EXPERIMENT 9 CONTAMINANTS: TIN CONTENT IN CANNED FOODS

Structure

9.1 INTRODUCTION

Food contaminants are substances, which can cause harmful effects in the human system. They generally are pesticide residues, heavy metals, toxins and harmful microorganisms. Therefore, their detection and determination in foods is very important. However, the methods available for the determination of most of the contaminants require very sophisticated instruments and are time consuming. Therefore, most of these analyses are done in specialized laboratories and usually not done in the food processing industries.

One of the few estimations, which can be done easily, is tin content in canned foods. Canned food industry is one of the largest food processing industries. Dissolution of tin (can corrosion) into the canned product during storage is a common problem in canned foods. Excess tin dissolution causes discolouration and flavour change in the products and gives an unattractive appearance to can interior. Excess tin is also harmful to the human system. Therefore, maximum limits for tin content in canned foods have been specified.

Tin content in canned foods is usually determined by iodimetry.

Objectives

After studying and performing this experiment, you should be able to:

- carry out ashing of food products for tin estimation; and
- perform the iodimetric estimation of tin.

9.2 EXPERIMENT: TIN ESTIMATION BY IODIMETRY

9.2.1 Principle

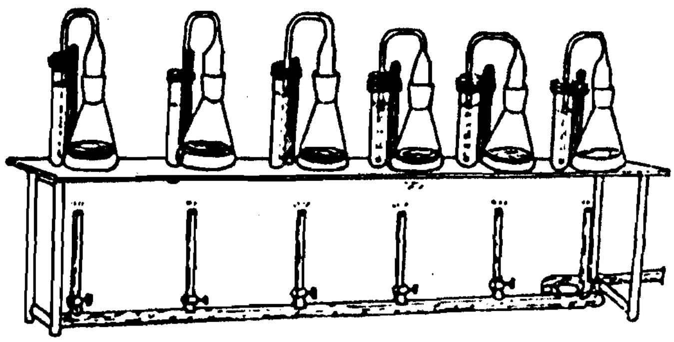
Canned food sample is acid digested (wet digested) to destroy the organic matter. Tin salts present in the digested sample are reduced with nascent hydrogen to stannous form. Titration of the stannous tin with potassium iodate quantitatively estimates tin.

9.2.2 Requirements

Instruments and Apparatus

Analytical Balance

Blender	
Kjeldahl digestion flask, 300 ml	–2
Pipettes, 10 ml	–2
Burette, 10 ml	–2
Volumetric flasks, 50, 100 ml, 500 ml, 1 lit	–1 each
Conical flask, 150ml with glass jointed (B24)	
capillary bent tube:	2
Test tubes, 20 ml	2
Glass beads	



Set of Flasks Used for Reduction of Tin Salts

Reagents

i) Conc. HNO_3

ii) Conc. H_2SO_4

iii) Hydrogen peroxide

iv) 3N HCl: Dilute 294.6 ml conc.HCl to 1 litre with distilled water

v) Potassium iodide solution: Dissolve 0.2 g of KIO_3 and 3 g sodium bicarbonate in 100 ml of boiled and cooled water. Transfer to a reagent bottle. Add a few drops of HCl and shake. When effervescence ceases, insert stopper.

vi) Potassium iodate stock solution: Dissolve 5.3505 g KIO_3 in boiled and cooled water and make up the volume to 1 litre. Prepare working standard (0.005N) by diluting 5 ml to 100 ml.

vii) Antimont trichloride ($SbCl_3$) solution: Dissolve 1.5 g $SbCl_3$ in 50 ml HCl and dilute to 100 ml.

viii) Standard tin solution: Dissolve 0.5 g pure tin in 250 ml conc. HCl containing 2 drops of antimony trichloride solution and dilute to 500 ml (1 ml = 1 mg tin).

ix) Aluminium foil, pure.

x) 5% sodium bicarbonate solution.

xi) Starch indicator: 1% starch in 20% sodium chloride solution.

Note: The potassium iodide and iodate reagents should be freshly prepared.

9.2.3 Procedure

Empty the contents of the can immediately to a container after opening to avoid further tin pick up. Blend the product in a blender and digest a suitable quantity of the sample.

Wet Digestion: Weigh 50 g sample and transfer to a Kjeldahl digestion flask using distilled water. Add a few glass beads and 10 ml conc. H_2SO_4 and 10 ml or more conc. HNO_3. Heat gently until the liquid darkens. Continue addition of HNO_3 in small proportions (1 to 2 ml) and heating until the solution fails to darken. At this stage, all the organic matter would have been oxidized. Cool and add 10 ml of hydrogen peroxide (30%) drop wise and heat until the digest is colourless. Cool and make up to 50 ml in a volumetric flask with distilled water.

Pipette out 20 ml of the digest into the 150 ml conical flask having glass joint. Add 1 drop of antimony trichloride solution, 30 ml of 3N HCl and about 0.3 g aluminium foil. Connect the flask by mean of B24 joint and a capillary bent tube to a "suck-back" test tube containing sodium bicarbonate solution. Sodium bicarbonate sucked into the conical flask, liberates CO_2 to maintain inert atmosphere.

Heat the flask gently until evolution of gas commences. When the aluminium foil has almost completely dissolved, heat again. Boil till the liquid is colourless. Cool the flask in ice water, disconnect the side tube and add about 4 ml potassium iodide solution along the sides of the flask from a pipette to wash down the digested solution. Add a few drops of starch indicator and titrate rapidly with 0.005 N potassium iodide solution to a blue end point. Run a blank determination with the regents at the same time. The blank titre should not be more than 0.2 ml of 0.005 N potassium iodate.

9.2.4 Observations

Weight of the sample taken: = W = —— g

Volume of the digest made up to: = V = —— ml

Volume of the digest taken for tin estimation: V_1 = —— ml

Volume of potassium iodate required (titre): = V_2 = —— ml

Blank titre: = V_3 = —— ml

Normality of potassium iodate solution: = 0.005 N

9.2.5 Calculations

1000 ml 1 N KIO_3 = 59.35 g Sn (tin)

or 1 ml 1 N KIO_3 = 59.35 mg tin

Actual volume of the standard iodate required by the sample = (sample titre - blank titre) = $(V_2 - V_3)$

Therefore, tin content in the canned product (mg / Kg or ppm)

$$= \frac{\text{Actual titre} \times \text{Normality of } KIO_3 \times \text{Total volume of digest} \times 59.35 \times 1000}{\text{Volume of digest taken for tin estimation} \times \text{Weight of sample}}$$

$$= \frac{(V_2 - V_3) \times 0.005 \times V \times 59.35 \times 1000}{V_1 \times W} = \text{mg / Kg}$$

9.2.6 Result

Tin content in the product = ppm or mg per Kg.

9.3 PRECAUTIONS

The general precautions mentioned in the course 'Introduction' and those indicated in the experiments should be followed meticulously.

Handle the flask assembly with are to prevent breakage.