Fructose

1 Nonproprietary Names

BP: Fructose
JP: Fructose
PhEur: Fructose
USP–NF: Fructose

2 Synonyms

Advantose FS 95; D-arabino-2-hexulose; D-arabino-hex-2-ulopyranose; *Fructamyl*; *Fructofin*; D-(−)-fructopyranose; β-D-fructose; fructosum; fruit sugar; *Fruitose*; *Krystar*; laevulose; levulose; nevulose.

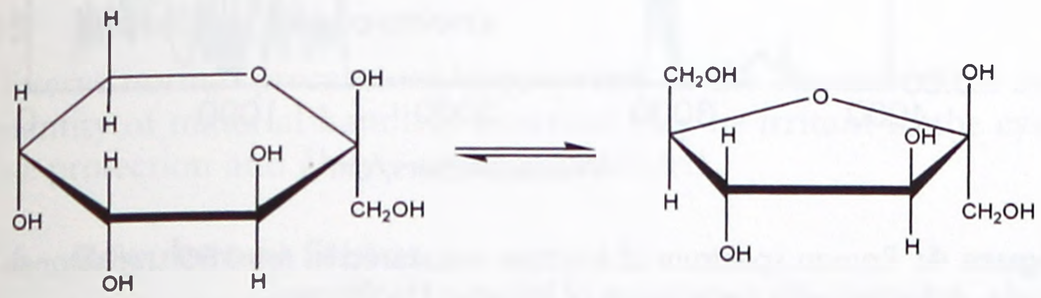
3 Chemical Name and CAS Registry Number

D-Fructose [57-48-7]

4 Empirical Formula and Molecular Weight

$C_6H_{12}O_6$ 180.16

5 Structural Formula



Pyranose form

Furanose form

See Section 18.

6 Functional Category

Flavoring agent; sweetening agent; taste-masking agent.

7 Applications in Pharmaceutical Formulation or Technology

Fructose is used in tablets, syrups, and solutions as a flavoring and sweetening agent.

When used as a sweetening agent, fructose is perceived as sweeter than mannitol and sorbitol at equivalent concentration. The sweet taste is perceived more rapidly than that of sucrose and dextrose; *see* Table I. Fructose has greater solubility in ethanol than dextrose and sucrose and may therefore be a more suitable sweetener for alcohol-based formulations.

Fructose is more water soluble than sucrose and dextrose and can present fewer problems with undesired crystallization, for example when solutions are refrigerated or deposited on bottle threads (e.g. 'cap-locking').

At a given concentration fructose has a higher osmotic potential than sucrose, and therefore lower water activity in solution. This may be beneficial for microbial stability of solutions.

The compactibility of fructose based tablets is improved by the addition of a small amount of starch,[1] that is commercially available as *Advantose FS 95*,[2] *see also* Fructose and Pregelatinized Starch.

Table I: Relative sweetness of fructose and other sugars.

Sugar	Relative sweetness at 25°C (10% solids)
Fructose	117
Sucrose	100
High fructose syrup-55	99
High fructose syrup-42	92
Dextrose	65

8 Description

Fructose occurs as odorless, colorless crystals or a white crystalline powder with a very sweet taste.

9 Pharmacopeial Specifications

See Table II.

Table II: Pharmacopeial specifications for fructose.

Test	JP XVII	PhEur 9.2	USP 40–NF 35 S1
Identification	+	+	+
Characters	—	+	—
Color of solution	+	+	+
Acidity	+	+	+
pH	4.0–6.5	—	—
Specific optical rotation	—	−91.0° to −93.5°	—
Foreign sugars	—	+	—
Loss on drying	≤0.5%	—	≤0.5%
Residue on ignition	≤0.1%	≤0.1%	≤0.5%
Chloride	≤0.018%	—	≤0.018%
Sulfate	≤0.024%	—	≤0.025%
Sulfite	+	—	—
Water	—	≤0.5%	—
Arsenic	≤1.3 ppm	—	≤1 µg/g
Barium	—	+	—
Calcium and magnesium (as calcium)	+	—	≤0.005%
Lead	—	≤0.5 ppm	—
Heavy metals	≤4 ppm	—	≤5 ppm
Hydroxymethylfurfural	+	+	+
Assay (dried basis)	≥98.0%	—	98.0–102.0%

10 Typical Properties

Acidity/alkalinity pH = 5.35 (9% w/v aqueous solution)
Density 1.58 g/cm^3. *See also* Table III.
Dissociation constant pK_a = 12.06 at 18°C
Heat of combustion 15.3 kJ/g (3.66 kcal/g)
Heat of solution 50.2 kJ/g (12 kcal/g)
Hygroscopicity At 25°C and relative humidities above approximately 60%, fructose absorbs significant amounts of moisture; *see* Figure 1.
Melting point ≈102–105°C (with decomposition)
Osmolarity A 5.05% w/v aqueous solution is isoosmotic with serum.