CYCLODEXTRIN CONTAINING PRODUCTS

Cyclodextrins are natural cyclic oligosaccharides that were discovered just over 100 years ago (A. Villiers. Sur la fermentation de la fécule par l'action du ferment butyriqué. C.R. Hebd. Seances Acad. Sci. 112 (1891) 536-538.), but only recently highly purified cyclodextrins became available as pharmaceutical excipients (see T. Loftsson and D. Duchêne, „Historical perspective. Cyclodextrins and their pharmaceutical applications", *Int. J. Pharm.*, **329**, 1-11 (2007)). Worldwide about 30 different pharmaceutical products containing cyclodextrins are on the market (Table I). In the pharmaceutical industry cyclodextrins have mainly been used as complexing agents to increase aqueous solubility of poorly soluble drugs, and to increase their bioavailability and stability. In addition, cyclodextrins can for example be used to reduce gastrointestinal drug irritation, convert liquid drugs into microcrystalline or amorphous powder, and prevent drug-drug and drug-excipient interactions. A number of books and review articles have been published on the pharmaceutical applications of cyclodextrins.

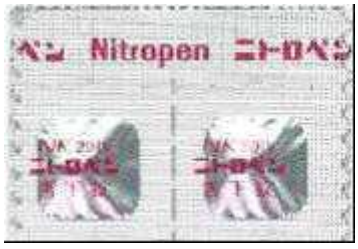

Table I. Cyclodextrin containing pharmaceutical products.

Drug/Cyclodextrin	Trade Name	Formulation	Company/Country
PGE_2/βCD	Prostarmon E	Sublingual tablet	Ono, Japan
PGE_1/αCD	Prostavastin	i.v. solutions and infusions	Ono, Japan Schwarz, Germany, USA
OP-1206/αCD	Opalmon	Tablet	Ono, Japan
Piroxicam/βCD	Brexin, Flogene Cicladon	Tablet Suppository Liquid	Chiesi, Italy several European countries Aché, Brasil
Benexate HCl/βCD	Ulgut Lonmiel	Capsule	Teikoku, Japan Shionogi, Japan
Iodine/βCD	Mena-Gargle	Solution	Kyushin, Japan
Dexamethasone/βCD	Glymesason	Ointment	Fujinaga, Japan
Nitroglycerin/βCD	Nitropen	Sublingual tablet	Nihon Kayaku, Japan
Cefotiam-hexetil/αCD	Pansporin T	Tablet	Takeda, Japan
Cephalosporin (ME 1207)/βCD	Meiact	Tablet	Meiji Seika, Japan
Tiaprofenic acid/βCD	Surgamyl	Tablet	Roussel-Maestrelli, Italy
Diphenhydramin, Chlortheophyllin/βCD	Stada-Travel	Chewing tablet	Stada, Germany
Chlordiazepoxide/βCD	Transillium	Tablet	Gador, Argentina
Hydrocortisone/HPβCD	Dexocort	Solution	Actavis, Iceland
Itraconazole/HPβCD	Sporanox	Oral and i.v. olutions	Janssen, Belgium and USA
Cisapride /HPβCD	Propulsid	Suppository	Janssen, Belgium
Nimesulide/βCD	Nimedex	Tablets	Novartis and others, Europe
Alprostadil/αCD	Rigidur	i.v. solution	Ferring, Denmark
Nicotine/βCD	Nicorette	Sublingual tablets	Pharmacia, Sweden
Chloramphenicol/MβCD	Clorocil	Eye drop solution	Oftalder, Portugal
Diclofenac-Na/HPγCD	Voltaren	Eye drop solution	Novartis, France
17β-Estradiol/RMβCD	Aerodiol	Nasal Spray	Servier, France
Indomethacin/HPβCD	Indocid	Eye drop solution	Chauvin, France
Omeprazol/βCD	Omebeta	Tablet	Betafarm, Germany
Voriconazole/SBEβCD	Vfend	i.v. solution	Pfizer, USA
Ziprasidone mesylate/ SBEβCD	Geodon, Zeldox	im solution	Pfizer, USA & Europe
Dextromethorphan/βCD	Rynathisol		Synthelabo, Italy
Cetirzine/βCD	Cetrizin		Losan Pharma, Germany
Mitomycin/HPβCD	MitoExtra Mitozytrex	i.v. infusion	Novartis, Switzerland
Tc-99 Teoboroxime/HPγCD	Cardiotec	i.v. solution	Bracco, USA
Meloxicam	Mobitil	Tablet and suppository	Medical Union Pharmaceuticals, Egypt
Aripiprazole/SBEβCD	Abilify	im solution	Bristol-Myers Squibb, USA Otsuka Pharm. Co., Japan

αCD: the natural α-cyclodextrin; βCD: the natural β-cyclodextrin; γCD: the natural γ-cyclodextrin; HPβCD: 2-hydroxypropyl-β-cyclodextrin (Kleptose HPB) from Roquette (France); MβCD: methylated β-cyclodextrin RMβCD: randomly methylated β-cyclodextrin from Wacker-Chemie GmbH (Germany); SBEβCD: sulfobutylether β-cyclodextrin (Captisol™) from CyDex Inc. (USA); HPβCD: 2-hydroxypropyl-β-cyclodextrin from Wacker-Chemie GmbH (Germany)