November 2, 1936.

Mr. W. R. M. Wharton,
Chief, Eastern District,
Food and Drug Administration,
201 Varick Street,
New York City.

Dear Mr. Wharton:

I appreciate your October 29th letter, attaching the circular statement with respect to the removal of lead from metal products. I am submitting this statement to our experts for their comment and I will advise you of it.

Cordially yours,

Charles Wesley Dunn

KE 0006390

LABORATORY EXPERIMENTS ON THE SOURCES, PREVENTION AND REMOVAL OF LEAD CONTAMINATION OF MAPLE PRODUCTS

The following studies in the Food and Drug Administration laboratories are presented in the hope that they may have some practical bearing on the troublesome problem of contaminating lead in maple products. It is, of course, the province of the industries concerned to test, on a plant scale, the applicability of these findings to the removal of existing lead contamination and its prevention in the future. It may be that these principles may also find application to similar problems in other food industries.

In the investigation of lead contamination of maple syrups and sugars suspicion was directed toward various soldered and galvanized metallic surfaces as possible sources.

The fact that maple syrups will take up lead when boiled down in contact with solder was demonstrated as follows: 35 cc of syrup of 1.68 p.p.m. lead content on the dry basis was diluted 1 + 34 with water (total volume of water added - 1190 cc) in order to obtain approximately the solids content of the sap as drawn. The idea was to simulate the evaporation process. The solution was boiled down in a Pyrex beaker to approximately the original consistency of the syrup with a piece of solder (50-50 lead-tin) approximately 3 x 1/2 x 3/16" (total area about 4.3 square inches) immersed. After boiling down (4 hours) the syrup was filtered, and upon analysis showed 18.05 p.p.m. lead dry basis.

It was next decided to investigate possible lead takeup from impure zinc. A sample was obtained from the Bureau of Standards which showed, according to their figures, 0.53 per cent lead. A portion of the sample was melted down in a casserole to obtain a disc approximately 3 inches in diameter, or of about 14 square inches surface area. The previous experiment was repeated, using the same syrup of 1.68 p.p.m. lead, with the zinc disc immersed in the boiling solution. The lead content of the syrup after evaporation to about the same consistency, showed .38 p.p.m. on the dry basis.

This result, although entirely unforeseen, was logically explained by the effect of electrochemical deposition of the lead upon the zinc surface.

The experiment was repeated upon another syrup showing 2.45 p.p.m. on the dry basis, using the same zinc disc. The lead content was lowered to 1.27 p.p.m. dry basis.

It was decided to test the effect of contact with both solder and zinc. Accordingly, 50-50 solder was melted and poured into a well-galvanized pail about 8-1/2 inches in diameter, so as to form a solder ring around the entire inside circumference of the bottom. There were approximately 10 square inches of exposed solder in the pail. 70 cc of the syrup showing 9.45 p.p.m. of lead was diluted with 2400 cc of water and boiled down to syrup consistency, using the direct flame of two burners. The lead content was reduced to 1.96 p.p.m.

These experiments suggested the possibility of reducing the lead content of syrups and sugars by some such similar treatment. Zinc did not recommend itself because of its somewhat toxic nature. Further, it imparted a distinctly metallic taste to the syrups when they were concentrated in the presence of metallic zinc.

It was decided to try aluminum in place of zinc. This metal is non-toxic and, because of its higher position in the electrochemical series, should be even more effective than zinc in reducing the lead content of syrups. It was found that when a sample of syrup of 1.66 p.p.m. was diluted 1 + 34 and reconcentrated with a piece of aluminum sheet 4 x 1-3/4 inches (approximately 14 square inches) immersed, the lead content was reduced to .24 p.p.m. on the dry basis. Taking into account that the surface area of the piece of aluminum sheet and that of the zinc disc were approximately the same, it would appear that aluminum is more effective than zinc in reducing the lead content of the syrup. Furthermore, no apparent metallic taste was imparted to the syrup in the evaporation process.

It was next decided to try aluminum dust to see if finely divided metal was effective in reducing the lead content of the undiluted syrup in the cold. Accordingly, about 10 grams of aluminum dust (of a grade used as the pigment of aluminum paint) was added to 50 cc of syrup of 9.45 p.p.m. lead content and the mixture agitated mechanically for one hour. At the end of that time the mixture was filtered, and analysis of this syrup showed a lead content of 8.22 p.p.m. Thus a significant lowering was noted, but the action is not as great as when the syrup is diluted and reconcentrated.

It was then decided to try the effect of aluminum dust upon the hot undiluted syrup. 10 grams of aluminum dust were mixed with 50 cc of the same syrup (9.45 p.p.m.) and heated on the steam bath under a reflux condenser for one hour with occasional shaking. The syrup was filtered, and upon analysis showed 1.55 p.p.m. lead dry basis, showing that the aluminum dust is quite effective in reducing the lead content when the syrup is heated.

Commercial applications of this principle would appear possible but are at this time, of course, a matter of conjecture.

July 1, 1936.