IRON OXIDES

Specifications prepared at the 63rd JECFA (2004) and published in FNP 52 Add 12 (2004), superseding specifications prepared at the 35th JECFA (1989) and published in FNP 52 (1992). An ADI of 0-0.5 mg/kg bw was established at the 53rd JECFA (1999).

SYNONYMS

Iron Oxide yellow: CI Pigment Yellow 42 and 43; CI(1975) No. 77492; INS No. 172 (iii)
Iron Oxide Red: CI Pigment Red 101 and 102; CI (1975) No. 77491; INS No. 172(ii)
Iron Oxide Black: CI Pigment Black 11; CI (1975) No. 77499; INS No. 172(i)

DEFINITION

Produced from ferrous sulfate by heat soaking, removal of water, decomposition, washing, filtration, drying and grinding.
They consist essentially of anhydrous and/or hydrated iron oxides; range of hues includes yellows, reds, browns and blacks. Food quality iron oxides are primarily distinguished from technical grades by the comparatively low levels of contamination by other metals; this is achieved by the selection and control of the source of the iron and/or by the extent of chemical purification during the manufacturing process.

Chemical names

Iron Oxide Yellow:	Hydrated ferric oxide, hydrated iron (III) oxide
Iron Oxide Red:	Iron sesquioxide, anhydrous ferric oxide, anhydrous iron (III) oxide
Iron Oxide Black:	Ferroso ferric oxide, iron (II,III) oxide

C.A.S. number

Iron Oxide Yellow:	51274-00-1
Iron Oxide Red:	1309-37-1
Iron Oxide Black:	1317-61-9

Chemical formula

Iron Oxide Yellow:	$FeO(OH) \cdot xH_2O$
Iron Oxide Red:	Fe_2O_3
Iron Oxide Black:	$FeO \cdot Fe_2O_3$

Formula weight

88.85	FeO(OH)
159.70	Fe_2O_3
231.55	$FeO \cdot Fe_2O_3$

Assay: Not less than 60% of iron

DESCRIPTION: Yellow, red, brown or black powder

FUNCTIONAL USES: Colour

CHARACTERISTICS

IDENTIFICATION

Solubility (Vol. 4): Insoluble in water and organic solvents; soluble in concentrated mineral acids

Water soluble matter (Vol. 4): Not more than 1.0%

PURITY

Loss on drying (Vol. 4)	Iron Oxide Red : Not more than 1% (105°, 4 h)
Arsenic (Vol. 4)	Not more than 3 mg/kg (Method II) See description under TESTS
Cadmium	Not more than 1 mg/kg See description under TESTS
Lead (Vol. 4)	Not more than 10 mg/kg Determine using an atomic absorption technique appropriate to the specified level. The selection of sample size and method of sample preparation may be based on the principles of the method described in Volume 4, “Instrumental Methods.”
Mercury (Vol. 4)	Not more than 1 mg/kg Determine using an atomic absorption technique appropriate to the specified level. The selection of samples size and method of sample preparation may be based on principles of methods described in FNP 5, “Instrumental Methods”.

TESTS

PURITY TESTS

Arsenic, cadmium and lead	Weigh 5 g of the sample and transfer to a beaker. Add 50 ml concentrated hydrochloric acid and heat on a hot plate until totally dissolved. Dilute with water to 100 ml in a volumetric flask. Determine cadmium and lead using an atomic absorption technique appropriate to the specified level and arsenic using Method II of Volume 4.

METHOD OF ASSAY

Weigh accurately about 0.2 g of the sample, add 10 ml of 5 N hydrochloric acid and heat cautiously to boiling in a 200-ml conical flask until the sample has dissolved. Allow to cool, add 6 to 7 drops of 30% hydrogen peroxide solution and again heat cautiously to boiling until all the excess hydrogen peroxide has decomposed (about 2-3 min). Allow to cool, add 30 ml of water and about 2 g of potassium iodide and allow to stand for 5 min. Add 30 ml of water and titrate with 0.1 N sodium thiosulfate adding starch TS as the indicator towards the end of the titration. Each ml of 0.1 N sodium thiosulfate is equivalent to 5.585 mg of Fe (III).