ADVISORY STATEMENT:

USE OF CALCIUM CHLORIDE TO IMPROVE THE TEXTURE OF PICKLES[1,2]

by

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SUMMARY: The texture of fresh-pack, dill chips was much improved by the addition of calcium chloride to the cover brine. The effects of three levels of acetic and lactic acids with and without alum, and in combination with calcium chloride, were investigated. The best treatment was a cover brine containing acetic acid with calcium chloride and without alum. Examinations were based on commercially prepared samples after 10-12 months' storage at room temperature. Based on this work, done in cooperation with the PPI Research Committee, a number of packers are routinely using calcium chloride as a firming agent for their various products.

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[2]Mention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U.S. Department of Agriculture or North Carolina State University, nor does it imply approval to the exclusion of other products that may be suitable.

INTRODUCTION: In recent years there have been complaints within the pickle industry on the poor texture of fresh-pack pickle products. Much of the texture problem stems from: (1) excessive heating during blanching; and (2) subsequent pasteurization; (3) inadequate cooling of the product prior to storage; and (4) unfavorable storage conditions. Corrective measures for these factors are self-evident.

However, other measures may be taken to improve the texture of properly processed, pickle products. In this connection the use of certain calcium salts has been shown to improve the texture of processed vegetables (Kertesz, 1939). In the pickle industry, these chemicals have been used by certain packers for many years, particularly for fresh-pack pickles, although little or no information has been made available for the industry as a whole. Herein, we give specific information on the effectiveness of one of these firming agents in pickles prepared under commercial conditions.

PROCEDURE: A cooperative study with members of the PPI Research Committee (1971) to improve the texture of Kosher-style, dill chips was undertaken. The plan of work involved several variables, such as three levels each of lactic and acetic acids, together with the presence or absence of alum or calcium chloride. Typical, combined results from this study, from cooperators that evaluated their product after 10-12 months' storage at room temperature, are attached (see Table 1, M. D. Orloff, personal communication). A brief outline of the desired experimental treatments is included in the table.

The best basic treatment was acetic acid with calcium chloride, but without alum. All three levels of acetic acid in this treatment (0.7, 1.3, and 0.3; = regular, high, and low amounts) gave a product rated as "Excellent" as to texture after 10-12 months' storage. No other treatment reached this rating although a few single treatments (B-1-a, B-3-a, A-3-a, B-3-1, and C-3-1) reached the "Good" class. Of these five lots, four had calcium chloride added; also, four were made with the lowest level of acetic acid used (0.3%). This amount of acid, however, would probably not be acceptable for commercial use, depending on the product's equilibrated pH (3.9-3.8 or below).

You will note the striking effect of lactic acid on the texture of the dill chips (Table 1). Of the nine sub-treatments prepared with this organic acid, six were soft and were rated "Not Acceptable" as to texture; another lot was placed as "Poor." Only two made the "Good" category, but as mentioned earlier, both were at the threshold acidity level (0.3%) that probably would not be safe for commercial practice. As the result of this study, several members of the Research Committee, as well as a number of other pickle processors, replaced alum with calcium chloride in the formulation of their cover brine for Kosher-style, dill chips, as well as for other fresh-pack pickle items with success! Certain packers prefer to use less than 0.1% $CaCl_2$ (equilibrated concentration in the product) as given in Table 1 because of possible flavor changes. For those

considering the commercial application, the correct level of calcium chloride for a given formula should be determined by test packs. As a start, we suggest a final equilibrated concentration of not less than 0.05% $CaCl_2$; more or less than this amount may be needed for different fresh-pack pickle products, depending on the pack-out ratio.

It is emphasized that the general plan of work for the Kosher-style, dill chip study was, to a great extent, based on earlier cooperative investigation, under actual plant conditions, with cooperating members of the 1971 PPI, Inc., Research Committee.

It should be noted that the work on the influence of alum and acetic and lactic acids on texture of fresh-pack, dill pickles has been previously reported (Etchells et al., 1972; Bell et al., 1972).

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Table 1. Experimental Study on Firmness of Kosher-Style Dill Chips (Texture After 10-12 Months' Storage).

Treatment code	Acid used and amount	$CaCl_2$ used[2]	Alum used	Firmness at 10 months[1]	
				Numerical	Adjective
	%	%			
A-1-a	Acetic 0.70 = regular	0	Yes	5-6	Fair
2-a	Acetic 1.30 = high	0	Yes	3-4	Poor
3-a	Acetic 0.30 = low	0	Yes	7-8	Good
B-1-a	Acetic 0.70	0.1	Yes	7-8	Good
2-a	Acetic 1.30	0.1	Yes	5-6	Fair
3-a	Acetic 0.30	0.1	Yes	7-8	Good
C-1-a	Acetic 0.70	0.1	No	9-10	Excellent
2-a	Acetic 1.30	0.1	No	9-10	Excellent
3-a	Acetic 0.30	0.1	No	9-10	Excellent
A-1-1	Lactic 0.60 = regular	0	Yes	1	Not Acceptable
2-1	Lactic 1.20 = high	0	Yes	1	Not Acceptable
3-1	Lactic 0.30 = low	0	Yes	1	Not Acceptable
B-1-1	Lactic 0.60	0.1	Yes	1	Not Acceptable
2-1	Lactic 1.20	0.1	Yes	1	Not Acceptable
3-1	Lactic 0.30	0.1	Yes	7-8	Good
C-1-1	Lactic 0.60	0.1	No	3-4	Poor
2-1	Lactic 1.20	0.1	No	1	Not Acceptable
3-1	Lactic 0.30	0.1	No	7-8	Good

[1]Firmness rating: 1-2 = Not Acceptable; 3-4 = Poor; 5-6 = Fair; 7-8 = Good; 9-10 = Excellent.

[2]Calcium chloride content (0.1%) was based on the total contents of a 24-oz. jar of chips. The pack-out was such that the cover brine consisted of 350 gal. of brine and 7-1/4 lb of calcium chloride, so that at equilibrium the product contained 0.1% of the firming agent. For those considering the commercial application, the correct level of calcium chloride for a given formula should be determined by test packs.