Phenylmercuric Borate

1 Nonproprietary Names

BP: Phenylmercuric borate
PhEur: Phenylhydrargyri boras

2 Synonyms

(Dihydrogen borato)phenylmercury; phenylmercuriborate; phenylmercury borate; PMB.

3 Chemical Name and CAS Registry Number

[Orthoborato(3-)-O]-phenylmercurate(2-)dihydrogen [102-98-7]

The CAS Registry Number, chemical name and synonyms all refer to phenylmercuric borate alone, rather than the compound. The name phenylmercuric borate and the synonyms may, however, be applied to the PhEur 2002 material, which is a compound or a mixture of compounds, *see* Section 4. Unique CAS Registry Numbers for phenylmercuric borate and the compounds are as follows:

$C_6H_7BHgO_3$ [102-98-7]
$C_{12}H_{13}BHg_2O_4$ [8017-88-7]
$C_{12}H_{11}BHg_2O_3$ [6273-99-0]

4 Empirical Formula Molecular Weight

The PhEur 2002 material is a compound consisting of equimolecular proportions of phenylmercuric hydroxide and phenylmercuric orthoborate ($C_{12}H_{13}BHg_2O_4$) or of the dehydrated form (metaborate, $C_{12}H_{11}BHg_2O_3$), or a mixture of the two compounds.

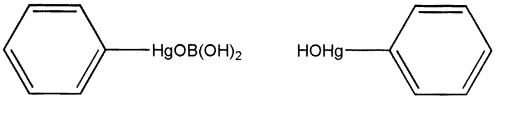
Phenylmercuric hydroxide and phenylmercuric orthoborate:

$C_{12}H_{13}BHg_2O_4$ 633.2

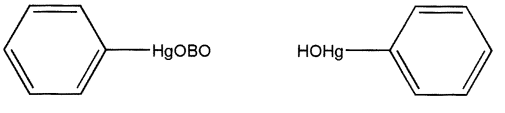
Phenylmercuric hydroxide and phenylmercuric metaborate:

$C_{12}H_{11}BHg_2O_3$ 615.2

5 Structural Formula



Phenylmercuric orthoborate and phenylmercuric hydroxide



Phenylmercuric metaborate and phenylmercuric hydroxide

6 Functional Category

Antimicrobial preservative; antiseptic.

7 Applications in Pharmaceutical Formulation or Technology

Phenylmercuric borate is used as an alternative antimicrobial preservative to phenylmercuric acetate or phenylmercuric nitrate. It is more soluble than phenylmercuric nitrate and has also been reported to be less irritant than either phenylmercuric acetate or phenylmercuric nitrate.[1] *See* Table I.

See also Phenylmercuric Nitrate.

Table I: Uses of phenylmercuric borate.

Use	Concentration (%)
Antimicrobial agent in ophthalmics	0.002–0.004
Antimicrobial agent in parenterals	0.002

8 Description

Phenylmercuric borate occurs as colorless, shiny flakes or as a white or slightly yellow, odorless, crystalline powder.

9 Pharmacopeial Specifications

See Table II.

Table II: Pharmacopeial specifications for phenylmercuric borate.

Test	PhEur 2002
Identification	+
Appearance of solution	+
Ionized mercury (as heavy metals)	+
Loss on drying (at 45 °C)	≤3.5%
Assay (dried basis) of	
Mercury	64.5–66.0%
Borates (as H_3BO_3)	9.8–10.3%

10 Typical Properties

Acidity/alkalinity: pH = 5.0–7.0 for 0.6% w/v aqueous solution at 20 °C.

Antimicrobial activity: phenylmercuric borate is a broad-spectrum antimicrobial preservative with slow bactericidal and fungicidal activity similar to that of phenylmercuric nitrate; *see* Phenylmercuric Nitrate.

Dissociation constant: pK_a = 3.3

Melting point: 112–113 °C

Solubility: *see* Table III.

Table III: Solubility of phenylmercuric borate.

Solvent	Solubility at 20 °C[a] unless otherwise stated
Ethanol (95%)	1 in 150
Glycerin	Soluble
Propylene glycol	Soluble
Water	1 in 125
	1 in 100 at 100 °C

[a] Compendial values for solubility vary considerably.

11 Stability and Storage Conditions

As for other phenylmercuric salts; *see* Phenylmercuric Nitrate. Solutions may be sterilized by autoclaving.

Phenylmercuric borate should be stored in a well-closed container, protected from light, in a cool, dry place.

12 Incompatibilities

As for other phenylmercuric salts; *see* Phenylmercuric Nitrate.

Incompatible with: halides; anionic emulsifying agents and suspending agents; tragacanth; starch; talc; sodium metabisulfite; sodium thiosulfate; disodium edetate; silicates; aluminum and other metals; amino acids; ammonia and ammonium salts; sulfur compounds; rubber; and some plastics.

13 Method of Manufacture

Phenylmercuric borate may be prepared by heating mercuric borate with benzene or by evaporating to dryness, under vacuum, an alcoholic solution containing equimolar proportions of phenylmercuric hydroxide and boric acid.

14 Safety

Phenylmercuric borate is mainly used as an antimicrobial preservative in topical pharmaceutical formulations. A number of adverse reactions to mercury-containing preservatives have been reported; *see* Phenylmercuric Nitrate.

Although phenylmercuric borate is an irritant, it has been reported to be less so than either phenylmercuric acetate or phenylmercuric nitrate.[1] There is, however, some cross-sensitization potential with other mercurial preservatives.

Systemic absorption has been reported following regular use of a hand disinfectant soap containing 0.04% phenylmercuric borate, resulting in an increase in the estimated total daily body load of mercury from 30–100 μg per 24 hours.[2]

15 Handling Precautions

Observe normal precautions appropriate to the circumstances and quantity of material handled. Phenylmercuric borate may be irritant to the skin, eyes, and mucous membranes. Eye protection, gloves, and a respirator are recommended. In the UK, the occupational exposure limit for mercury containing compounds, calculated as mercury, is 0.01 mg/m^3 long-term (8-hour TWA) and 0.03 mg/m^3 short-term.[3]

16 Regulatory Status

Included in nonparenteral medicines licensed in Europe. In France, a maximum concentration of up to 0.01% is permitted for use in pharmaceutical formulations. In the UK, the use of phenylmercuric borate in cosmetics is restricted;[4] *see* Phenylmercuric Nitrate.

17 Related Substances

Phenylmercuric acetate; phenylmercuric nitrate; thimerosal.

18 Comments

The EINECS number for phenylmercuric borate is 203-068-1.

19 Specific References

1 Marzulli FN, Maibach HI. Antimicrobials: experimental contact sensitization in man. *J Soc Cosmet Chem* 1973; **24**: 399–421.

2 Peters-Haefeli L, Michod JJ, Aelhg A, *et al.* Urinary excretion of mercury after the use of an antiseptic soap containing 0.04% of phenylmercuric borate [in French]. *Schweiz Med Wochenschr* 1976; **106**(6): 171–178.

3 Health and Safety Executive. *EH40/2002: Occupational Exposure Limits 2002*. Sudbury: Health and Safety Executive, 2002.

4 Statutory Instrument (SI) 1989: No. 2233. Consumer Protection: The Consumer Products (Safety) Regulations 1989. London: HMSO, 1989.

20 General References

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21 Author

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22 Date of Revision

1 May 2002.