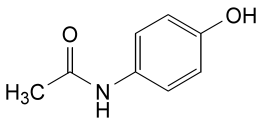
**01/2008:0049**
**corrected 6.0**

# PARACETAMOL

## Paracetamolum



$C_8H_9NO_2$ $M_r$ 151.2
[103-90-2]

DEFINITION

*N*-(4-Hydroxyphenyl)acetamide.

*Content*: 99.0 per cent to 101.0 per cent (dried substance).

CHARACTERS

*Appearance*: white or almost white, crystalline powder.

*Solubility*: sparingly soluble in water, freely soluble in alcohol, very slightly soluble in methylene chloride.

IDENTIFICATION

*First identification: A, C.*

*Second identification: A, B, D, E.*

A. Melting point (*2.2.14*): 168 °C to 172 °C.

B. Dissolve 0.1 g in *methanol R* and dilute to 100.0 ml with the same solvent. To 1.0 ml of the solution add 0.5 ml of a 10.3 g/l solution of *hydrochloric acid R* and dilute to 100.0 ml with *methanol R*. Protect the solution from bright light and immediately measure the absorbance (*2.2.25*) at the absorption maximum at 249 nm. The specific absorbance at the maximum is 860 to 980.

C. Infrared absorption spectrophotometry (*2.2.24*).

*Preparation*: discs.

*Comparison*: *paracetamol CRS*.

D. To 0.1 g add 1 ml of *hydrochloric acid R*, heat to boiling for 3 min, add 1 ml of *water R* and cool in an ice bath. No precipitate is formed. Add 0.05 ml of a 4.9 g/l solution of *potassium dichromate R*. A violet colour develops which does not change to red.

E. It gives the reaction of acetyl (*2.3.1*). Heat over a naked flame.

TESTS

**Related substances**. Liquid chromatography (*2.2.29*). *Prepare the solutions immediately before use.*

*Test solution*. Dissolve 0.200 g of the substance to be examined in 2.5 ml of *methanol R* containing 4.6 g/l of a 400 g/l solution of *tetrabutylammonium hydroxide R* and dilute to 10.0 ml with a mixture of equal volumes of a 17.9 g/l solution of *disodium hydrogen phosphate R* and of a 7.8 g/l solution of *sodium dihydrogen phosphate R*.

*Reference solution (a)*. Dilute 1.0 ml of the test solution to 50.0 ml with the mobile phase. Dilute 5.0 ml of this solution to 100.0 ml with the mobile phase.

*Reference solution (b)*. Dilute 1.0 ml of reference solution (a) to 10.0 ml with the mobile phase.

*Reference solution (c)*. Dissolve 5.0 mg of *4-aminophenol R*, 5 mg of *paracetamol CRS* and 5.0 mg of *chloroacetanilide R* in *methanol R* and dilute to 20.0 ml with the same solvent. Dilute 1.0 ml to 250.0 ml with the mobile phase.

*Reference solution (d)*. Dissolve 20.0 mg of *4-nitrophenol R* in *methanol R* and dilute to 50.0 ml with the same solvent. Dilute 1.0 ml to 20.0 ml with the mobile phase.

*Column*:

– *size*: *l* = 0.25 m, Ø = 4.6 mm,
– *stationary phase*: *octylsilyl silica gel for chromatography R* (5 µm),
– *temperature*: 35 °C.

*Mobile phase*: mix 375 volumes of a 17.9 g/l solution of *disodium hydrogen phosphate R*, 375 volumes of a 7.8 g/l solution of *sodium dihydrogen phosphate R* and 250 volumes of *methanol R* containing 4.6 g/l of a 400 g/l solution of *tetrabutylammonium hydroxide R*.

*Flow rate*: 1.5 ml/min.

*Detection*: spectrophotometer at 245 nm.

*Injection*: 20 µl.

*Run time*: 12 times the retention time of paracetamol.

*Relative retentions* with reference to paracetamol (retention time = about 4 min): impurity K = about 0.8; impurity F = about 3; impurity J = about 7.

*System suitability*: reference solution (c):

– *resolution*: minimum 4.0 between the peaks due to impurity K and to paracetamol,
– *signal-to-noise ratio*: minimum 50 for the peak due to impurity J.

*Limits*:

– *impurity J*: not more than 0.2 times the area of the corresponding peak in the chromatogram obtained with reference solution (c) (10 ppm),
– *impurity K*: not more than the area of the corresponding peak in the chromatogram obtained with reference solution (c) (50 ppm),
– *impurity F*: not more than half the area of the corresponding peak in the chromatogram obtained with reference solution (d) (0.05 per cent),
– *any other impurity*: not more than half the area of the principal peak in the chromatogram obtained with reference solution (a) (0.05 per cent),
– *total of other impurities*: not more than the area of the principal peak in the chromatogram obtained with reference solution (a) (0.1 per cent),
– *disregard limit* for the calculation of the total of other impurities: the area of the principal peak in the chromatogram obtained with reference solution (b) (0.01 per cent).

**Heavy metals** (*2.4.8*): maximum 20 ppm.

Dissolve 1.0 g in a mixture of 15 volumes of *water R* and 85 volumes of *acetone R* and dilute to 20 ml with the same mixture of solvents. 12 ml of the solution complies with limit test B. Prepare the standard using lead standard solution (1 ppm Pb) obtained by diluting *lead standard solution (100 ppm Pb) R* with a mixture of 15 volumes of *water R* and 85 volumes of *acetone R*.

**Loss on drying** (*2.2.32*): maximum 0.5 per cent, determined on 1.000 g by drying in an oven at 105 °C.

**Sulphated ash** (*2.4.14*): maximum 0.1 per cent, determined on 1.0 g.

ASSAY

Dissolve 0.300 g in a mixture of 10 ml of *water R* and 30 ml of *dilute sulphuric acid R*. Boil under a reflux condenser for 1 h, cool and dilute to 100.0 ml with *water R*. To 20.0 ml of the solution add 40 ml of *water R*, 40 g of ice, 15 ml of

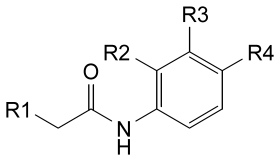
*dilute hydrochloric acid R* and 0.1 ml of *ferroin R*. Titrate with *0.1 M cerium sulphate* until a greenish-yellow colour is obtained. Carry out a blank titration.

1 ml of *0.1 M cerium sulphate* is equivalent to 7.56 mg of $C_8H_9NO_2$.

STORAGE

Protected from light.

IMPURITIES




A. R1 = R3 = R4 = H, R2 = OH: *N*-(2-hydroxyphenyl)acetamide,

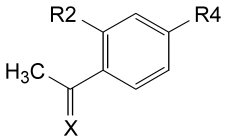
B. R1 = $CH_3$, R2 = R3 = H, R4 = OH: *N*-(4-hydroxyphenyl)propanamide,

C. R1 = R2 = H, R3 = Cl, R4 = OH: *N*-(3-chloro-4-hydroxyphenyl)acetamide,

D. R1 = R2 = R3 = R4 = H: *N*-phenylacetamide,

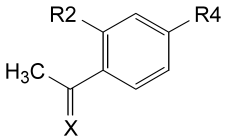
H. R1 = R2 = R3 = H, R4 = O-CO-$CH_3$: 4-(acetylamino)phenyl acetate,

J. R1 = R2 = R3 = H, R4 = Cl: *N*-(4-chlorophenyl)acetamide (chloroacetanilide),

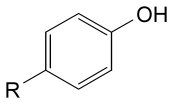



E. X = O, R2 = H, R4 = OH: 1-(4-hydroxyphenyl)ethanone,

G. X = N-OH, R2 = H, R4 = OH: 1-(4-hydroxyphenyl)ethanone oxime,




I. X = O, R2 = OH, R4 = H: 1-(2-hydroxyphenyl)ethanone,




F. R = $NO_2$: 4-nitrophenol,

K. R = $NH_2$: 4-aminophenol.

**01/2008:1034**

# PARAFFIN, HARD

## Paraffinum solidum

DEFINITION

A purified mixture of solid saturated hydrocarbons generally obtained from petroleum. It may contain a suitable antioxidant.

CHARACTERS

*Appearance*: colourless or white or almost white mass; the melted substance is free from fluorescence in daylight.

*Solubility*: practically insoluble in water, freely soluble in methylene chloride, practically insoluble in ethanol (96 per cent).

IDENTIFICATION

*First identification: A, C.*

*Second identification: B, C.*

A. Infrared absorption spectrophotometry (*2.2.24*).

*Comparison*: *hard paraffin CRS*.

*Preparation*: place about 2 mg on a sodium chloride plate, heat in an oven at 100 °C for 10 min, spread the melted substance with another sodium chloride plate and remove one of the plates.

B. Acidity or alkalinity (see Tests).

C. Melting point (*2.2.16*): 50 °C to 61 °C.

TESTS

**Acidity or alkalinity**. To 15 g add 30 ml of boiling *water R* and shake vigorously for 1 min. Allow to cool and to separate. To 10 ml of the aqueous layer add 0.1 ml of *phenolphthalein solution R*. The solution is colourless. Not more than 1.0 ml of *0.01 M sodium hydroxide* is required to change the colour of the indicator to red. To a further 10 ml of the aqueous layer add 0.1 ml of *methyl red solution R*. The solution is yellow. Not more than 0.5 ml of *0.01 M hydrochloric acid* is required to change the colour of the indicator to red.

**Polycyclic aromatic hydrocarbons**. *Use reagents for ultraviolet absorption spectrophotometry*. Dissolve 0.50 g in 25 ml of *heptane R* and place in a 125 ml separating funnel with unlubricated ground-glass parts (stopper, stopcock). Add 5.0 ml of *dimethyl sulphoxide R*. Shake vigorously for 1 min and allow to stand until 2 clear layers are formed. Transfer the lower layer to a 2nd separating funnel, add 2 ml of *heptane R* and shake the mixture vigorously. Allow to stand until 2 clear layers are formed. Separate the lower layer and measure its absorbance (*2.2.25*) between 265 nm and 420 nm using as the compensation liquid the clear lower layer obtained by vigorously shaking 5.0 ml of *dimethyl sulphoxide R* with 25 ml of *heptane R* for 1 min. Prepare a 7.0 mg/l reference solution of *naphthalene R* in *dimethyl sulphoxide R* and measure the absorbance of this solution at the absorption maximum at 278 nm using *dimethyl sulphoxide R* as the compensation liquid. At wavelengths from 265 nm to 420 nm, the absorbance of the test solution is not greater than one-third that of the reference solution at 278 nm.

**Sulphates** (*2.4.13*): maximum 150 ppm.

Introduce 2.0 g of the melted substance to be examined into a 50 ml ground-glass-stoppered separating funnel. Add 30 ml of boiling *distilled water R*, shake vigorously for 1 min and filter.

STORAGE

Protected from light.

**01/2008:0240**

# PARAFFIN, LIGHT LIQUID

## Paraffinum perliquidum

DEFINITION

Purified mixture of liquid saturated hydrocarbons obtained from petroleum.