	0	0
Apple cider	High Hill Orchard	0	0
Apple cider	Hogan's Cider Mill	0	0.061
Apple cider	Hogan's Cider Mill	0	0
Apple cider	Holmberg Orchards	0	0
Apple cider	Kaeser's Cider Mill	0.007**	0
Apple cider	Lapsley Orchard	0	0
Apple cider	Lost Acres Orchard	0	0
Apple cider	Miro Farms & Garden Center	0	0
Apple cider	Mornin' Dew	0.041	0
Apple cider	Old Cider Mill	0.012	0
Apple cider	Old Orchard Farm	0	0
Apple cider	Old Orchard Farm	0	0
Apple cider	Outhouse Orchards	0	0
Apple cider	Park Lane Cider Mill	0	0
Apple cider	Rolling Acres Orchard	0	0
Apple cider	Rose Orchard	0	0
Apple cider	Rose's Berry Farm	0	0
Apple cider	Rudy's Blend	0.036	0
Apple cider	Scott's Fruit Farm & Villa Orchard	0	0
Apple cider	Scott's Orchard	0	0
Apple cider	Sensational	0.052	0

Table 1. Preservatives in juices sold in Connecticut (continued).

Product	Description Brand Name	Potassium Sorbate (%)	Sodium Benzoate (%)
Apple cider	Silverman's Farm	0	0
Apple cider	Sweet-Life	0	0
Apple cider	The Notch Store	0.025	0
Apple cider	The Yankee Farmer	0	0
Apple cider	Tree Top	0	0
Apple cider	Vermont Apple Orchard	0.028	0
Apple cider	We-Li-Kit Farm	0	0
Apple cider	West Lynn Creamery	0	0.002**
Apple cider*	West Lynn Creamery	0	0
Apple cider*	West Lynn Creamery	0	0
Apple cider	Woodland Orchard	0	0
Apple cider	Woodstock Farm	0.044	0
Apple cider	Woodstock Orchards	0	0
Apple cranberry cider	M.H. Zeigler & Sons, Inc.	0.070	0
Cranberry apple cider	Zeigler's	0.049	0
Apple juice	Big Y	0	0
Apple juice	Food Club	0	0
Apple juice	IGA	0	0
Apple juice	Lucky Leaf	0	0
Apple juice	Natural Country Farms	0	0
Apple juice	Nature's Own	0	0
Apple juice	No Frills	0	0
Apple juice	Richelieu	0	0
Apple juice	Sam's Choice	0	0
Apple juice	Verifine	0	0
Apple cranberry juice	Apple & Eve	0	0.0028***
Apple cranberry juice	Tropicana Twisters	0	0.0007***
Cranberry juice	Ocean Spray	0	0.0056***
Cranberry juice	Stop & Shop	0	0.0035***
Cranberry blend juice	Apple & Eve Blend	0	0.0037***
Cranberry blend juice	Ocean Spray	0	0.0053***
Cranberry raspberry juice	Ocean Spray	0	0.0008***
Cranberry raspberry juice	Stop & Shop	0	0.0012***
Grape juice	Carmel	0	0
Grape juice	Cascadian Farm, Organic	0	0
Grape juice	IGA	0	0
Grape juice	Kedem (Mitz de Moscato)	0.013**	0
Grape juice*	Kedem (Mitz de Moscato)	0.013**	0
Grape juice	Kedem natural	0	0
Grape juice	Kedem natural concord	0.003**	0
Grape juice	Kedem premium (Mitzbarrie)	0.0009**	0
Grape juice	No Frills	0	0
Grape juice	Welch's	0	0
Grape juice	Welch's red	0	0
Grapefruit juice	Florida's Natural Ruby Red	0	0
Grapefruit juice	Stop & Shop from concentrate	0	0
Grapefruit juice	Tropicana Pure Premium	0	0
Lemonade	Minute Maid	0	0

Table 1. Preservatives in juices sold in Connecticut (continued).

Product	Description Brand Name	Potassium Sorbate (%)	Sodium Benzoate (%)
Lemonade	Newman's Own	0	0
Lemonade	Stew Leonard's	0	0.0015**
Orange juice	Big Y, not from concentrate	0	0
Orange juice	Big Y, from concentrate	0	0
Orange juice	Finast	0	0
Orange juice	Florida's Natural	0	0
Orange juice	Garelick Farms, from concentrate	0	0
Orange juice	Guida's Dairy, from concentrate	0	0
Orange juice	Honestly Fresh Squeezed	0	0
Orange juice	Minute Maid, from concentrate	0	0
Orange juice	Natural Country Farms	0	0
Orange juice	Natural Country Farms	0	0
Orange juice	Sensational, not from concentrate	0	0
Orange juice	Stew Leonard's	0	0
Orange juice	Stop & Shop, from concentrate	0	0
Orange juice	Stop & Shop, not from concentrate	0	0
Orange juice	Sweet Life Premium	0	0
Orange juice	Tropicana Pure Premium Homestyle	0	0
Orange juice	Waldbaums, from concentrate	0	0
Orange juice	Waldbaums, not from concentrate	0	0
Orange pineapple juice	Dean Foods	0	0
Pineapple juice	Dole	0	0
Pineapple juice	Dole	0	0
Pineapple juice	No Frills	0	0.027**
Pineapple juice	No Frills	0	0
Pineapple juice*	No Frills	0	0.025**
Pineapple juice	Pathmark	0	0
Pineapple juice	Stop & Shop	0	0
Pineapple juice	Sun Glory	0	0
Prune juice	Shop Rite	0	0
Prune juice	Sunsweet	0	0
Raspberry cranberry juice	Apple & Eve	0	0.0011***
Tomato juice	Finast, from concentrate	0	0
Tomato juice	Food Club	0	0
Tomato juice	Knudsen organic	0	0
Tomato juice	Sacramento	0	0
Vegetable juice cocktail	Food Club	0	0
Vegetable juice cocktail	Stop & Shop	0	0
Vegetable juice cocktail	V8	0	0
Apricot nectar	Stop & Shop	0	0
Peach nectar	Libby's from concentrate	0	0
Pear nectar	Libby's from concentrate	0	0

* - Resampled product.
** - In variance with label claim.
***- Cranberry products contain naturally-occurring benzoic acid.

Table 2. Preservatives in processed juice and fruit products sold in Connecticut.

Product	Description Brand Name		Potassium Sorbate (%)	Sodium Benzoate (%)
Apple cider vinegar	Ellsworth Hill Farm		0	0
Apple vinegar beverage	Switchel		0.0026**	0.0005**
Apple vinegar beverage*	Switchel		0.0067**	0.0013**
Apple vinegar beverage*	Switchel		0.0072**	0.0013**
Apple vinegar beverage*	Switchel	0.0074**	0.0013**	
Apple vinegar beverage*	Switchel		0.0061**	0.0005**
Apples, vacuum packed	Lyman Farm Store		0	0
Cranberry sauce	IGA		0	0.0096***
Cranberries, fresh	Ocean Spray		0	0.0148***
Grapefruit concentrate	Minute Maid		0	0
Grapefruit concentrate	Shop Rite		0	0
Grapefruit concentrate	Sweet Life		0	0
Lemonade concentrate	Finast		0	0
Lemonade concentrate	Fine Fare		0	0
Lemonade concentrate	IGA		0	0
Lemonade concentrate	Minute Maid		0	0
Lemonade concentrate	River Valley		0	0
Orange concentrate	Sweet Life frozen		0	0

* - Resampled product.
** - In variance with label claim.
***- Cranberry products contain naturally occurring benzoic acid.

The Connecticut Agricultural Experiment Station, founded in 1875, is the first experiment station in America. It is chartered by the General Assembly to make scientific inquiries and experiments regarding plants and their pests, insects, soil and water, and to perform analyses for State agencies. The laboratories of the Station are in New Haven and Windsor; its Lockwood Farm is in Hamden. Single copies of bulletins are available free upon request to Publications; Box 1106; New Haven, Connecticut 06504. ISSN 0097-0905