# FOODQUALITY

Food and Feed Analysis

## *Safety and added value, guaranteed*

BioSystems

REAGENTS & INSTRUMENTS

# FOODQUALITY

Modern society demands safe foods that are readily traceable and properly labelled. Current regulations and standards (ISO, BRC, IFS) are used to safeguard food safety and ensure that consumers have quality products of high added value.

To avoid a public health risk, food hazards are tested using a variety of techniques, among them, immunoassay due to its reliability, easy management and low cost. In addition to microbiology, which plays an indisputable role in food safety, risk substances can be divided into several groups, most notably, allergens, mycotoxins, sulfites and histamine, among others. Several renowned world organizations (WHO/FAO, EFSA, FDA, etc.) also continuously review these substances to identify new hazards.

Furthermore, processed foods require comprehensive raw material and finished product testing in production plants to minimize cross-contamination. Also, sugars, organic acids, additives and other components in food and beverages are key parameters in order to control processes, quality and nutrition facts.

**BioSystems, S.A.**, leaders in the manufacturing and distribution of reagents and instruments for the clinical diagnostic and agri-food industries, provide testing laboratories and food companies with the analytical tools and pre- and post-sales technical support needed to ensure the quality and safety of their products.

Best regards,

Antonio Elduque
CEO

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# INDEX

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# Enzymatic / Chemical Reagents

## ADVANTAGES

- Liquid Reagents*, stable until the expiry date
- Standards included in the kit
- Dedicated reagents
- Ready to use
- Automation in BioSystems instruments

Enzymatic and chemical reagents are simple and efficient methods used to measure substances in food and beverages through photometry. BioSystems reagents are a sensitive and specific way to identify sugars, organic acids, additives, cations and other components in food and beverages, in order to control processes, quality and nutrition facts.

Also, the analysis of by-products produced by microorganisms like lactic acid, acetic acid, ethanol or histamine is important to control the presence/absence of growing and thus, control the hygiene and the process of our products in a rapid and efficient way.


*Except some lyophilized components:
12810, 12820, 12825, 12828 and 12843

# Sugars

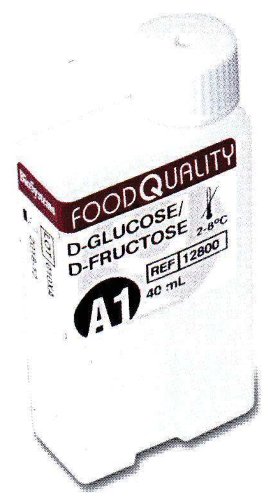
The enzymatic method is official analytical method in some cases, and is a quick, affordable, and efficient alternative compared with laborious manual methods or chromatography. Pretreatment methods for sugars in foods and beverages have been carefully validated while taking into account their biochemical nature and with the aim of maximizing extraction. All of these reagents can be automated.

| | Reagent | Code |
|---|---|---|
| **Sugars*** | D-Glucose/D-Fructose | 12800 |
| | Sucrose/D-Glucose/D-Fructose | 12819 |

*Lactose and maltose coming soon

The analysis of simple **sugars** is a tool required when monitoring different food processes, in the detection of adulterations and the measurement of nutritional parameters. Given that specific populations must restrict their sugar intake (people with diabetes, intolerances, obesity, etc.), different global regulations control the correct labeling of sugars in food.

Simple sugars, monosaccharides and disaccharides, occur naturally in many foods and beverages and/or they are added artificially for various technical purposes, such as to sweeten the end product. Information on the composition of simple sugars in foods is useful with regards to product quality or for nutrition labeling purposes.



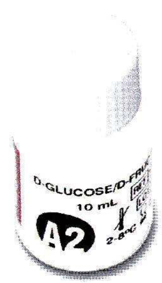
## D-Glucose / D-Fructose

The D-glucose/D-fructose kit detects the most common isomer of both sugars, and therefore measures their exact content in several food matrices such as juices and beverages, vegetables, dairy and meat products, or honey.

**D-fructose** and **D-glucose** in the sample generate NADH (by the following reaction), which can be measured by spectrophotometry. The configuration of these reagents allows **D-glucose/D-fructose** (total sugars) to be determined if the enzyme PGI is added or **D-glucose** to be determined if it is not.

$$\text{D-Fructose} + \text{ATP} \xrightarrow{\text{HK}} \text{Fructose-6-Phosphate} + \text{ADP}$$
$$\text{D-Glucose} + \text{ATP} \xrightarrow{\text{HK}} \text{Glucose-6-Phosphate} + \text{ADP}$$
$$\text{Fructose-6-Phosphate} \xrightarrow{\text{PGI}} \text{Glucose-6-Phosphate}$$
$$\text{Glucose-6-Phosphate} + \text{NADP}^+ \xrightarrow{\text{G6P-DH}} \text{Gluconate-6-Phosphate} + \text{NADPH}^+\text{H}^+$$

| | |
|---|---|
| Kit Volume: | 120 mL |
| Method: | Two-reagent differential determination reading at 340 nm |
| Limit of linearity: | 8 g/L |
| Limit of detection: | D-Glucose: 0,01 g/L<br>D-Glucose/D-Fructose: 0,01 g/L |




## Sucrose / D-Glucose / D-Fructose

The Sucrose/D-glucose/D-fructose kit measures sucrose or the sum of the three simple sugars in different food matrices such as juices and beverages, vegetables, and dairy and meat products.

**Sucrose, D-fructose** and **D-glucose** in the sample generate NADPH (by the following reaction), which can be measured by spectrophotometry. The configuration of these reagents allows sucrose or **Sucrose/D-glucose/D-fructose** (total sugars) to be determined.

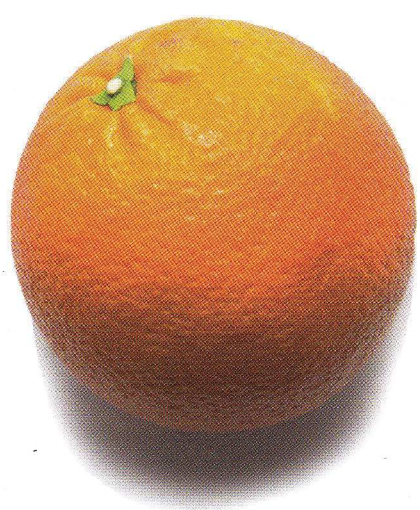
$$\text{Sucrose} + H_2O \xrightarrow{\beta\text{-Fructosidase}} \text{D-glucose} + \text{D-fructose}$$
$$\text{D-fructose} + \text{ATP} \xrightarrow{\text{HK}} \text{Fructose-6-Phosphate} + \text{ADP}$$
$$\text{D-glucose} + \text{ATP} \xrightarrow{\text{HK}} \text{Glucose-6-Phosphate} + \text{ADP}$$
$$\text{Fructose-6-Phosphate} \xrightarrow{\text{PGI}} \text{Glucose-6-Phosphate}$$
$$\text{Glucose-6-Phosphate} + \text{NADP}^+ \xrightarrow{\text{G6P-DH}} \text{Glucose-6-Phosphate} + \text{NADPH} + \text{H}$$

| | |
|---|---|
| Kit Volume: | 60 mL |
| Method: | One-reagent end point or two-reagent differential determination, reading at 340 nm |
| Limit of linearity: | Sucrose 4 g/L, Total sugar: 8 g/L |
| Limit of detection: | Sucrose 0.08 g/L, Total sugar 0.07 g/L |

# Organic Acids

The analysis of different **organic acids** in food matrices can be used to measure additives, to detect bacterial or fungal by-products (lactic acid, acetic acid, etc.) and to monitor processes such as fermentation. Moreover, the content of different organic acids found in a given food matrix provides information about the quality of the product.

| | Reagent | Code |
|---|---|---|
| **Organic Acids** | D-Lactic Acid | 12801 |
| | L-Lactic Acid | 12802 |
| | L-Malic Acid | 12803 |
| | Acetic Acid | 12810 |
| | D-Gluconic Acid/D-Gluconolactone | 12811 |
| | Tartaric Acid | 12808 |
| | Citric Acid | 12825 |
| | Ascorbic Acid | 12828 |
| | Pyruvic Acid | 12826 |
| | L-Glutamic Acid (Glutamate) | 12830 |
| | D-Isocitric Acid | 12844 |



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## D-Lactic Acid

D-lactic acid is an acid produced by various microorganisms as a result of glucose metabolism. The presence of D-lactic acid is usually an indication of undesired fermentation in many foods such as juices, beverages, milk, or sugar beet, and it can be used as a very quick method of monitoring for the appearance of microorganisms in order to ensure product safety and hygiene.

**D-lactic acid** in the sample yields NADH (by the following reaction), which can be measured by spectrophotometry.

$$\text{D-Lactate} + NAD^{+} \xrightarrow{\text{D-LDH}} \text{Pyruvate} + NADH$$

| | |
|---|---|
| Kit Volume: | 120 mL |
| Method: | Two-reagent differential determination reading at 340 nm |
| Limit of linearity: | 0,25 g/L |
| Limit of detection: | 0,004 g/L |

## Ascorbic Acid

D-ascorbic acid is an organic acid that occurs naturally in different plant-based foods (juices, vegetables, fruits, etc.), or is added artificially as a preservative (meat products, desserts, etc.). Its powerful antioxidant action stops foods from undergoing oxidative processes, while determination of D-ascorbic acid levels indicate the food's quality at source and throughout its shelf life.

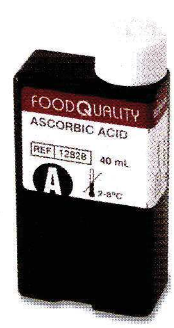
**Ascorbic acid** in the sample lowers MTT in the presence of PMS, forming dehydroascorbic acid and MTT-formazan that can be assayed by spectrophotometry. In a second determination, ascorbic acid is eliminated by oxidation and other reducing substances (Xred) are measured. The difference between the results is the ascorbic acid concentration

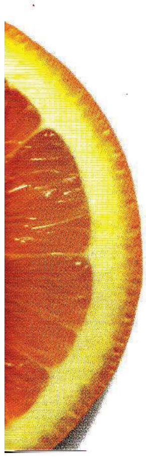
$$\text{Ascorbic Acid} + \text{Xred} + \text{MTT} \xrightarrow{\text{PMS}} \text{Dehydroascorbic Acid} + \text{Xox} + \text{MTT-formazán}$$

$$\text{Ascorbic Acid} + \tfrac{1}{2}\,O_2 \xrightarrow{\text{AO}} \text{Dehydroascorbic Acid}$$

| | |
|---|---|
| Kit Volume: | 90 mL |
| Method: | Two-reagent differential determination reading at 560 nm |
| Limit of linearity: | 1000 mg/L (ST1)*; 250 mg/L (ST2)* |
| Limit of detection: | 1 mg/L (ST1)*; 2 mg/L (ST2)* |

*ST: Sample Type



## Citric Acid

Citric acid is an organic acid that either occurs naturally in different plant-based foods (juices, vegetables, fruits, etc.), or is added artificially as a preservative (meat products, desserts, etc.). Measurements of some organic acids (citric, malic, tartaric, or isocitric) are used to detect juice adulteration, as each fruit has a specific profile of organic acids.

**Citrate** in the sample yields oxaloacetate due to the action of the enzyme known as lyase citrate. All oxaloacetate from citrate in the sample is converted into L-malic acid by the enzyme L-malate dehydrogenase. This enzyme uses NADH as a coenzyme and is oxidized to NAD+. The disappearance of NADH may be read by spectrophotometry.

$$\text{Citrate} \xrightarrow{\text{CL}} \text{Oxaloacetate} + \text{Acetate}$$

$$\text{Oxaloacetate} + \text{NADH} + \text{H}^+ \xrightarrow{\text{L-MDH}} \text{L-malate} + \text{NAD}^+$$

| | |
|---|---|
| Kit Volume: | 50 mL |
| Method: | Two-reagent differential determination reading at 340 nm |
| Limit of linearity: | 400 mg/L |
| Limit of detection: | 11 mg/L |

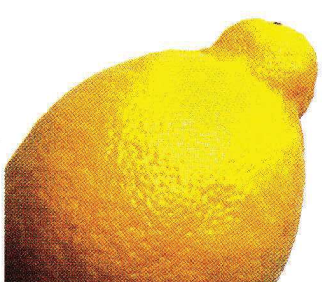
## D-Isocitric Acid

D-isocitric acid is an organic acid which, together with measurements of citric and other acids, is used to determine whether juices are authentic because it serves as an indicator of adulteration. Measurements of some organic acids (citric, malic, tartaric, or isocitric) are used to detect juice adulteration, as each fruit has a specific profile of organic acids.

**D-isocitric** acid in the sample generate, by means of the reaction described below, oxoglutarate, $CO_2$ and NADPH that can be measured by spectrophotometry

$$\text{D-Isocitric Acid} + \text{NADP}^+ \xrightarrow{\text{ICDH}} \text{2-oxoglutarate} + CO_2 + \text{NADPH} + \text{H}^+$$

| | |
|---|---|
| Kit Volume: | 100 mL |
| Method: | Two-reagent differential determination reading at 340 nm |
| Limit of linearity: | 1000 mg/L |
| Limit of detection: | 8 mg/L |



# Cations

| | Reagent | Code |
|---|---|---|
| **Cations** | Iron | 12817 |
| | Calcium | 12824 |
| | Copper | 12814 |
| | Potassium | 12823 |

## Calcium

Calcium is a metal cation that occurs naturally in various foods such as dairy products, or is added artificially to enrich products because of its beneficial properties for the human body.

**Calcium** in the sample reacts with 2,7-[bis(2-arsonophenylazo)]-1,8-dihydroxynaphthalene-3,6-disulfonic acid (Arsenazo III). The color increase is directly proportional to the calcium concentration of the sample.

$$\text{Calcium (Ca)} + \text{Arsenazo III} \xrightarrow{pH = 6,5} [\text{Ca-(Arsenazo III)}]$$

| | |
|---|---|
| Kit volume: | 80 mL |
| Method: | Two-reagent differential determination reading at 635 nm |
| Limit of linearity: | 180 mg/L |
| Limit of detection: | 2 mg/L |

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# Sulfite

| | Reagent | Code |
|---|---|---|
| **Sulfite** | Total Sulfite | 12806 |
| | Free Sulfite | 12813 |
| | Sulfite | 12845 |
| | Sulfite Control | 12827 |

Sulfites are preservatives added artificially to different foods such as meat products, shellfish, jams, cookies, or beverages. They can cause hypersensitivity in some people, and as such they are regulated as both allergens (Food Labeling Regulation 1169/2011) and additives, and their maximum permitted limits by food group are established in Regulation 1129/2011.

Sulfite in the sample reacts with 4,4'-(4-iminocyclohexa-2,5-dienylidenemethylene) dianiline chromogen (pararosaniline; PR) and formaldehyde (F) in acid medium. In a second reaction, free sulfite is removed by oxidation and the rest of substances (I) that are able to react with the chromogen are measured. The difference between the results obtained from the two reactions is the sulfite concentration.

| | |
|---|---|
| Kit volume: | 300 mL |
| Method: | Two-reagent differential determination reading at 560 nm |
| Limit of linearity: | 50 mg/L |
| Limit of detection: | 0,92 mg/L |

Ref. 12845

$$SO_2 + PR + I \xrightarrow{pH = 0{,}9 / F} [PR\text{-}F\text{-}SO_2] + [PR\text{-}F\text{-}I]$$

$$SO_2 + PR + I \xrightarrow[+Oxidizer - SO_2]{pH = 0{,}9 / F} [PR\text{-}F\text{-}I]$$

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# Phosphated and Nitrogenous Substances

| | Reagent | Code |
|---|---|---|
| **Phosphated and Nitrogenous* Substances** | Ammonia | 12809 |
| | Nitrite | 12842 |
| | Nitrate/Nitrite | 12843 |
| | Phosphate (Phosphorus) | 12877 |

*Urea coming soon

Nitrates and nitrites are substances that can be found naturally in certain vegetables and are added to meat products (sausages, cured meats, cooked meats, fresh meats, etc.) to act as preservatives. They are essential additives because of the protection they offer against *Clostridium botulinum*. They also improve the organoleptic properties of some foods. However, under certain circumstances they produce nitrosamines, which have potentially harmful effects.
Given the risk they may pose to human health, their maximum limits are regulated.

**Nitrite** in the sample react with sulfanilamide (SA) and naphtylethylenediamine(NE) in an acid media generating a compound measured spectrophotometrically. In a second reaction, **nitrate** is reduced to nitrite by nitrate reductase, NADPH and FAD and initial nitrites and nitrates reduced to nitrites are measured. The difference between the results obtained from the two reactions is the nitrate concentration

Ref. 12843

$$\text{Nitrite} + \text{SA} + \text{NE} \xrightarrow{\text{pH} = 1{,}0} [\text{Nitrite-SA-NE}]$$

$$\text{Nitrate} \xrightarrow[\text{FAD, NADPH}]{\text{Nitrate reductase}} \text{Nitrite}$$

| | |
|---|---|
| Kit volume: | 120 mL |
| Method: | Two-reagent differential determination reading at 560 nm |

Limit of linearity and detection:
Nitrite
- Limit of detection: 0,05 mg/L (1,7 mg/Kg)
- Limit of linearity: 6,00 mg/L (200 mg/Kg)

Nitrate
- Limit of detection: 0,18 mg/L (6 mg/Kg)
- Measurement interval: 0,18-6,00 mg/L (6-200 mg/Kg)

# Applications per sector

| | | Enology | Vegetables and juices | Dairy products | Meat products |
|---|---|---|---|---|---|
| Sugars | Glucose / Fructose | • | • | • | • |
| | Sucrose | • | | • | • |
| Organic Acids | D-Lactic | • | • | • | |
| | L-Lactic | • | • | • | |
| | L-Malic | • | • | | |
| | L-Ascorbic | • | • | • | • |
| | Citric | • | • | • | • |
| | Acetic | • | • | • | |
| | Tartaric | • | • | | |
| | Gluconic | • | | | • |
| | Pyruvic | • | | | |
| | Glutamic | | | | • |
| | D-isocitric | | • | | |
| Alcohol | Etanol | • | • | | |
| | Glicerol | • | • | | |
| Phosphated and Nitrogenous Substances | Ammonia | • | • | • | • |
| | PAN | • | • | | |
| | Nitrite | • | • | | |
| | Nitrite/Nitrate | • | • | | • |
| | Phosphate/Phosphorus | | • | • | • |
| Sulfite | Free Sulfite | • | • | | |
| | Total Sulfite | • | • | | |
| | Sulfite | | | | • |
| Cations | Iron | • | | | |
| | Calcium | • | • | • | |
| | Copper | • | | | |
| | Potassium | • | | | |
| Other parameters | Polyphenols | • | • | | |
| | $CO_2$ | • | • | | |
| | Acetaldehyde | • | | | |
| | Histamine | • | | • | • |
| Allergens | Milk (Beta-Lactoglobulin) | | • | • | • |
| | Milk (casein) | • | • | • | • |
| | Total Milk | • | • | • | • |
| | Egg White (Ovomucoid) | | | | • |
| | Egg (Ovoalbumin) | • | | | |
| | Egg (Lysozyme) | • | | • | |
| | Fish | • | | | |
| | Crustacean | | | | |
| | Soy | | | • | • |
| | Cashew | | | | • |
| | Lupin | | • | | • |
| | Almond | | | • | |
| | Hazelnut | | • | | |
| | Peanut | | | • | |
| | Walnut | | | • | |
| | Pistachio | | | • | |
| | Coconut | | | • | |
| | Mustard | | | • | • |
| | Sesame | | | • | • |
| | Gluten | • | | • | • |