

Rapid Measurement of **Vitamin A** in Fortified Sugar with **iCheck Fluoro**



Vitamin A Fortification of Sugar

Large-scale food fortification is one of the most cost-effective public health interventions to increase vitamin A intakes and reduce the risk of vitamin A deficiency. Experiences with food fortification suggest that it works best where a food is 1) widely consumed by populations regardless of socioeconomic status; and 2) centrally manufactured or processed. Sugar is found in almost every household worldwide, and consumed in relatively small, but consistent quantities of around 15-30 grams/person/day. Additionally, the sugar refining process is not easily accomplished at small-scale or within the home. These qualities make sugar an attractive and potentially effective food vehicle for vitamin A fortification.

Sugar was one of the first foods to be fortified in low- and middle-income countries to address micronutrient malnutrition. The technology was first implemented in Guatemala in 1975, primarily because other food vehicles that had been used for fortification were not widely consumed or sufficiently centralized in their processing. The success of the Guatemalan experiment, resulting in a reduction of vitamin A deficiency from 22% to 5% over only one year¹, triggered the replication of sugar fortification programs across several Latin American and African countries as a viable option. Today, there are nine countries who mandate vitamin A fortification of sugar (Guatemala, El Salvador, Honduras, Malawi, Mozambique, Nigeria, Rwanda, Zambia, and Zimbabwe) and many more that allow it on a voluntary basis. The cost of fortification averages US \$9-10 per metric ton of fortified sugar produced².



Vitamin A beadlets adhered to sugar crystals
Credit: DSM Fortification Basics

Vitamin A premix used for sugar fortification is typically retinyl palmitate encapsulated with a gelatin or starch to improve stability. This Vitamin A premix is usually first mixed with unfortified sugar, antioxidants, vegetable oil, and other stabilizers to form a highly concentrated vitamin A sugar pre-blend. The pre-blend is then mixed with unfortified sugar in a known ratio through the use of a dosifier and the final fortified sugar is quality assured to consistently adhere to the national standards or specifications for sugar fortification.

Monitoring and controlling the levels of vitamin A in fortified sugar during production and in the marketplace can be challenging, since laboratory analysis of vitamins is complex and expensive. To support the implementation of sugar fortification, BioAnalyt has developed methods for measuring vitamin A in sugar and sugar pre-blends with our innovative iCheck Fluoro technology.

¹ Mejia, L.A.; Bower, A.M. The global regulatory landscape regarding micronutrient fortification of condiments and seasonings. *Ann. Acad. Sci.* 2015, 1357, 1-7.

² Dary, O.; Mora, J.O. Food fortification to reduce vitamin A deficiency: International vitamin A consultative group recommendations. *J. Nutr.* 2002, 132, 2927S-2933S.



How it works

Measuring **Vitamin A** in Fortified Sugar with **iCheck**

To facilitate the implementation of sugar fortification, BioAnalyt developed a sample preparation protocol to enable reliable measurement of the concentrations of vitamin A in fortified sugar and sugar pre-blend samples.

iCheck Fluoro is a portable, single-wavelength fluorometer that quantitatively measures vitamin A in many different foods, including fortified sugar and sugar pre-blends.*

What Is iCheck Fluoro?



Measurement Device

iCheck Fluoro is a device that measures autofluorescence of vitamin A in the sample and converts it to vitamin A concentration in micrograms retinyl equivalents per liter ($\mu\text{g RE/L}$). The device comes in a case with all necessary accessories and have a 2 year warranty.



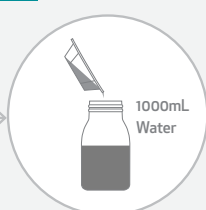
Consumables

Ready-to-use iCheck Fluoro reagent vials come in a Test Kit box, containing 100 reagent vials for 100 analyses. The consumables have a 12-month shelf-life at room temperature.

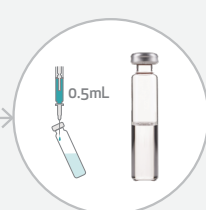
VITAMIN A MEASUREMENT



Mix well your sugar sample before weighing in. It is recommended to use a composite sample. Weigh in 50 grams.



Transfer sugar to a flask and fill to 1000mL with distilled or bottled water. Shake well to solubilize the sample.



Proceed with measurements following the iCheck Fluoro User Manual.



Multiply the iCheck results by the dilution factor of 20 when 50g sample and 1000mL water is used.

* For sugar pre-blends with an expected concentration of 10,000-20,000 mg/kg vitamin A, a dilution of 1 to 10,000 is recommended. For example: Measure 0.1 grams of pre-blend, transfer to a flask and fill to 1000mL with distilled or bottled water, and proceed with measurement. Multiply the result with the dilution factor of 10,000.

Contact us to get **detailed protocol and training:**

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Results with **iChecks** are Comparable to those with **Reference Methods**

To ensure reliability and accuracy of measurements, results obtained with iCheck devices are compared to expected concentrations in spiked samples and/or traditional laboratory methodologies. Vitamin A in fortified sugar samples with different vitamin A concentration ranges were measured with both iCheck and traditional laboratory methods using HPLC (High Performance Liquid Chromatography). The results are listed in table below and are comparable.

Sample Type	Expected Concentration (mg/kg)	Measured Concentration with HPLC (mg/kg \pm SD)	Measured Concentration with iCheck (mg/kg \pm SD)
Fortified Sugar 1	7-10	10 \pm 2	8 \pm 2
Fortified Sugar 2	14-17	17 \pm 5	14 \pm 2
Fortified Sugar 3	20-23	25 \pm 8	18 \pm 5
Fortified Sugar 4	29-31	28 \pm 7	24 \pm 3

iCheck Analysis was performed at BioAnalyt lab in Germany as well as another government lab. HPLC analysis was performed in 3 different accredited labs based on AOAC method with in-house modification for vitamin A determination.

Benefits of iCheck



- **Speed:** Results in 5 to 60 minutes.
- **Economy:** Cost is only 10% of conventional lab methods.
- **Easy implementation:** Only 1 day of training is required.
- **Scalability:** Portable, with no set-up calibration required.
- **Accuracy:** Performance is comparable to reference lab methods.

iChecks are manufactured in Germany, used in over 80 countries and validated against standard laboratory methods. Learn more at www.bioanalyt.com/products.

