

Chapter 2

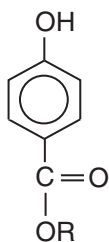
Common Preservatives

1. Parabens

INCI Name	CAS Number	EINECS Number	Canada	Japan CLS
Methylparaben	99-76-3	202-785-7	DSL	522119
Ethylparaben	120-47-8	204-399-4	DSL	522119
Propylparaben	94-13-3	202-307-7	DSL	522119
Butylparaben	94-26-8	202-318-7	DSL	522119
Isopropylparaben	4191-73-5	224-069-3	DSL	522119
Isobutylparaben	4247-02-3	224-208-8	DSL	522119
Benzylparaben	94-18-8	202-311-9	DSL	Not allowed

Chemistry

These are the esters of parahydroxybenzoic acid which is also known as para acid. Para acid is antimicrobial, but above a pH of 6, is totally in the inactive salt form and is not used.



Regulations

The EU and Brazil allow a maximum of 0.4% of each paraben and a maximum total of 0.8% of all parabens. Japan allows a maximum total paraben of 1% in all cosmetic products.

Cosmetic Ingredients Review

J. of the American College of Toxicology 3 (3) 1984, 147-209 Final Report on the Safety Assessment of Methylparaben, Ethylparaben, Propylparaben and Butylparaben. Conclusion: Safe as cosmetic ingredients in the present practices of use.

J. of the American College of Toxicology 5 (5) 1986, 301-307 Final Report on the Safety Assessment of Benzylparaben. Conclusion: Available data are insufficient

to support the safety of Benzylparaben as used in cosmetics.

Final Report on Isobutylparaben and Isopropylparaben. Conclusion: Safe as cosmetic ingredients in the present practices of use. March 8, 1994.

Noncosmetic Approvals

In the US, Methylparaben and Propylparaben are GRAS (Generally Recognized as Safe-allowed in foods) by the FDA up to 0.1% of each ester. All esters except Benzyl are allowed in Japan for ingestion. In the EU, the Methyl, Ethyl and Propyl esters are permitted in ingestion.

The Methyl, Ethyl, Propyl and Butyl esters are monographed in the USP/NF.

Parabens are permitted in non-FDA regulated uses such as adhesives.

Producers

Parabens are manufactured in the US, Japan, England, Germany, Republic of China, Israel, Mexico, India and South Africa. The major producers are Ueno (Japan), Clariant (formerly Nipa) (US and England), and Bayer (Germany). Parabens are sold usually by distributors both locally and world-wide.

Purity and Combinations

The following esters are available as the pure powder:

- Methyl,
- Ethyl,
- Propyl,
- Butyl,
- Benzyl.

Solubility

Grams per 100 grams

Paraben	Water, 25°C	Water, 80°C	Propylene Glycol
Methylparaben	0.25	2.0	22
Ethylparaben	0.17	0.86	25
Propylparaben	0.05	0.30	26
Butylparaben	0.02	0.15	110
Benzylparaben	0.01	0.05	13

Activity

Parabens are most active against fungi. They have activity against Gram positive bacteria but are considered weak against Gram negative bacteria. The limitation of the use of parabens is the amount you can dissolve in the water. Parabens function only in the water phase.

Inactivators

Parabens are inactivated (partially or fully) by strong hydrogen bonders, such as highly ethoxylated compounds like polysorbates, and compounds like cellulose derivatives, proteins and lecithin. They also can be absorbed by many different clays or similar compounds. Parabens are pH-dependent. The order of addition or the method parabens are added to formulations often determines if they will be inactivated.

For example, heating parabens in the water phase in an anionic emulsion with the base and parabens together in the water phase, will increase hydrolysis to the free acid. The free acid shows no activity at a pH above 6. As the pH increases, they dissociate into the salt (inactive) form. The highest pH with activity is about 8. Iron ions will cause dissociation at lower pH's. Parabens can be adsorbed by polyethylene containers. Parabens show no functionality in the oil phase of products.

Stability

Parabens are organic esters and are subject to saponification into para acid and the corresponding alcohol. The conditions for this to occur are the combination of temperature, pH and time.

Incorporation

The best methods to incorporate parabens into formulations include: pre-dissolving in an appropriate solvent such as propylene glycol, addition of the salt at room temperature (salts of parabens are very water soluble) and adjusting the pH to cosmetic range, or addition of the powder parabens at emulsification temperature (75-80°C), to the water phase.

Adding parabens to the oil phase is not recommended as the parabens function only in the water phase. They tend to migrate to the oil phase on aging and prefer the oil phase of an emulsion at a ratio of 10 to 1. Finally, adding parabens to the water before heating results in significantly longer time needed to dissolve. Parabens tend to "clump" together in cold water. Also heating in water to dissolve can cause saponification in anionic emulsions, as the base is usually put in at the same time.

Analysis

Parabens are easy to analyze in finished formulations by HPLC or GC. Caution: these methods only show the presence of parabens, not if they are active! Another critical factor in this method is the ratio of parabens to the parabens salt which is dependent on the pH of the product being analyzed.

Concerns

In 2003 and 2004, parabens came under attack from several publications of scientific articles. Although the attacks have not been proven to be accurate, many companies, under pressure from environmental and other groups, are looking to replace parabens. The CIR is reviewing the safety again of parabens and will probably issue a new report in late 2005 or 2006.