The Scientific Association Dedicated to Analytical Excellence®

AOAC SPIFAN Stakeholder Meeting

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New Orleans, LA

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Iodine

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Background and History

- Iodine was discovered by Courtois in 1811
- Iodine is a chemical element with the symbol I and atomic number 53
- Iodine like many other halogens occurs primarily as a diatomic molecule I_2
- Iodine is a relatively rare element in nature, ranking 47th in abundance

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Background and History

- Iodine is essential in humans for the synthesis of thyroid hormones
- Thyroid hormones regulate physiological processes such as growth, development, metabolism, and reproductive functions
- Due to it's rarity, iodine deficiency affects as many as 2 billion people worldwide

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Background and History

- Iodine deficiency in mothers can lead to increased rates of abortion, prenatal death, infant mortality, and babies being born with central nervous system defects
- Iodine deficiency in infants may cause mild decreases in intellectual performance to severe mental retardation

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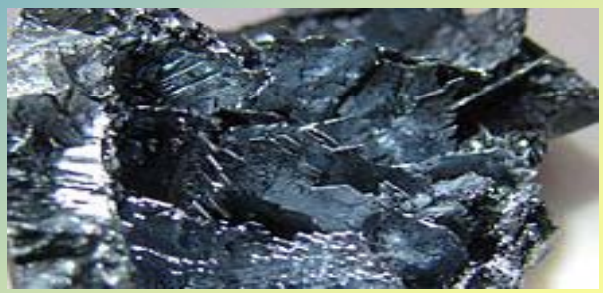
Iodine Chemistry

- Iodine under standard conditions is a bluish back solid.



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Iodine Chemistry

- Iodine in a gas phase shows a violet color which is the origin of the name (Greek)

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Iodine Chemistry

- Elemental iodine is readily soluble in most organic solvents, but only slightly soluble in water
- Potassium iodide, the most common form of iodine in nutrition, is highly water soluble

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Iodine Recommended Daily Allowances (RDA)

- Adolescents and adults 150 mcg/day
- Pregnant women 220 mcg/day
- Lactating women 290 mcg/day

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Iodine Recommended Daily Allowances (RDA)

- Infants (0-6 months) 110 mcg/day
- Infants (7-12 months) 130 mcg/day
- Children (1-3 years) 90 mcg/day
- Children (3-13 years) 90-120 mcg/day

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Regulations (Iodine content)

Regulating Entity	Regulation		
	Units	Minimum	Maximum
Australia/ New Zealand	mcg/100 kcal	15	42
China	mcg/100 kcal	18	58.6
CODEX	mcg/100 kcal	20	50

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Regulations (Iodine content)

Regulating Entity	Regulation		
	Units	Minimum	Maximum
European Union	mcg/100 kcal	(20)	50
Thailand	mcg/100 kcal	10	50
United States	mcg/100 kcal	(15)	(50)

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Calculated Range for Infant Formula

- Minimum = 100 µg/100 mL
- Maximum = 500 µg/100 mL

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Analysis of Iodine – Sample Digestion

- Direct analysis
- Dry ashing procedures
- Open vessel ashing with acids
- Open vessel ashing with base
- Microwave oven for above

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Analysis of Iodine – Detection

- Titration methods
- Catalytic colorimetric reactions
- Ion specific electrodes
- Atomic Absorption (flame and furnace)

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Analysis of Iodine – Detection

- X-ray fluorescence
- HPLC, GC, IC
- Neutron Activation
- ICP – MS

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Analysis of Iodine – Precautions

- Losses of iodine during digestion
- Laboratory contamination
- Absorption of iodine into glass
- Background readings (ICP-MS)
- Interferences

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Analysis of Iodine – ICP-MS

- Sample digestion using acid and tetramethyl ammonium hydroxide (TMAH)
- Sample digestion using base

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Official Methods for Iodine

- **AOAC 992.22 – HPLC EC Detection**
  - **Requires use of a membrane filter to remove protein and insoluble material**
  - **Chromatography is challenging**

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Official Methods for Iodine

- **AOAC 992.24 – Ion Specific Electrode**
  - **Very simple method to set up and use**
  - **Suffers from a number of interferences**

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Official Methods for Iodine

- **EN 15111:2007 – ICP-MS**
  - **Method used microwave digestion and TMAH extraction**
  - **Not collaboratively studied on infant formula or adult nutrtionals**

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Fitness for Purpose

Iodine Working Group

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Fitness for Purpose Statement

- An analytical method to determine the level of total iodine in infant formula and adult nutritionals, as defined by AOAC SPIFAN, in concentration ranges from 5 mcg/100 mL to 1000 mcg/100 mL. Time to signal should be <12 hours. The method need to be capable of dispute resolution.

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Questions?