

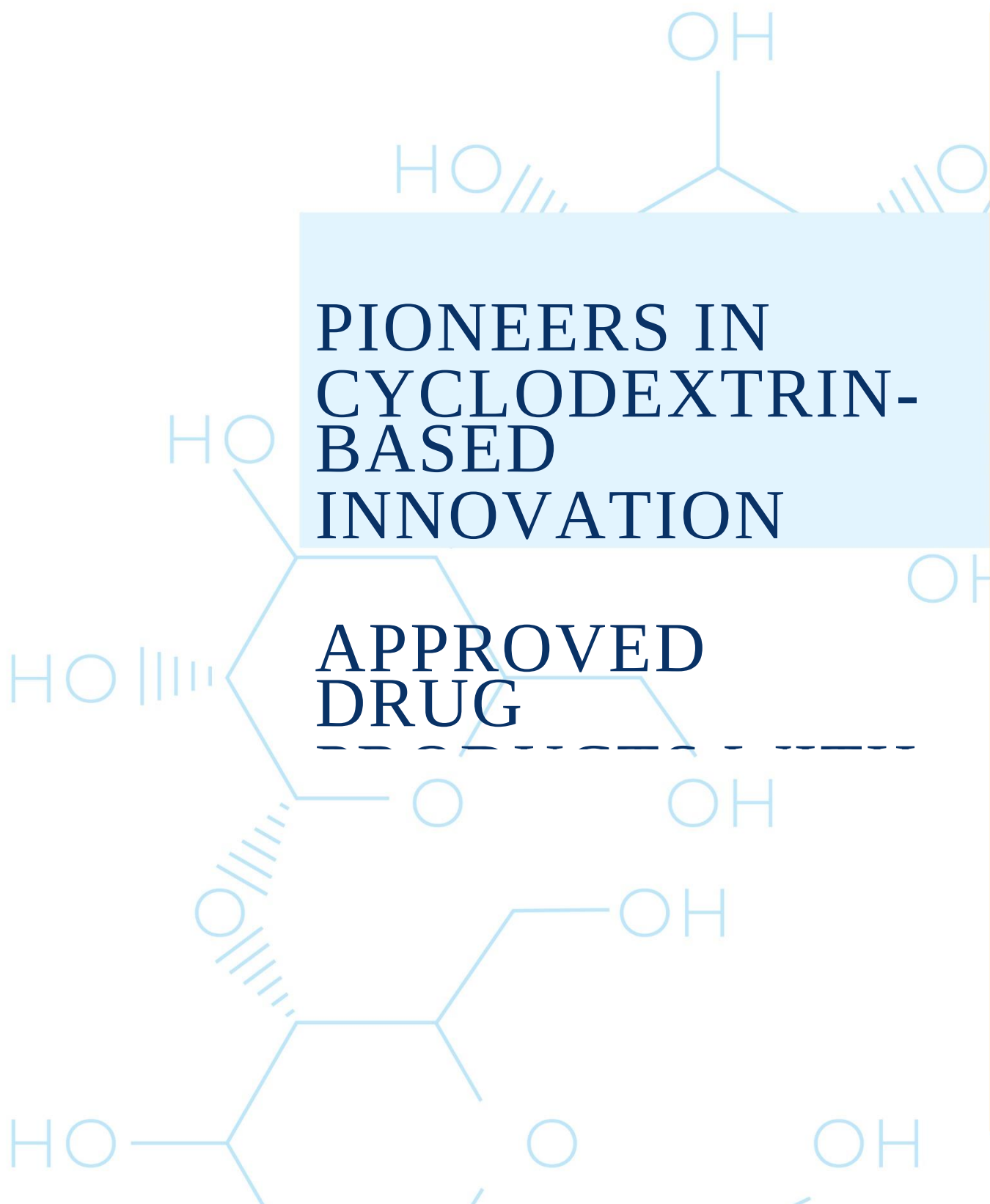


PIONEERS IN CYCLODEXTRIN-BASED INNOVATION



PIONEERS IN
CYCLODEXTRIN-
BASED
INNOVATION

APPROVED
DRUG



The list of the cyclodextrins-containing pharmaceutical products approved and marketed has been increasing (Table 2 and 3) i,ii,iii.

Table 1 gives a summary of the number of active ingredients formulated with various CDs showing that most of them contain BCD or its derivative. Among the derivatives hydroxypropyl (HP), sulfobutyl ether (SBE) and random methyl (RM) cyclodextrins can be found in formulations.

These tables do not show the two drugs where the active ingredient is a CD: Bridion (Sugammadex) and HPBCD, which are used for reversal of neuromuscular block in anesthesia and for the treatment of fatal genetic Niemann Pick Type C disease, a cholesterol metabolism disorder, respectively. The latter one has recently received an orphan drug designation.

Vitamins, various herbal compositions, phytosterols, carotenoids, unsaturated fatty acids, fish oil, etc. usually marketed as nutraceuticals have not been taken into account although they are on the borderline between drugs and healthy foods. The nutrition supplements with steroids for body builders have not been included either.

Table 1 Number of active pharmaceutical ingredients formulated with various cyclodextrins

	ACD	BCD	GCD	not specified
parent	5	150	6	3
HP		63	3	2
SBE		21		
RM		3		
SL (sulfolipo)		1		
Total	4	238	9	5

Table 2 Approved pharmaceutical products with parent cyclodextrins

No	Drug	CD	Trade Name	Dosage Form	Company
1.	Aceclofenac	β -CD	Aceclofenac-B-Cyclodextrin, Acerap, Bextrin	tablet	Taj Pharm., Pharmanova India Drugs
2.	Aceclofenac + Thiocolchicoside + Paracetamol	β -CD	Entaflam	tablet	Bionovics Pharm. (India)
3.	Aceclofenac + Trypsin + Bromelain + Rutoside	β -CD	Bextrin Total Capsule	capsule	Pharmanova India Drugs
4.	Acetaminophen	β -CD	Acetaminophen Chewable Gels	tablet, chewable	7T Pharma, USA
5.	Acetaminophen Chlorpheniramine maleate Dextromethorphan hydrobromide	β -CD	Alka-Seltzer Plus Cold & Flu FizzyChews	tablet, chewable	Bayer Healthcare
6.	Acetylcysteine	β -CD	Ilyang Bio Acetylcysteine , Moktin, Wooridul Acetylcysteine	capsule	Ilyang Pharm. (Korea), Hanmi Pharm. (Korea), PharmGen Science (Korea)
7.	Acetyl salicylic acid	β -CD	Low Dose Aspirin, Apohealth Cardio Aspirin, EC Aspirin 100, Aspirin EC 100	tablet	Pharmacy Action, Apohealth, Pharmacy Choice, Trust, Amcal (Australia)
8.	Allergens (geraniol, cinnamaldehyde, eugenol, rosin, etc.)	β -CD	T.R.U.E. test	thin-layer rapid use patch test	SmartPractice (Denmark)
9.	α -bromoisovaleric acid ethyl ester	β -CD	Corvalol Forte	tablet	Farmak (Ukraine)

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10.	α -bromoisovaleric acid ethyl ester+phenobarbital+ Valeriana extract + peppermint oil	β -CD	Corvalol, Valocordin	tablet	Farmak (Ukraine), Pharmstandart-Leksredstva (Russia) Usolye-Sibirskiy Himfarmzavod (Russia)
11.	α -bromoisovaleric acid ethyl ester+phenobarbital+ motherwort extract + peppermint oil	β -CD	Corvalol Phyto	tablet	Pharmstandart-Leksredstva JSC
12.	Aluminum chlorohydrate	β -CD	Sweat defense pure sport plus dry, Secret, Old spice	antiperspirant spray	Procter & Gamble
13.	Aluminum Zirconium Trichlorohydrate Gly	β -CD	Secret, Outlast, Olay, Old Spice, Gillette	deodorant stick, cream	Procter & Gamble, Navajo
14.	Ambroxol	β -CD	Wooridul Ambroxol HCl syrup	syrup	Pharmgen Sci. (S. Korea)
15.	Aminophenylbutyric acid	β -CD	Fenorabine Extra	tablet	JSC Usolye-Siberian Chemical Pharm. Plant (Russia)
16.	Amizolide	β -CD	Amizolid	tablet	JSC Pharmasyntez (Russia)
17.	Amlodipine maleate	β -CD	Conjupri	tablet	CSPC Ouyi Pharm, Shijiazhuang
18.	Amoxicillin + K-Clavulanate	β -CD	Augumac Duo, Shinacin	dry syrup, dispersible tablet	Jinyang Pharm. (Korea), Shinpung Pharm. (Korea)
19.	Anagliptin + metformin	α -CD	Metoana Combination Tablets	tablet	Sanwa Kagaku Kenkyusho
20.	Artemether + Lumefantrine	β -CD	Artemether 80 mg &	tablets	M/s. St. Jude Pharmavy Ltd (Nigeria)

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			Lumefantrine 480 mg Tablets		
21.	Atorvastatin	β -CD	Parotene	tablet	Pharmaking (Korea)
22.	Atorvastatin + fenofibrate	β -CD	Atotin-F	tablet	Dr. Ethix's Product & Services (India)
23.	Avobenzone, Homosalate, Octisalate, Octocrylene	β -CD	Liftactiv peptide-C	UV cream	L'Oreal
24.	Barberry +ivy leaf dry extracts	β -CD	Synatura	suspension syrup	Ahngook Pharm. (Korea)
25.	Benexate	β -CD	Ulgut, Lonmiel	capsule	Teikoku, Shionogi, Negase
26.	Benproperine	β -CD	Sanqing	effervescent tablets	Beijing Beiyi United Pharm. (China)
27.	Benzoyl peroxide	γ -CD	Nujevi Acne	cream	Nujevi
28.	Betahistine	β -CD	Betahist	tablet	Geno Pharm.
29.	Bilastin	β -CD	Ilaxten	oral solution (pediatric)	Menarini Farm. Int.
30.	Brivaracetam	β -CD	Briviact	tablet	UCB Pharma
31.	Bromhexin	β -CD	Bisolvon	tablet	Sanofi
32.	Bromdihydrochlorphe nylbenzodiazepine	β -CD	Phenazepam	tablet	Valenta Farm (Russia)
33.	Calcium carbonate	β -CD	Calprimum	chewing tablet	Cemag Care (withdrawn in 2021)
34.	Cefditoren pivoxil (Cephalosporin)	β -CD	Meiact	tablet	Meiji
35.	Cefotiam hexetyl	α -CD	Pansporin-T	tablet	Takeda
36.	Cefpodoxime	β -CD	Sagacefpo	tablet	Saga Laboratories (India)
37.	Cetirizine	β -CD	Zyrtec, WalZyr, Revicet	chewing tablet, OD tablet, sucking	Losan Pharma, UCB Pharma, Sandoz, Walgreen, Sawai

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				tablet, dry syrup	Pharm., Nichi-Iko, Takeda
38.	Cefuroxime	β -CD	Haginat	granules for suspension	Hau Giang Pharm. (Vietnam)
39.	Ciprofloxacin HCl	β -CD	Cipglo D Ciprofloxacin HCl Betadex Eye Drop	ez drops	Aglowmax (India)
40.	Cisapride	β -CD	Propulsid, Coordinax	suppository	Janssen
41.	Chlordiazepoxide	β -CD	Transilium	tablet	Gador
42.	Chlorpheniramine maleate + acetaminophen	β -CD	Cold Remedy Soothing	tablet	Foshang Dezhong Pharm. (China)
43.	Chlorpheniramine maleate + acetaminophen +Chinese herbs	β -CD	"Wei C Yin Qiao Pian" for flu and colds	tablet	Guizhou Bailin Pharm. (China)
44.	Cholecalciferol	β -CD	Vitamin D3	tablet	Natures Aid (U.K.)
45.	Cholic acid, deoxycholic acid, menthol	β -CD	Qingkailing	oral liquid	Guangzhou Baiyunshan Pharm
46.	Clofazimine	β -CD	Clofazimine	tablet	Macleods Pharm. (India)
47.	Clomifene	β -CD	Clomifene Tablets	tablet	West Coast Pharmaceutical Works (India)
48.	Domperidone	β -CD	Domperidone	tablet	Hinan Pharm. (China)
49.	Dry extract of Coptidis rhizoma and Ivy leaf	β -CD	Synatura syrup	oral solution	Anguk Pharm. (Korea)
50.	Curcumin extract	γ -CD	Curcumin Extract 45	capsules	Dr. Wolz Zell GmbH (Germany)
51.		CD	Curuline	powder (veterinary)	KB'S Solution

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52.	Curcumin + other herbal extracts	β -CD	Curcujoint, Gut relief, Liver-V	gelatin capsule	Clover Group Australia, Nutrition Care Pharm. (Australia)
53.	Dexamethasone + Glyther	β -CD	Glymesason	tablet, ointment	Fujinaga
54.	Dextromethorphan	β -CD	Rinathiol, Bisolvon Dry	tablet	Synthelabo, Sanofi-Aventis
55.	Dextromethorphan + guaifenesin	β -CD	Stona cough	syrup	Sato Pharm.
56.	Dextromethorphan.H Br + Pseudoephedrine.HCl	β -CD	Thymicol syrup (withdrawn)	syrup	Daewoong Pharm. (Korea)
57.	Desloratadine	β -CD	Desloratadine	tablet	Northstar Rx
58.	Diacerein	β -CD	Diacerein-Mac	capsule	Macleods Pharm. (India)
59.	Dimenhydrinate	β -CD	Yihanning Tea Dimenhydrinate	tablet	Beijing Yimin Pharm.
60.	Diphenhydramine	β -CD	Stada-Travel	chewing tablet	Stada
61.	Diomagnite	β -CD	Dioma	sachet	Donggu Biopharm. (Korea)
62.	Doxycycline	β -CD	Doxydan, Doxy-100 Doxilac-B	tablet	Danish Healthcare, Shah Pharma Modern Agencies (India)
63.	Doxycycline + Ornidazole	β -CD	Dox M OZ	tablet	Moraceae Pharm.
64.	Doxylamine hydrogen succinate	β -CD	Stada	melting tablet	Stada
65.	Dutasteride	γ -CD	Adamo	tablet	HanAll (S.Korea)
66.	Econazol	β -CD	Econazole Nitrate Aerosol	spray	Guangdong Tongde Pharm. (China)

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67.	Ensulizole + Octinoxate	β -CD	Harmon face values revitalizing day cream	cream	Emilia Resources
68.	Erdosteine	β -CD	Elstein syrup	oral solution	Daewon Pharm. (Korea)
69.	Efavirenz	β -CD	Regast	tablet	Pharmasyntez (Russia)
70.	Efavirenz + Tenofovir + Emtricitabine	β -CD	Trakten-N	tablet	Pharmasyntez (Russia)
71.	Ethinyl estradiol+ drospirenone+ levomefolate	β -CD	Safyral, Beyaz, Yaz, Yarina	tablet	Bayer Healthcare,
72.	Ethinyl estradiol + drospirenone	β -CD	Yaz, Yasminiq, Gianvi, Rajani, Loryna	tablet	Bayer
73.	Etoricoxib	β -CD	Brutaflam	tablet	Mankind Pharma (India)
74.	Etoricoxib + Paracetamol	β -CD	Brutaflam plus	tablet	Mankind Pharma (India)
75.	Etoricoxib + Thiocolchicoside	β -CD	Brutaflam MR4	tablet	Mankind Pharma (India)
76.	Famotidine	β -CD	Famotidine OD Tablets,	OD tablet, chewable tablets	Takeda Teva, Taiko, Yantai Rongchang Pharm. (China)
77.	Famotidine + CaCO ₃ +Mg(OH) ₂	β -CD	Shiwei Famotidine Calcium Magnesium	tablet	Rongchang Pharm. (China)
78.	Fenofibrate	β -CD	fenofibrate, Fenacor, Fibrate, Lipicard, Fibrolip, Fenocor, Fibril,	tablet,capsule ,injection	Karalex Pharma, Avinash Health, Taj Pharm., US Vitamins, Emcure Pharm., Medindia, Torrent, Grandix

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			Thrombiflo, Lotgl		
79.	Fenofibrate + Rosuvastatin	β -CD	Creolip F	tablet	4 Care Lifescience (India)
80.	Ferric hydroxyde sodium gluconate complex + Calcium Folate	β -CD	Santa Mon Plus Solution	oral solution	Koryo Pharm. (Korea)
81.	Fingolimod	β -CD	Fingolimod beta	capsule	Betapharm
82.	Flunarizine	β -CD	Fluner	tablet	Geno Pharm.
83.	Flupentixol dihydrochloride	β -CD	Fluanxol	tablet	Lundbeck (UK)
84.	Flupentixol + Melitracen	β -CD	Deanxit	film-coated tablet	Lundbeck (UK)
85.	Flurbiprofen	β -CD	Flurbiprofen- Pharmstandard	lozenge	Pharmstandard- Leksredstva (Russia)
86.	Flurbiprofen + Benzylidimethyl- myristoylamino- propylammonium	β -CD	Mitrseptin- Prolor	spray	Pharmstandard- Leksredstva (Russia)
87.	Garlic Extract	β -CD		various dragees	Various
88.	Glipizide	β -CD	GLEZ 5 TAB	tablet	Otsira
89.	Glipizide + Metformin	β -CD	Glynase-MF	tablet	USV PVT LTD (India)
90.	Glucagon	β -CD	Baqsimi	nasal spray	Eli Lilly
91.	Hederae helix fluid (Hederacoside)	β -CD	Hedra syrup	oral solution	Kukje Pharm. (Korea)
92.	Hesperidine + Rutin	β -CD	Cyclofag Lipo Clean	capsules	Flavin 77 (Hungary)
93.	Histamine dihydrochloride	β -CD	Australian dream	pain relieving antiarthritis cream	Nature's Health Connection

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94.	Ibuprofen	β -CD	Nurofen Rapid Forte, Nurofen Express	sachet, soluble oral powder, syrup	Reckitt Benckiser Healthcare, Hanmi Pharm. (Korea)
95.	Ibuprofen + Paracetamol	β -CD	Ibuclin Express	powder	Dr. Reddy (India)
96.	Iodine	β -CD	Mena-Gargle, Betiodex, Cydiodine	solution, tablet	Kyushin, „Remedy Group” MCHJ QK (Uzbekistan), Sanjiu Zhongyi Pharm. (China)
97.	Itraconazole	β -CD	Itler-200/ Itraqueen	tablet	Kepler Health Care, Dermaland (India)
98.	Ivabradin	β -CD	Ivabradin	tablet	betapharm Arzneimittel
99.	Ketotifen fumarate	β -CD	Samacetotifen syrup	oral solution	Sanya Pharm.
100	Lactobacillus johnsonii No. 1088 (heat-treated), Bifidobacterium longum	β -CD	Gastricell	sachet	LABO Nutrition
101	Levamlodipine	β -CD	Levamlodipine/ Conjupri	tablet	CSPC Ouyi Pharm., Xspire Pharma
102	Levodropropizine	β -CD	Levotro syrup, Dropizin syrup	oral solution	Shinil Pharm. (Korea), Kolon Pharm. (Korea)
103	L-menthol + eucalyptus oil	β -CD	Pectusin	tablet	Pharmstandard (Russia)
104	Loperamide	β -CD	Akme-Entoquol Tablet	tablet	Akme Biotec
105	Meclizine + Scopolamine	β -CD	Bomirong Mountain	sachet	Youngil Pharm. (Korea)
106	Melatonin	β -CD	SonNormDuo	tablets	Pharmstandard-Leksredstva (Russia)
107	Meloxicam	β -CD	Mobitil	tablet, suppository	Med. Union Pharm.

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108	Menthol/camphor	β -CD	Pain relief gel	ointment	MMA Elite, Doctor Hoy's, Clientele
109	Mequitazine	β -CD	Zeslan, Nipolazine	pediatric syrup	Asahi Kasei, Alfresa
110	Metronidazole	β -CD	Metrogel, Flagyl, Vandazol, Nidagel, Liangyi	vaginal gel, tablet	Curatek, Fougera, Tolmar, Malderma Labs, Shanxi Maidi Pharm. (China)
111	Methylprednisolone	β -CD	Macpred	tablet	Macleods (India)
112	Methyl salicylate	β -CD	Xceptor Pain	cream	Xceptor
113	Miconazole	β -CD	MiconHex-Triz	wipes (veterinary)	Dechra Veterinary
114	Midazolam	γ -CD	Ozalin	oral solution	Primex, Advicenne, Valdepharm
115	Minoxidil	γ -CD	Alopexy	solution	Pierre Fabre
116	Melatonin + peppermint extract + motherwort extract	β -CD	SonNormDuo	tablet	Pharmstandard-Leksredstva JSC (Russia)
117	Naphasoline hydrochloride	β -CD	Clear eyes	eye drop	Medtech
118	Nateglinide	β -CD	Nateglinide Tablets	tablet	Teva Takeda
119	Nebivolol	β -CD	Nebilong, Nebivolol	tablet	MicroLabs (India), Izvarino Farma (Russia)
120	Nebivolol & Amlodipine	β -CD	Nebilong-AM	tablet	MicroLabs (India)
121	Nebivolol & Hydrochlorothiazide	β -CD	Nebilong-H	tablet	MicroLabs (India)
122	Niacinamide + adenosine	CD	Botanic Heal boH Air Jet Daily Mask Panthenol	anti-wrinkle mask	Cj Olive networks

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123	Nicotine	β -CD	Nicorex, Nicorette, Nicogum	tablet, chewing gum	Pierre Fabre ,Pfizer
124	Nimesulide	β -CD	Nimedex	tablet	Novartis, others
125	Nitroglycerin	β -CD	Nitrophen	sublingual tablet	Nippon Kayaku
126	Norfloxacin	β -CD	Cypmor-B, Norfloxacin&Betadex	tablet	Cyper Pharma, Elder Lab (India)
127	Norfloxacin and Tinidazole	β -CD	Entronor –TZ, Noroxin	tablet	India
128	Octyl methoxy cinnamate	β -CD	Cetaphil Sun Ultra-Light Lotion SPF50	Lotion	Galderma Australia
129	Ofloxacin Dexamethasone	β -CD	Orof-D	Eye/Ear drops	
130	Olmesartan medoxomil	β -CD	Olmetec OD Tablets, Olmesartan OD tables	OD tablets	Daiichi Sankyo
131	Omeprazol	β -CD	Omebeta, Omeprazol, Losamel	enteric capsule	Betafarm, Basics, Stada, Aliud,
132	Oxymatrine	β -CD	Liverin	capsule	Chia Tai Tianqing
133	Pantoprazole	β -CD	Topp	tablet	Systopic Laboratories (India)
134	Paracetamol, Caffeine, Artificial Cow-bezoar and Chlorphenamine Maleate	β -CD	Amikahuangmin	capsule	Chongqing Greenlin Pharm.
135	Paroxetine HCl	β -CD	Serestill, Stiliden	oral solution (drops)	Italfarmaco S.p.a.,
136	Pelargonium Sidoides extract	β -CD	Canium syrup	syrup	Il Sung Pharm. (Korea)
137	Perindopril erbumine	β -CD	Perindopril	tablet	Sandoz

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138	PGE1	α -CD	Prostavasin, Prostandin, Alprostadil, Arteris-Vero	intra-arterial inf./ointment	Ono, Schwarz, Ellara, Verofarm, Biohimik (Russia), IDT Biologika (Germany)
			Viridal, Alprostadil, Edex, Caverject, Rigidur,	intra- cavernous inj.	Schwarz, Ferring, Pfizer
		β -CD	Prostandin 500	infusion	Ono
		β -CD	Opalmon	tablet	Ono
139	PGE1 analogue: Limaprost	α -CD	Limaprost alfadex, Opalmon	tablet	Ono, Sumitomo, Sawai
140	PGE2	α -CD + β - CD		tablet	Sawai Pharm., Nichiiko, Sumitomo
141	PGE2	β -CD	Prostarmon E, Dinoproston- betadex	sublingual tablets	Ono
142	Piroxicam	β -CD	Cycladol, Brexin, Briax, Dexpir, Flamexin, Pyrodex, Medicam	tablet	Chiesi, Ranbaxy, Sun, MMC
			Brexin	suppository	Chiesi
			Flogene	pediatric liquid	Ache
143	Plant extracts (Bachticia, Echinacea, etc.)	β -CD	Esberitox Forte	tablet	Phytotec Hungaria
144	Plant extract (Leonuri herba) + Peppermint oil, + Melatonin	β -CD	SonNorm Duo	tablet	Farmstandart- Leksredstva (Russia)

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145	Plant extract (Leonuri herba + Melissa) + Peppermint oil,	β -CD	Corvalol Phytocomfort	tablet	Farmstandart- Leksredstva (Russia)
146	Plant extract (alder buckthorn, senna, althaea, mauve)	β -CD	Boribel N°13	sachet	Pierre Fabre
147	Pramipexole Dihydrochloride	β -CD	Pramipexole Dihydrochloride	tablet	Endo Pharmaceuticals
148	Prasugel	β -CD	Arprel	tablet	Micro Labs Ltd (India)
149	Praziquantel, Pyrantel, Febantel	β -CD	Prazicide	vet. suspension	Apicenna
150	Praziquantel, Pyrantel, Silibinin	β -CD	Prazitel Special	vet. suspension	LLC Scientific Research Company, SKiFF, Russia
151	Prednisolone	β -CD	Omnacortil DT	dispersible tablets	Macleods
152	Pseudoephedrine hydrochloride, Tripolidine hydrochloride	β -CD	Commacor syrup (withdrawn)	syrup	Ilhwa (Korea)
153	Rabeprazole	β -CD	Ravezen	tablet	Newgen Pharm. (Korea)
154	Risperidone	β -CD	Risperidone oral solution	oral solution	Wockhardt (India)
			ANDRO	orally disintegrating tablet	Endurance Healthcare PVT (India)
155	Rofecoxib	β -CD	Rofizgel	tablet	Wockhardt (India)
156	Salicylic acid	γ -CD	Prosoria, Treatment Cream	psoriasis treatment gel,	Nuvothera
157	Scopolamine + Vitamins B + caffein	β -CD	Toslong solution	oral solution	Dongsung Pharm. (Korea)
158	Sildenafil	β -CD	Anerchu	tablet	Korea United Pharm.

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159	Solifenacin	β -CD	Solifenacin Succinate OD Tablets	OD tablet	Japan generic
160	Spironolactone	CD	Spironolactone tablet (Hongsen)	tablet	Suzhou Hongsen Pharm. (China)
161	Telmisartan	β -CD	Arbitel-80	tablet	Micro Labs (India)
162	Telmisartan + Amlodipine	β -CD	Arbitel-AM	tablet	Micro Labs (India),
163	Telmisartan & Hydrochlorothiazide	β -CD	Arbitel-H	tablet	Micro Labs (India)
164	Theophylline	β -CD	Unicontin	tablet	Modi Mundi pharma (India)
165	Terbinafine	β -CD	Tebina	tablet	Rivera pharma
166	Thyme extract	β -CD	Bronchipret® Thymian Pastillen	tablets	Bionorica
167	Thiomersal	β -CD	Vitaseptol	eye drops	Novartis, Europhtha
168	Tiaprofenic acid	β -CD	Surgamyl	tablet	Roussel-Maestrelli
169	Triamcinolone Acetonide + Econazole Nitrate	β -CD	Triamcinolone Acetonide and Econazole Nitrate Cream	cream	Chongqing Huabang Pharm. (China)
170	Trolamine salicylate	β -CD	CBD pain cream	cream	Xceptor
171	Ursodeoxycholic acid	β -CD	Worliv-300	tablet	Worth Medicines (India)
172	Valerian and melisse leaf extract	β -CD	Sedogelat	tablet	Kwizda Pharma
173	Voriconazole	β -CD	Voriconazole Canon, Voriconazole Sandoz	powder	Vifitech, Biocad, Lek (Slovenia)
174	Zipeprol	β -CD	Respirene syrup	oral liquid	Hanwha Pharm. (Korea)

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Table 3 Approved pharmaceutical formulations with hydroxypropyl cyclodextrin derivatives

	Drug	CD	Trade Name	Dosage form	Company
1.	Aceclofenac + Paracetamol	HP-β-CD	Equidol P	tablet	Akumentis Healthcare (India)
2.	Acetaminophen	HP-β-CD	Paracetamol, Headache man, no more pills!, One shot, Calmour childrens acetaminophen strips chewable	infusion, chewable tablet, oral solution, dissolvable film	Uni-Pharma, 7T Pharma, Calmour
3.	Ad26.COV2.S	HP-β-CD	Jcovden (previously COVID-19 Vaccine Janssen)	vaccine	J&J
4.	Alfaxalone	HP-β-CD	Alfaxan	i.v. (veterinary)	Jurox, CTD
5.	Alprostadil	HP-β-CD	Alprostadil injection	injection	Yabao Pharm. (China)
6.	Azelastine	HP-β-CD	Antalerg	eye drops	Unimed Pharma
7.	Bilastine	HP-β-CD	Drynol	eye drops	Menarini
8.	Biotin and surfactants	HP-β-CD	RegeNail	nail lacquer	Reig Jofre, S.A (Spain)
9.	Bromfenac	HP-β-CD	Ivinak-Solofarm,	eye drops	Solopharm (Russia)
10	Butylphthalide	HP-β-CD	Butylphthalide and Sodium Chloride Injection	i.v. infusion	CSPC Enbipu Pharm. (China)
11	Ciclopirox	HP-β-CD	Dexulac	nail lacquer	Reig Jofre, S.A (Spain)
12	Ciprofloxacin + Dexamethasone	HP-β-CD	Kombinil-Duo	eye and ear drops	Promed Exports (India)

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13	Cisapride	HP- β -CD	Prepulsid	suppository	Janssen
14	Cladribine	HP- β -CD	Mavenclad, Movectro	tablet	Merck, Nerviano Medical Sciences (Italy)
15	Dantrolene sodium	HP- β -CD	ASgilus	injection	Norgine
16	Diclofenac	HP- β -CD	Dyloject, Diclofenac- Solofarm, Flector Dolo Rapid	I.v. and i.m. solution, eye drops, capsules	Javelin Pharm., Vidal, IBSA Pharma
17		HP- γ -CD	Voltaren Ophtha CD, Voltarol	eye drop	Novartis, Excelvision
18	Diphenhydramine HCl	HP- β -CD	FirstCare - Children's Allergy Relief	chewable bars	FirstCare, USpharma
19	Deexamethason + Moxifloxacin	HP- β -CD	MOSI-D Eye Drops	eye drop	FDC Limited (India)
20	Docetaxel	HP- β -CD	Docetaxel Teva Generics	infusion	Teva
21	Ethylhexyl methoxycinnamate (Octinoxate)	HP- β -CD	Ethylhexyl methoxycinnam ate cream	UV cream	Inspira Cosmetics
22	Drotaverine	HP- β -CD	Drotaverine	tablet	Moskovskiy endokrinniy zavod
23	Fingolimod	HP- β -CD	Gilenya	capsule	Novartis
24	Florbetaben	HP- β -CD	Neuraceq	solution of contrasting agent	Piramal Imaging SA
25	Fluconazol	HP- β -CD	Zeenat	eye drops	Ciron Drugs and Pharmaceuticals Pvt. (India)
26	Flurbiprofen	β -CD and HP- β -CD	Strephen, Strepfen, Strefzap, Strefen, Flurbiprofen	oromucosal spray	Reckitt (U.K.), Mylan, Fear, Busetti,

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			Geiser, Dobendan, FrobenGolmed, Benactivdol, PoloVox		A B
27	Flurbiprofen + Mitraseptin	β -CD and HP- β -CD	Mitraseptin® - Prolor	oromucosal spray	Pharmstandart- Leksredstva (Russia)
28	Glycerin	HP- β -CD	Alopel	foam for scalp	Catalysis (Spain)
29	Hitchner B1 strain	HP- β -CD	Cevac	vaccine	Ceva-Phylaxia
30	Hyaluronic acid	HP- β -CD	DOLATROX®hcc, Vijointhcc	injection	Kolinpharma, Innventa
31	Hydrocortisone	HP- β -CD	Dexacort	mouth wash	Actavis
32	Indomethacin	HP- β -CD	Indocid, Indocyllir	eye drop	Chauvin, Baush & Lomb
33	Indomethacin + Gentamicine	HP- β -CD	Indobiotic	eye drop	Vidal
34	Itraconazole	HP- β -CD	Sporanox, Orungal, Itraconazol Altan, Itrafungol (vet)	oral solution, i.v. solution	Janssen, Eli Lilly, Elanco, Altan, Mylan EPD
35	Lanosterol	HP- β -CD	Lanomax	eye drops (veterinary)	Ventura Labs (US CA)
36	Lansoprazole	HP- β -CD	Lansoprazole	tablet	Chenxin Pharm. (China)
37	Larotrectinib	HP- β -CD	Vitrakvi	capsules, oral solutions	Bayer, Penn Pharmaceutical Services (UK)
38	Latanoprost	HP- β -CD	Auproprost	eye drops	Aurolab (India)
39	Letermovir	HP- β -CD	Prevymis	i.v.	Merck
40	Levocabastine	HP- β -CD	Allergiflash, Levofree	eye drops	Bausch & Lomb
41	Levocetirizin	HP- β -CD	Monte Rijin Chu	tablet	Hanmi Pharm. (Korea)

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42	Levosimendan	HP- β -CD	Levosimendan injection	injection	Qilu Pharm. (China)
43	L-thyroxine sodium	HP- β -CD	Leventa	oral solution (veterinary)	Intervet, Merck, Shering Plough
44	Methylethylpyridinol	HP- β -CD	Vixipin, Emoxipin Neo	eye drops	Grotex (Russia), Farmstandart-leksredstva (Russia)
45	Metronidazole	HP- β -CD	Metronidazole buccal tablets (Ocoan)	tablet	Grand Pharma (China)
46	Newcastle disease vaccine, live	HP- β -CD	Cevac New L, Cevac Uni L	lyophilisate for the preparation of suspension for ocular and oral use (veterinary)	CEVA Sante Animale (France)
47	Mitomycin	HP- β -CD	MitoExtra, Mitozytrex	i.v. infusion	Novartis, SuperGen
48	Moxifloxacin + Prednisolone	HP- β -CD	Apdrops PD	eye drops	Ajanta Pharma (India)
49	Noxamovir	HP- β -CD	Prevymis	i.v. injection	Merck
50	Olopatadine	HP- γ -CD	Pazeo, Pataday, Opatanol, Olantin	eye drops	Novartis, Alcori
51	Oritavancin	HP- β -CD	Kimyrsa	i.v. injection	Melinta
52	Paroxetine HCl	HP- β -CD	Serestill	oral solution (drops)	Italfarmaco S.p.a.,
53	Pantoprazole + Levosulpiride	HP- β -CD	Tripepsa L	tablet	Akumentis Healthcare (India)
54	Pemetrexed	HP- β -CD	Pemetrexed	powder for concentrate for solution for infusion	Fresenius Kabi

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55	Perindopril tert.butylamine	HP- β -CD	Perindopril Erbumine	tablet	Sandoz
56	Perindopril + Indapamide	HP- β -CD	Perindapam	tablet	Lek (Slovenia), Pharma GmbH
57	Progesterone	HP- β -CD	Lubion, Prolutex	injection	Hikma (Portugal), IBSA Institut Biochimique (Switzerland)
58	Quizartinib	HP- β -CD	Vanflyta	tablet	Daiichi Sankyo
59	Recombinant adenovirus serotype 5 vector	HP- β -CD	Adstiladrin	intravesical solution	Ferring
60	Televancin	HP- β -CD	Vibativ	i.v. solution	Astellas Pharma, Therevance, R-farm
61	Thyme herb extract (<i>Nerba Thymi vulgaris</i>)	HP- β -CD	Bronchipret	oral solution	Bionorica (Germany)
62	Tc-99 Teboroxime	HP- γ -CD	CardioTec	i.v. solution	Bracco
63	Umbralisib tosylate	HP- β -CD	UKONIQ	tablet	TG Therapeutics, Inc.
64	Voriconazole	HP- β -CD	Vorzu, Voriconazole Synthon	tablet, powder for infusion	Rhambaxy, Synthon, Aktavis
65	Vortioxetine	HP- β -CD	Brintellix	tablet, oral solution	Lundbeck
66	Lanosterol (0.25%) + n- acetylcarnosine (1%)	HP- β - CD+ RAMEB	LumenPro	pet cataracts eye drops	Heliostatics
67	Panthenol, Allantoin	HPCD	bdrRe-lax	elixir	Hanaim Intern.
68	Salicylic acid	HPCD	Age Defying Blemish Treatment, Lipo™ CD-SA	cream, aqueous solution	Wasatch, Vantage

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**Table 4 Approved pharmaceutical formulations with
sulfobutyl β -cyclodextrin derivatives**

	Drug	CD	Trade Name	Dosage form	Company
1.	Alfaxalone	SBECD	Phaxan	i.v.	Drawbridge Pharm., Chemic Labs
2.	Amiodarone	SBECD	Nexterone	i.v. solution	Baxter
3.	Aripiprazole	SBECD	Abilify	I.m. solution	BMS,Otsuka
4.	Brexanolone (Allopregnalnone)	SBECD	Zulresso	injection solution	SAGE Therapy
5.	Carbamazepine	SBECD	Carnexiv	i.v.	Lundbeck
6.	Carfilzomib	SBECD	Kyprolis	i.v.	Amgen (Onyx), Ono
7.	Delafloxacin	SBECD	Baxdela	i.v.	Melinta
8.	Docetaxel	SBECD	Docetaxel Injection	i.v.	Sichuan Huiyu Pharm., Meridian Lab.
9.	Fosaprepitant	SBECD	Focinvez	i.v.	Spes Pharm. (US)
10.	Fosphenytoin	SBECD	Sesqient, Cerebyx	i.v. and i.m.	Sedor Pharm.
11.	Levothyroxine sodium	SBECD	Levothyroxine Sodium	injection	Hikma, Leucadia Pharm.
12.	Maropitant	SBECD	Cerenia, Vetemex, Maropital, Novart	vet. parenteral solution	Pfizer Animal Health, Virbac, Apicenna, Green Cross Veterinary Medicine (S. Korea)
13.	Meloxicam + rizatripan	SBECD	Symbravo	tablet	Axsome
14.	Melphalan	SBECD	Evomela	i.v.	Spectrum
15.	Nucleoside analogue VS-121354	SBECD	Ipecon	veterinary injection	Skolkovo (Russia)
16.	Posaconazole	SBECD	Noxafil, Posaconazol	i.v. solution	Merck, Fresenius Kabi, Eugia (ndia)

17.	Remdesivir	SBECD	Veklury, Remdeform	i.v.	Gilead Sciences, Farmasintez (Russia)
18.	Tigecycline	SBECD	Tigeciver/Tigetsiver	solution for infusion	Veropharm (Russia)
19.	Trametinib	SBECD	Mekinist, Spexotras	oral solution	Novartis
20.	Voriconazole	SBECD	Vfend, Voriconazole (vet)	I.v. solution	Pfizer, Sandoz
21.	Ziprasidone	SBECD	Geodon, Zeldox	i.m. solution	Pfizer

Table 5 Approved pharmaceutical formulations with random methyl, dimethyl and sulfolipo β -cyclodextrin derivatives

	Drug	CD	Trade Name	Dosage form	Company
1.	Chloramphenicol	DIMEB	Clorocil	eye drop	Oftalder
2.	Estradiol	RAMEB	Aerodiol	nasal spray	Servier
3.	Lanosterol (0.25%) + n-acetylcarnosine (1%)	HPBCD + RAMEB	LumenPro	pet cataracts eye drops	Heliostatics
4.	Inactivated porcine circovirus	Sulfolipo-CD	Suvaxin-PCV	vaccine	Pfizer

ⁱ www.cyclolab.hu

ⁱⁱ Brewster, M.: (2012) Registration Experiences with Hydroxypropyl- β -cyclodextrin. Pre-conference Workshop. Cyclodextrins and Cyclodextrin Derivatives as Pharmaceutical Excipients: Toxicological and Regulatory Issues. June 2nd 2012, Reykjavik, Iceland

ⁱⁱⁱ drugs.com

^{iv} www.kegg.jp/kegg/medicus.html

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