delivery of doxorubicin to cancer cells. This copolymer exhibited increased toxicity due to hyaluronan receptor-mediated uptake of the macromolecular drug.[14]

Hyaluronan is used therapeutically to treat osteoarthritis in the knee, and is an effective treatment for arthritic pain.[15] It also has important applications in the fields of vascosurgery and vascosupplementation.[16]

The EINECS number for sodium hyaluronate is 232-678-0. The PubChem Compound ID (CID) for sodium hyaluronate is 3084049.

19 Specific References

1 Dehayza P, Cheng L. Sodium hyaluronate microspheres. US Patent No. 2,004,127,459; 2004.
2 Pitkänen L, *et al.* Vitreous is a barrier in nonviral gene transfer by cationic lipids and polymers. *Pharm Res* 2003; **20**(4): 576–583.
3 Ruponen M, *et al.* Interactions of polymeric and liposomal gene delivery systems with extracellular glycosaminoglycans: physicochemical and transfection studies. *Biochim Biophys Acta* 1999; **1415**: 331–341.
4 Vercruysse KP, Prestwich GD. Hyaluronate derivatives in drug delivery. *Crit Rev Ther Carrier Syst* 1998; **15**: 513–555.
5 Contipro C a.s. *Sodium hyaluronate.* www.contipro.cz (accessed 1 December 2011).
6 Lewis RJ, ed. *Sax's Dangerous Properties of Industrial Materials*, 11th edn. New York: Wiley, 2004; 1970.
7 Saettone MF, *et al.* Mucoadhesive ophthalmic vehicles: evaluation of polymeric low-viscosity formulations. *J Ocul Pharm* 1994; **10**: 83–92.
8 Cho KY, *et al.* Release of ciprofloxacin from polymer-graft-hyaluronic acid hydrogels *in vitro*. *Int J Pharm* 2003; **260**(1): 83–91.
9 Jackson JK, *et al.* Paclitaxel-loaded crosslinked hyaluronic acid films for the prevention of postsurgical adhesions. *Pharm Res* 2002; **19**(4): 411–417.
10 Kim A, *et al.* Characterization of DNA-hyaluronan matrix for sustained gene transfer. *J Control Release* 2003; **90**(1): 81–75.
11 Rochira M, *et al.* Novel vaginal delivery systems for calcitonin II. Preparation and characterisation of HYAFF microspheres containing calcitonin. *Int J Pharm* 1996; **144**: 19–26.
12 Ghezzo E, *et al.* Hyaluronan derivative microspheres as NGF delivery devices: preparation methods and *in vitro* release characterization. *Int J Pharm* 1992; **29**: 133–141.
13 Illum L, *et al.* Hyaluronic acid ester microspheres as a nasal delivery system for insulin. *J Control Release* 1994; **29**: 133–141.
14 Luo Y, *et al.* Targetted delivery of doxorubicin by HPMA copolymer–hyaluronan bioconjugates. *Pharm Res* 2002; **19**(4): 396–402.
15 Castellacci E, Polieri T. Antalgic effect and clinical tolerability of hyaluronic acid in patients with degenerative diseases of knee cartilage: an outpatient treatment survey. *Drugs Exp Clin Res* 2004; **30**(2): 67–73.
16 Balazs EA *et al.* Clinical uses of hyaluronan. In: Evered D, Whelan J, eds. *The Biology of Hyaluronan.* Chichester: Wiley, 1989; 265–280.

20 General References

21 Authors

ME Quinn, PJ Sheskey.

22 Date of Revision

4 May 2017.

Sodium Hydroxide

S

1 Nonproprietary Names

BP: Sodium Hydroxide
JP: Sodium Hydroxide
PhEur: Sodium Hydroxide
USP–NF: Sodium Hydroxide

2 Synonyms

Caustic soda; E524; lye; natrii hydroxidum; soda lye; sodium hydrate.

3 Chemical Name and CAS Registry Number

Sodium hydroxide [1310-73-2]

4 Empirical Formula and Molecular Weight

NaOH 40.00

5 Structural Formula

See Section 4.

6 Functional Category

Alkalizing agent.

7 Applications in Pharmaceutical Formulation or Technology

Sodium hydroxide is widely used in pharmaceutical formulations to adjust the pH of solutions.[1] It can also be used to react with weak acids to form salts.

8 Description

Sodium hydroxide occurs as a white or nearly white fused mass. It is available in small pellets, flakes, sticks, and other shapes or forms. It is hard and brittle and shows a crystalline fracture. Sodium hydroxide is very deliquescent and on exposure to air it rapidly absorbs carbon dioxide and water.

9 Pharmacopeial Specifications

See Table I.

10 Typical Properties

Acidity/alkalinity

pH ≈ 12 (0.05% w/w aqueous solution);
pH ≈ 13 (0.5% w/w aqueous solution);
pH ≈ 14 (5% w/w aqueous solution).

Melting point 318°C
Solubility *see* Table II.