CYCLODEXTRIN NEWS

VOLUME 29. No. 09. SEPTEMBER 2015 ISSN 0951-256X

Chapter in a Recently Published Book - Sulfobutylether-Cyclodextrins: Structure, Degree of Substitution and Functional Performance

A new book dealing with cyclodextrins entitled "Cyclodextrins: Synthesis, Chemical Applications and Role in Drug Delivery" has been recently released by Nova Science Publishers, Inc., New York (Editor: Francis G. Ramirez). Cyclolab colleagues (István Puskás, Erzsébet Varga, Kata Tuza, Julianna Szemán, Éva Fenyvesi, Tamás Sohajda and Lajos Szente) contributed to this hardcover edited collection with a chapter entitled "Sulfobutylether-cyclodextrins: Structure, Degree of Substitution and Functional Performance" and summarized in this editorial.

Sulfobutylether Cyclodextrins: Variability of DS and Performance

The major scope of the chapter is the demonstration of the applicability of different sulfobutylether cyclodextrins (SBECD) in the light of different cavity sizes and average DS. Some historical data are also presented. In the 1990's SBEBCD of different average DS were concurrently available and used in early phase drug formulation and toxicology studies. A number of publications dealt with the use of SBEBCD of low DS [1-4]. Qu et al. synthesized sulfobutyl ether-β-cyclodextrin of DS 2.5: 1H NMR indicated that the primary hydroxyl group was mainly subject to the substitution. MS spectra showed that no more than one substitution occurred on a single glucose unit [5]. Comparative studies were demonstrated in the early patent of Stella et al. [6] wherein the association constants (*K*) of SBE7-β-CD, SBE4-β-CD and SBE1-β-CD (i.e. SBEBCD of DS=7; 4 and 1, respectively) with different substances were enumerated. In one case the DS versus *K* correlation had a minimum type of curve (for progesterone), while digoxin and phenytoin showed a descending correlation (SBEBCD of low DS binds the strongest) and testosterone showed an ascending correlation. Thompson [7] compared (amongst other CD derivatives) to what extent sulfobutylether cyclodextrin (SAE-CD) derivatives such as SBE7-β-CD, SBE4-β-CD and SBE1-β-CD show hemolytic behavior in concentrations typically used to solubilize pharmaceutical formulations. The hemolytical activity was found in the order of SBE7-β-CD < SBE4-β-CD << SBE1-β-CD << β-CD. From the data it may be derived that the use of SBE7-β-CD was considered the safest.

Mosher et al. demonstrated the applicability of SBEBCD of different average degrees of substitution (4, 7 and 11) for solubilizing amiodarone resulting in a liquid formulation which is dilutable without the risk of drug precipitation [8]. SBEBCD of average DS of 7 was found the preferred composition.

The effect of DS on the applicability of different CD derivatives in capillary electrophoresis for chiral separations in pharmaceutical analysis (SBEBCD included) was reviewed by de Boer et al. [9]. Herein it is emphasized that the use of commercially available CDs having a defined DS may lead to a better modeling, optimization, reproducibility, and to a more rugged separation system.

From the year 2000 the use of SBEBCD of DS 7 is overwhelming, since SBE7-β-CD was selected for the clinical studies and later this material was specified in the USP. It must be noted herein that the denotation of DS 7 is somewhat misleading, since the average DS of the USP compliant substance is between 6.2-6.9. The denotation reflects that the required distribution profile may be attained easier if the DS is closer to 7.

Zia et al. attempted to find correlation between the DS and binding of molecules to SBEBCDs with varying degrees of sulfobutyl ether substitution. Complexation constants of molecules to SBEBCDs were calculated as a function of temperature, enabling the estimation of thermodynamic parameters, including the enthalpy and entropy of binding. Binding constants of various molecules to SBEBCDs did not show a uniform trend to total degree of sulfobutylether substitution. However, a distinct pattern was observed with the enthalpy and entropy of complexation. The results showed the complexation of substrates to SBEBCDs to be more entropy-favored as the number of sulfobutyl ether groups increased. This favorable entropy was compensated by a less favorable enthalpy of interaction [10].

Skanchy et al. elaborated a separation technique for the enantiomers of the basic drug bidisomide from five closely related known process impurities using novel sulfobutylether derivative mixtures and separated fractions having a specific DS (i.e isolated SBEBCD types having degrees of substitution from one to seven). Fractions having a lower DS provided adequate chiral and achiral selectivity allowing both chiral and achiral purity to be determined in a single run [11].

It may be therefore concluded from all these prior studies that the number of the sulfobutyl ether moieties (presumably owing to a combined effect of steric and electrostatic factors) may play a significant role in the binding process. Strict standardization of the DS profile evidently yields greater trust in the reproducible performance in the pharmaceutical and analytical fields of use. However, the versatile features of the potential variable SBEBCD compositions may not be fully exploited this way.

The chapter also presents the own work of Cyclolab conducted on the investigation of possible impact of the degree of substitution and number of anhydroglucose units. The applicability of sulfobutylated cyclodextrins was also studied in several aspects.

The utility of three different analytical techniques (HPLC, capillary electrophoresis and NMR) for investigating these cyclodextrin compositions were evaluated and compared. The strength of NMR is that the determined DS value is not distorted since the result is based on the signal areas corresponding to the anomeric glucose and sulfobutyl side-chain protons. On the other hand NMR only provides the average DS value, while by capillary electrophoresis (CE) the distribution profile may be obtained, too. The drawback of using CE is poor intermediate precision, moderate pH and background electrolyte composition sensitivity, questionable accuracy and limitation in the characterization of high-DS SBE-CDs. An alternative HPLC method was elaborated to overcome such disadvantages. By this technique the separation of SBEBCD components is based on anion exchange and inclusion complexation providing efficient separation of not only the SBEBCD components, but also residual beta-cyclodextrin and the synthesis related impurities. The HPLC method, however, can not be used for calculation of degree of substitution because of the non-linear characteristics of the evaporative light scattering detection method.

CE and solubility tests were utilized for the characterization of the host-guest type interactions between drug molecules and various sulfobutyl ether cyclodextrin compositions. Comparative data were collected how SBE-CD compositions differing from the favored, highly specified grade complying US Pharmacopoeia 37 may be used for pharmaceutical purposes. The aim of the study was to establish grounds for future extension of the applicability of sulfobutylated cyclodextrins in the field of e.g. pharmaceuticals, analytical method development and environmental technologies. Based on the collected data it has been demonstrated that multiple factors may play significant role in the binding process ensuring some sort of selectivity amongst the members of the cyclodextrin library used. Besides the dimensions of the cavities, the steric effect of the relatively bulky sulfobutyl ether moieties as well as the charge born on the terminal of the substituent chains influence the strength of interaction.

The research conducted by Cyclolab also focused on the effect of degree of substitution on complex stability constants. Within the study 12 test molecules were investigated. Many of these molecules prefer the cavity of β-CD. Complex stability constants were determined with CE by calculation using the x-reciprocal method. The stability constants *vs.* DS were plotted. The compounds were classified into four groups according to the type of trend.

I. Minimum curve

II. Maximum curve

III. Ascending curve

IV. Descending curve

12 drugs were selected based on the potential utility and due to the fact that these pharmacons are commonly used. Their structures represent a wide versatility, therefore firm correlation on the found trends and the chemical characteristics should not be made. Nevertheless it is assumed that two major factors influence the affinity of SBEBCDs ranked in increasing DS.

- The bulky sulfobutylether substituents block the cavity of the β-CD exposing a steric hindrance for the binding process (geometric factor).
- By increasing the DS, the charge of the host increases making the SBEBCD molecule more attractive to guest of opposite charge (electrostatic factor).

In conclusion it may be postulated that in certain cases the association may be primarily driven by geometric factors or primarily by electrostatic factors. For the minimum and maximum curve type drugs, probably the resultant of both factors influence the interaction.

References

1. Stella VJ; Lee HK; Thompson DO. The effect of SBE4-β-CD on i.m. prednisolone pharmacokinetics and tissue damage in rabbits: Comparison to a co-solvent solution and a water-soluble prodrug. *International Journal of Pharmaceutics*, 1995, 120(2), 197-204.
2. Järvinen, K; Järvinen, T; Thompson, DO; Stella, VJ. The effect of a modified beta-cyclodextrin, SBE4-beta-CD, on the aqueous stability and ocular absorption of pilocarpine. *Current Eye Research*, 1994, 13, 897-905.
3. Stella, VJ; Lee, HK; Thompson DO. The effect of SBE4-β-CD on i.v. methylprednisolone pharmacokinetics in rats: Comparison to a co-solvent solution and two water-soluble prodrugs. *International Journal of Pharmaceutics,* 1995, 120(2), 189-195.
4. Gorecka, BA; Sanzgiri, YD; Bindra, DS; Stella, VJ. Effect of SBE4-β-CD, a sulfobutyl ether β-cyclodextrin, on the stability and solubility of O6-benzylguanine (NSC-637037) in aqueous solutions. *International Journal of Pharmaceutics,* 1995, 125(1), 55-61.
5. Stella, VJ; Rajewski, RA. Derivatives of cyclodextrins exhibiting enhanced aqueous solubility and the use thereof. PCT patent application WO9111172, 1991.
6. Qu, Q; Tucker, E; Christian, SD. Sulfoalkyl ether β-cyclodextrin derivatives: Synthesis and characterizations. *Journal of inclusion phenomena and macrocyclic chemistry*, 2002, 43(3-4) 213-222.
7. Thompson, DO. Cyclodextrins-enabling excipients: their present and future use in pharmaceuticals. *Critical reviews in therapeutic drug carrier systems*, 1997, 14(1), 1-104.

8. Mosher, GL; Johnson, KT; Gayed, AA. US patent application US2003216353, 2003.

9. de Boer, T; de Zeeuw, RA; de Jong, GJ; Ensing, K. The use of charged cyclodextrins in capillary electrophoresis for chiral separations in pharmaceutical analysis. *Electrophoresis*, 2000, 21, 3220-3239.

10. Zia, V; Rajewski, RA; Stella, VJ; Thermodynamics of binding of neutral molecules to sulfobutyl ether beta-cyclodextrins (SBE-beta-CDs): the effect of total degree of substitution. *Pharmaceutical Research*, 2000, 17(8), 936-941.

11. Skanchy, DJ; Xie, GH; Tait, RJ; Luna, E; Demarest, C; Stobaugh, JF. Application of sulfobutylether-beta-cyclodextrin with specific degrees of substitution for the enantioseparation of pharmaceutical mixtures by capillary electrophoresis. *Electrophoresis,* 1999, 20(13), 2638-49.

István Puskás

CycloLab Cyclodextrin R&D Laboratory, Ltd.,
Budapest, HUNGARY

BIBLIOGRAPHY & KEYWORDS

1. CDs: Derivatives, Production, Enzymes, Toxicity

Ho, T. M.; Howes, T.; Bhandari, B. R.

Characterization of crystalline and spray-dried amorphous α-cyclodextrin powders

Physical properties α-CD powder, Re-crystallization, Water absorption, Equilibrium relative humidity

Powder Technology, 2015, 284, 585-594; DOI:10.1016/j.powtec.2015.06.027

Kaulpiboon, J.; Rudeekulthamrong, P.; Watanasatitarpa, S.; Ito, K.; Pongsawasdi, P.

Synthesis of long-chain isomaltooligosaccharides from tapioca starch and an *in vitro* investigation of their prebiotic properties

Degree of sweetness, Viscosity, Hygroscopicity, Amylomaltase, Transglucosidase

Journal of Molecular Catalysis B: Enzymatic, 2015, 120, 127-135; DOI:10.1016/j.molcatb.2015.07.004

Lee, B.-H.; Koh, D.-W.; Territo, P. R.; Park, C.-S.; Hamaker, B. R.; Yoo, S.-H.

Enzymatic synthesis of 2-deoxyglucose-containing maltooligosaccharides for tracing the location of glucose absorption from starch digestion

Macronutrients, Location of glucose deposition, Mucosal α-glucosidases

Carbohydrate Polymers, 2015, 132, 41-49; DOI:10.1016/j.carbpol.2015.06.012

Li, Z.; Ji, K.; Dong, W.; Ye, X.; Wu, J.; Zhou, J.; Wang, F.; Chen, Q.; Fu, L.; Li, S.; Huang, Y.; Cui, Z.

Cloning, heterologous expression, and enzymatic characterization of a novel glucoamylase GlucaM from *Corallococcus sp.* strain EGB

Hydrolytic activities, α-Cyclodextrin

Protein Expression and Purification, 2015, In Press; DOI:10.1016/j.pep.2015.06.009

Lin, Y. K.; Show, P. L.; Yap, Y. J.; Tan, C. P.; Ng, E.-P.; Ariff, A. B.; Annuar, M. S. B. M.; Ling, T. C.

Direct recovery of cyclodextringlycosyltransferase from *Bacillus cereus* using aqueous two-phase flotation

Downstream processing, Polyethylene glycol-salt system, Purification

Journal of Bioscience and Bioengineering, 2015, In Press; DOI:10.1016/j.jbiosc.2015.04.013

Liu, Y.-Y.; Lan, S.; Xiao, L.-Q.

Synthesis and characterization of PNIPAm core cross-linked star polymers and their functionalization with cyclodextrin

Poly(N-isopropylacrylamide), N,N-methylenebisacrylamide, β-CD, Miktoarm star polymers

Macromolecular Chemistry and Physics, 2015, 216, 749-760; DOI:10.1002/macp.201400538

Melzer, S.; Sonnendecker, C.; Föllner, C.; Zimmermann, W.

Stepwise error-prone PCR and DNA shuffling changed the pH activity range and product specificity of the cyclodextrin glucanotransferase from an alkaliphilic Bacillus sp.

γ-Cyclodextrin, Random mutagenesis

FEBS Open Bio, 2015, 5, 528-534; DOI:10.1016/j.fob.2015.06.002

Naumthong, W.; Ito, K.; Pongsawasdi, P.

Acceptor specificity of amylomaltase from *Corynebacterium glutamicum* and transglucosylation reaction to synthesize palatinose glucosides

Maltooligosaccharides, Tri- and tera-saccharide

Process Biochemistry, 2015, In Press; DOI:10.1016/j.procbio.2015.07.003

Tanaka, T.; Gotanda, R.; Tsutsui, A.; Sasayama, S.; Yamamoto, K.; Kimura, Y.; Kadokawa, J.-I.

Evaluating relative chain orientation of amylose and poly(L-lactide) in inclusion complexes formed by vine-twining polymerization using primer-guest conjugates

Copper (I)-catalyzed click chemistry, Propargyl-terminated polylactides, Maltoheptaosyl azide, Chirality

Macromolecular Chemistry and Physics, 2015, 216, 794-800; DOI:10.1002/macp.201400603

Tanaka, T.; Gotanda, R.; Tsutsui, A.; Sasayama, S.; Yamamoto, K.; Kimura, Y.; ichi Kadokawa, J.

Synthesis and gel formation of hyperbranched supramolecular polymer by vine-twining polymerization using branched primer-guest conjugate

Amylose-poly(L-lactide), Branched maltoheptaose

Polymer, 2015, 73, 9-16; DOI:10.1016/j.polymer.2015.07.022

Venuti, V.; Rossi, B.; D'Amico, F.; Mele, A.; Castiglione, F.; Punta, C.; Melone, L.; Crupi, V.; Majolino, D.; Trotta, F.; Gessini, A.; Masciovecchio, C.

Combining Raman and infrared spectroscopy as a powerful tool for the structural elucidation of cyclodextrin-based polymeric hydrogels

Nanosponges, Hydrogen bond scheme, β-Cyclodextrin EDTA dianhydride copolymer

Physical Chemistry Chemical Physics, 2015, 17, 10274-10282; DOI:10.1039/C5CP00607D

Wang, Z.; Guo, H.; Yang, F.; Zhang, Y.

The synthesis and dyes complexation properties of novel cyclodextrin derivatives with large conjugate acylhydrazone group

β-Cyclodextrin, 4-(Prop-2-ynyloxy)benzaldehyde, Click chemistry, Schiff-base condensation, Salicylic acid, Nicotinohydrazide, 2,4-Dinitrophenylhydrazine

Journal of Inclusion Phenomena and Macrocyclic Chemistry, 2015, 82, 101-108; DOI:10.1007/s10847-015-0501-3

Wenz, G.

Superstructures with cyclodextrins: Chemistry and applications II.

Beilstein Journal of Organic Chemistry, 2015, 11, 271-272; DOI:10.3762/bjoc.11.30

Xian, L.; Wang, F.; Luo, X.; Feng, Y.-L.; Feng, J.-X.

Purification and characterization of a highly efficient calcium-independent α-amylase from *Talaromyces pinophilus 1-95*

Starch-to-ethanol conversion process

PloS one, 2015, 10, e0121531; DOI:10.1371/journal.pone.0121531

Zhang, M.; Shen, W.; Xiong, Q.; Wang, H.; Zhou, Z.; Chen, W.; Zhang, Q.

Thermo-responsiveness and biocompatibility of star-shaped poly[2-(dimethylamino)ethyl methacrylate]-b-poly(sulfobetaine methacrylate) grafted on a β-cyclodextrin core

Thermo-induced associations of the star polymers, Tunable critical aggregation temperature, Cytotoxicity

RSC Advances, 2015, 5, 28133-28140; DOI:10.1039/C5RA02115D

Zhao, M.-Z.; Zhang, Y.-W.; Yuan, F.; Deng, Y.; Liu, J.-X.; Zhou, Y.-L.; Zhang, X.-X.

Hydrazino-s-triazine based labelling reagents for highly sensitive glycan analysis via liquid chromatography-electrospray mass spectrometry

Maltoheptaose, Chicken avidin and glycoproteins, Controllable synthesis, Glycomics profiling

Talanta, 2015, 144, 992-997; DOI:10.1016/j.talanta.2015.07.045

Zheng, W.; Du, M.; Feng, F.; Chen, G.; Liao, M.; Liu, Y.; Tang, L.; Xu, Z.

Fast and efficient synthesis of mono-(6-*p*-toluenesulfonyl)-β-cyclodextrin via ultrasound assisted method

Alk. water solution

Advanced Materials Research (Durnten-Zurich, Switzerland), 2015, 1083, 51-54; DOI:10.4028/www.scientific.net/AMR.1083.51

2. CD complexes: Preparation, Properties in solution and in solid phase, Specific guests

Aljhni, R.; Andre, C.; Lethier, L.; Guillaume, Y. C.

An HPLC chromatographic framework to analyze the β-cyclodextrin/solute complexation mechanism using a carbon nanotube stationary phase

Aniline and benzoic acid derivatives, Apparent formation constant, Hydrogen bonds, Thermodynamic data

Talanta, 2015, 144, 226-232; DOI:10.1016/j.talanta.2015.06.013

Barros, M. C.; Ramos, M. L.; Burrows, H. D.; Esteso, M. A.; Leaist, D. G.; Ribeiro, A. C.

Ternary mutual diffusion coefficients of aqueous {l-dopa (1) + β-CD (2) solutions at T = 298.15 K

Taylor dispersion method, Levodopa, β-Cyclodextrin, NMR spectroscopy

The Journal of Chemical Thermodynamics, 2015, 90, 169-173; DOI:10.1016/j.jct.2015.06.022

Chibunova, E.; Kumeev, R.; Terekhova, I.

Thermodynamic study on salt effects on complex formation of α-, β- and γ-cyclodextrins with *p*-aminobenzoic acid

Van't Hoff plots, Specific action of Br-, Dehydration of the interacting species

The Journal of Chemical Thermodynamics, 2015, 91, 30-34; DOI:10.1016/j.jct.2015.07.017

de León, A. S.; Muñoz-Bonilla, A.; Gallardo, A.; Fernandez-Mayoralas, A.; Bernard, J.; Rodríguez-Hernández, J.

Straightforward functionalization of breath figures: Simultaneous orthogonal host–guest and pH-responsive interfaces

Polymerization, Styrene modified with cyclodextrin, Click chemistry, Porous surfaces with controlled pore sizes, Adamantane end-terminated poly(acrylic acid), Reversible surface functionalization

Journal of Colloid and Interface Science, 2015, 457, 272-280; DOI:10.1016/j.jcis.2015.06.039

Periasamy, R.; Kothainayaki, S.; Sivakumar, K.

Preparation, physicochemical analysis and molecular modeling investigation of 2,2'-bipyridine:β-Cyclodextrin inclusion complex in solution and solid state

Co-precipitaion method, Benesi-Hildebrand plots, Atomic force microscope, UV and fluorescence spectrum, Molecular docking

Journal of Molecular Structure, 2015, 1100, 59-69; DOI:10.1016/j.molstruc.2015.07.026

Petrov, V.; Slavcheva, S.; Stanimirov, S.; Pina, F.

Origin of the metastable stability in flavylium multistate systems

Optical memory, Photochromic system, β-Cyclodextrin

Journal of Physical Chemistry A, 2015, 119, 2908-2918; DOI:10.1021/acs.jpca.5b01473

Pham, D.-T.; Nguyen, H.-T.; Lincoln, S. F.; Wang, J.; Guo, X.; Easton, C. J.; Prud'homme, R. K.

Complexation of dodecyl-substituted poly(acrylate) by linked β-cyclodextrin dimers and trimers in aqueous solution

Substituted poly(acrylate), Cross-links through complexation

Journal of Polymer Science, Part A: Polymer Chemistry, 2015, 53, 1278-1286; DOI:10.1002/pola.27563

Popova, O. V.; Sursyakova, V. V.; Burmakina, G. V.; Levdansky, V. A.; Rubaylo, A. I.

Determination of stability constants of inclusion complexes of betulin derivatives with β-cyclodextrin by capillary electrophoresis

Doklady Chemistry, 2015, 461, 67-69; DOI:10.1134/S0012500815030039

Tao, Y.; Gu, X.; Deng, L.; Qin, Y.; Xue, H.; Kong, Y.

Chiral recognition of D-tryptophan by confining high-energy water molecules inside the cavity of copper-modified β-cyclodextrin

Poly(L-glutamic acid), Binuclear hydroxy-bridge, H-bonds

Journal of Physical Chemistry C, 2015, 119, 8183-8190; DOI:10.1021/acs.jpcc.5b00927

Tijunelyte, I.; Dupont, N.; Milosevic, I.; Barbey, C.; Rinnert, E.; Lidgi-Guigui, N.; Guenin, E.; de la Chapelle, M. L.

Investigation of aromatic hydrocarbon inclusion into cyclodextrins by Raman spectroscopy and thermal analysis

Naphthalene, Fluoranthene, Toluene

Environmental Science and Pollution Research, 2015, In Press; DOI:10.1007/s11356-015-4361-6

Varganici, C.-D.; Marangoci, N.; Rosu, L.; Barbu-Mic, C.; Rosu, D.; Pinteala, M.; Simionescu, B. C.

TGA/DTA–FTIR–MS coupling as analytical tool for confirming inclusion complexes occurrence in supramolecular host–guest architectures

Thermal decomposition of a viologen included in a [2]rotaxane structure alongside β–cyclodextrin, Evolved gas analysis

Journal of Analytical and Applied Pyrolysis, 2015, 115, 132-142; DOI:10.1016/j.jaap.2015.07.006

Vukicevic, M.; Tonnesen, H. H.

Interaction between curcumin and human serum albumin in the presence of excipients and the effect of binding on curcumin photostability

2-Hydroxypropyl-β-cyclodextrin, 2-Hydroxypropyl-γ-cyclodextrin, Competitive binding, Fluorescence quenching, Pluronic F-127, Polyethylene glycol

Pharmaceutical development and technology, 2015, In Press

Wajs, E.; Nielsen, T. T.; Larsen, K. L.; Fragoso, A.

Template-assisted preparation of permeable nanocapsules from complementary cyclodextrin and adamantane-appended biocompatible dextran polymers

Alternate deposition of cyclodextrin and adamantane appended dextran polymers

Macromolecular Materials and Engineering, 2015, 300, 878-884; DOI:10.1002/mame.201500057

Wang, J.; Xu, Y.; Wang, Y.; Liu, J.; Xu, J.; Li, L.; Nguyen, H.-T.; Pham, D.-T.; Lincoln, S. F.; Guo, X.

Bridged-cyclodextrin supramolecular hydrogels: Host-guest interaction between cyclodextrin dimer and adamantyl substituted poly(acrylate)s

Cooperative effect, Long hydrophobic tether

RSC Advances, 2015, 5, 46067-46073; DOI:10.1039/C5RA06163F

Wang, J.; Zhang, Y.-M.; Zhang, X.-J.; Zhao, X.-J.; Liu, Y.

Light-controlled [3]pseudorotaxane based on tetrasulfonated 1,5-dinaphtho-32-crown-8 and α-cyclodextrin

Azobenzene-containing pyridinium salt, Photoinduced isomerization of the azobenzene moiety, Polymeric aggregates

Asian Journal of Organic Chemistry, 2015, 4, 244-250; DOI:10.1002/ajoc.201402238

Wang, J.; Li, J.; Li, N.; Guo, X.; He, L.; Cao, X.; Zhang, W.; He, R.; Qian, Z.; Cao, Y.; Chen, Y.

A bottom-up approach to dual shape-memory effects

Layer-by-layer film, α-Cyclodextrin-modified template acting as a photosocket, Azobenzene-modified poly(acrylic acid) photoplug

Chemistry of Materials, 2015, 27, 2439-2448; DOI:10.1021/cm504527w

Wessig, P.; Merkel, R.; Müller, P.

Articulated rods - A novel class of molecular rods based on oligospiroketals (OSK)

Fluorescence, Cyclodextrin addition, Preparation, UV-irradiation, Flexible and modular approach

Beilstein Journal of Organic Chemistry, 2015, 11, 74-84; DOI:10.3762/bjoc.11.11

Wszelaka-Rylik, M.; Gierycz, P.

Isothermal titration calorimetry (ITC) study of natural cyclodextrins inclusion complexes with tropane alkaloids

Scopolamine, Homatropine hydrobromide, Atropine sulfate, β-CD, α-CD

Journal of Thermal Analysis and Calorimetry, 2015, 121, 1359-1364; DOI:10.1007/s10973-015-4658-1

Wu, Y.; Shi, R.; Wu, Y.-L.; Holcroft, J. M.; Liu, Z.; Frasconi, M.; Wasielewski, M. R.; Li, H.; Stoddart, J. F.

Complexation of polyoxometalates with cyclodextrins

Organic-inorganic hybrid complexes, Sandwich-like structure, γ- and β-Cyclodextrins, Lanthanum molybdophosphate, Electrochemical studies, NMR, X-ray, MS

Journal of the American Chemical Society, 2015, 137, 4111-4118; DOI:10.1021/ja511713c

Xie, J.; Ding, W.; Guan, R.

Preparation and characterization of inclusion complexes between cyclodextrin and block polyether polysiloxanes

Poly(ethylene oxide)-poly(dimethylsiloxane)-poly(ethylene oxide) triblock copolymer, α-CD, γ-CD

Advanced Materials Research (Durnten-Zurich, Switzerland), 2015, 1089, 117-120; DOI:10.4028/www.scientific.net/AMR.1089.117

Xu, Q.; Wei, C.; Liu, R.; Gu, S.; Xu, J.

Quantitative structure–property relationship study of β-cyclodextrin complexation free energies of organic compounds

Multiple linear regression, Artificial neural network

Chemometrics and Intelligent Laboratory Systems, 2015, 146, 313-321; DOI:10.1016/j.chemolab.2015.06.001

Yang, L.-Y.; Fu, X.-B.; Chen, T.-Q.; Pan, L.-K.; Ji, P.; Yao, Y.-F.; Chen, Q.

Ionic conductivity of β-cyclodextrin-polyethylene-oxide/alkali-metal-salt complex

Supramolecular self-assembly, Nanochannels, Polymer electrolyte, Sodium, Lithium

Chemistry - A European Journal, 2015, 21, 6346-6349; DOI:10.1002/chem.201406380

Yang, J. S.; Zhou, Q. Q.; Han, S. Y.; Fang, Y.

Interaction between amphiphilic alginate esters and β-cyclodextrin in aqueous solution

Viscosity, Aggregates, Isothermal titration calorimeter

Journal of Carbohydrate Chemistry, 2015, 34, 70-79; DOI:10.1080/07328303.2015.1008519

Yao, H.; Tian, W.; Liu, Y.; Bai, Y.; Liu, D.; Liu, T.; Qi, M.; Wang, M.; Liu, Y.

Cyclodextrin-tunable reversible self-assembly of a thermoresponsive Y-shaped polymer

Heating-cooling process, Core-corona-structured micelles

RSC Advances, 2015, 5, 34557-34565; DOI:10.1039/C5RA03064A

Yasin, A.; Zhou, W.; Yang, H.; Li, H.; Chen, Y.; Zhang, X.

Shape memory hydrogel based on a hydrophobically-modified polyacrylamide (HMPAM)/α-CD mixture via a host-guest approach

Hydrogen bonds

Macromolecular Rapid Communications, 2015, 36, 845-851; DOI:10.1002/marc.201400698

Yonemura, H.; Forbes, M. D. E.

Electron spin exchange in linked phenothiazine-viologen charge transfer complexes incorporated in "through-ring" (rotaxane) α-cyclodextrins

Photoexcitation, Biradicaloid charge-separated state

Photochemistry and Photobiology, 2015, 91, 672-677; DOI:10.1111/php.12436

Zepon, K. M.; Otsuka, I.; Bouilhac, C.; Muniz, E. C.; Soldi, V.; Borsali, R.

Glyco-nanoparticles made from self-assembly of maltoheptaose-block-poly(methyl methacrylate): Micelle, reverse micelle and encapsulation

Maltoheptaose-block-poly(Me methacrylate), Conformational inversion

Biomacromolecules, 2015, 16, 2012-2024; DOI:10.1021/acs.biomac.5b00443

Zhang, J.; Li, H.; Sun, L.; Wang, C.

Determination of the kinetic rate constant of cyclodextrin supramolecular systems by high-performance affinity chromatography

High-performance affinity chromatography, Cyclodextrin-immobilized column

Methods in molecular biology (Clifton, N.J.), 2015, 1286, 309-319

Zhang, J.; Dumur, F.; Xiao, P.; Graff, B.; Bardelang, D.; Gigmes, D.; Fouassier, J. P.; Lalevée, J.

Structure design of naphthalimide derivatives: Toward versatile photoinitiators for near-UV/visible LEDs, 3D printing, and water-soluble photoinitiating systems

CD-complex, Water-soluble photoinitiator, Methyldiethanol amine, Hydrogel, Photopolymerization

Macromolecules (Washington, DC, United States), 2015, 48, 2054-2063; DOI:10.1021/acs.macromol.5b00201

Zhu, G.; Feng, N.; Xiao, Z.; Zhou, R.; Niu, Y.

Production and pyrolysis characteristics of citral-monochlorotriazinyl-β-cyclodextrin inclusion complex

Controlled release, Aggregates, "Worm-type" pore system, Geranial, Neral, Binding energy

Journal of Thermal Analysis and Calorimetry, 2015, 120, 1811-1817; DOI:10.1007/s10973-015-4498-z

Zhu, Q.-Y.; He, P.-Z.

Structural elucidation of D-camphor and β-cyclodextrin inclusion complex

Bicyclo[2.2.1]-2-heptanone of D-camphor, Hydrogen bonding, NMR, FTIR, XRD

Bopuxue Zazhi, 2015, 32, 87-94; DOI:10.11938/cjmr20150110

3. CDs in Drug Formulation

Anirudhan, T. S.; Nima, J.; Divya, P. L.

Synthesis, characterization and in vitro cytotoxicity analysis of a novel cellulose based drug carrier for the controlled delivery of 5-fluorouracil, an anticancer drug

Aminated-glycidylmethacrylate grafted cellulose-grafted polymethacrylic acid- succinyl cyclodextrin, Langmuir model

Applied Surface Science, 2015, 355, 64-73; DOI:10.1016/j.apsusc.2015.07.077

Borba, P. A. A.; Pinotti, M.; Andrade, G. R. S.; da Costa Jr, N. B.; Junior, L. R. O.; Fernandes, D.; de Campos, C. E. M.; Stulzer, H. K.

The effect of mechanical grinding on the formation, crystalline changes and dissolution behaviour of the inclusion complex of telmisartan and β-cyclodextrins

Solid state grinding, Rapid and effective antihypertensive effect, Molecular modeling

Carbohydrate Polymers, 2015, 133, 373-383; DOI:10.1016/j.carbpol.2015.06.098

Borbás, E.; Balogh, A.; Bocz, K.; Müller, J.; Kiserdei, É.; Vigh, T.; Sinkó, B.; Marosi, A.; Halász, A.; Dohányos, Z.; Szente, L.; Balogh, G. T.; Nagy, Z. K.

***In vitro* dissolution–permeation evaluation of an electrospun cyclodextrin-based formulation of aripiprazole using µFlux™**

Fast drug delivery through the oral mucosa

International Journal of Pharmaceutics, 2015, 491, 180-189; DOI:10.1016/j.ijpharm.2015.06.019

Bottari, N. B.; Baldissera, M. D.; Tonin, A. A.; Rech, V. C.; Nishihira, V. S.; Thomé, G. R.; Camillo, G.; Vogel, F. F.; Duarte, M. M.; Schetinger, M. R. C.; Morsch, V. M.; Tochetto, C.; Fighera, R.; da Silva, A. S.

Effects of sulfamethoxazole-trimethoprim associated to resveratrol on its free form and complexed with 2-hydroxypropyl-β-cyclodextrin on cytokines levels of mice infected by *Toxoplasma gondii*

Increased levels of pro-inflammatory cytokines, Immunomodulation

Microbial Pathogenesis, 2015, 87, 40-44; DOI:10.1016/j.micpath.2015.07.013

Bruschi, M. L.

6 - Drug delivery systems

Inclusion complexes with cyclodextrin, Therapeutic systems, Physicochemical properties.

Strategies to Modify the Drug Release from Pharmaceutical Systems, 2015, 87-194; DOI:10.1016/B978-0-08-100092-2.00006-0

Chen, X.; Yao, X.; Wang, C.; Chen, L.; Chen, X.

Mesoporous silica nanoparticles capped with fluorescence-conjugated cyclodextrin for pH-activated controlled drug delivery and imaging

3-Carboxy-5-nitrophenylboronic acid, Acid-sensitive gatekeeper, DOX-loaded functional mesoporous silica nanoparticles, pH-Sensitive

Microporous and Mesoporous Materials, 2015, 217, 46-53; DOI:10.1016/j.micromeso.2015.06.012

Chow, S. F.; Wan, K. Y.; Cheng, K. K.; Wong, K. W.; Sun, C. C.; Baum, L.; Chow, A. H. L.

Development of highly stabilized curcumin nanoparticles by flash nanoprecipitation and lyophilization

Confined impinging jets-with-dilution mixer, Polymeric stabilizer (i.e., polyethylene glycol-b-poly(DL-lactide) di-block copolymer), Nanosuspensions, Co-formulation with polyvinylpyrrolidone, Hydroxypropyl-β-cyclodextrin, Lyoprotectant, X-ray photoelectron spectroscopy

European Journal of Pharmaceutics and Biopharmaceutics, 2015, 94, 436-449; DOI:10.1016/j.ejpb.2015.06.022

Das, S.; Subuddhi, U.

Studies on the complexation of diclofenac sodium with β–cyclodextrin: Influence of method of preparation

Microwave irradiation, Kneading, Co-precipitation, Freeze drying

Journal of Molecular Structure, 2015, 1099, 482-489; DOI:10.1016/j.molstruc.2015.07.001

Gaffey, A. C.; Chen, M. H.; Venkataraman, C. M.; Trubelja, A.; Rodell, C. B.; Dinh, P. V.; Hung, G.; MacArthur, J. W.; Soopan, R. V.; Burdick, J. A.; Atluri, P.

Injectable shear-thinning hydrogels to deliver endothelial progenitor cells, enhance cell engraftment, and improve ischemic myocardium

Hyaluronic acid hydrogel, Endothelial progenitor cell construct, Interactions of adamantine and β-cyclodextrin modified hyaluronic acid, Direct cell delivery, Vasculogenesis

The Journal of Thoracic and Cardiovascular Surgery, 2015, In Press; DOI:10.1016/j.jtcvs.2015.07.035

Ijaz, M.; Matuszczak, B.; Rahmat, D.; Mahmood, A.; Bonengel, S.; Hussain, S.; Huck, C. W.; Bernkop-Schnürch, A.

Synthesis and characterization of thiolated β-cyclodextrin as a novel mucoadhesive excipient for intra-oral drug delivery

Cysteamine conjugated β-cyclodextrin, Improved retention time on porcine intestinal mucosa, Formation of inclusion complexes of miconazole nitrate and β-CD-Cys1054

Carbohydrate Polymers, 2015, 132, 187-195; DOI:10.1016/j.carbpol.2015.06.073

Kurniawansyah, F.; Mammucari, R.; Foster, N. R.

Inhalable curcumin formulations by supercritical technology

HP-β-CD, PVP, Atomized rapid injection solvent extraction, Aerodynamic properties, Pulmonary delivery

Powder Technology, 2015, 284, 289-298; DOI:10.1016/j.powtec.2015.04.083

Mavridis, I. M.; Yannakopoulou, K.

Anionic cyclodextrins as versatile hosts for pharmaceutical nanotechnology: Synthesis, drug delivery, enantioselectivity, contrast agents for MRI

Review, Single-isomer primary rim per-carboxylate- and per-sulfate-α-, -β- and –γ-cyclodextrin derivatives, Targeted drug delivery, Lanthanide cations

International Journal of Pharmaceutics, 2015, 492, 275-290; DOI:10.1016/j.ijpharm.2015.06.004

Meinguet, C.; Masereel, B.; Wouters, J.

Preparation and characterization of a new harmine-based antiproliferative compound in complex with cyclodextrin: Increasing solubility while maintaining biological activity

βCD, 2-HP-βCD, Job plot

European Journal of Pharmaceutical Sciences, 2015, 77, 135-140; DOI:10.1016/j.ejps.2015.06.010

Naito, Y.; Ikuta, N.; Okano, A.; Okamoto, H.; Nakata, D.; Terao, K.; Matsumoto, K.; Kajiwara, N.; Yasui, H.; Yoshikawa, Y.

Isomeric effects of anti-diabetic α-lipoic acid with γ-cyclodextrin

High fat diet, Peroxisome proliferator-activated receptor, AMP-activated protein kinase

Life Sciences, 2015, 136, 73-78; DOI:10.1016/j.lfs.2015.06.016

Najlaoui, F.; Pigeon, P.; Abdelkafi, Z.; Leclerc, S.; Durand, P.; Ayeb, M. E.; Marrakchi, N.; Rhouma, A.; Jaouen, G.; Gibaud, S.

Phthalimido–ferrocidiphenol cyclodextrin complexes: Characterization and anticancer activity

Tamoxifen, Methylated cyclodextrin, Steric hindrance, U87 tumor cells, Glioma models

International Journal of Pharmaceutics, 2015, 491, 323-334; DOI:10.1016/j.ijpharm.2015.06.043

Rajesh, Y.; Narayanan, K.; Reddy, M. S.; Bhaskar, V. K.; Shenoy, G. G.; Rao, J. V.; Subrahmanyam, V. M.

Production of β-cyclodextrin from pH and thermo stable cyclodextrin glycosyl transferase, obtained from *Arthrobacter mysorens* and its evaluation as a drug carrier for irbesartan

Immediate release oral dosage forms

Current drug delivery, 2015, 12, 444-453

Shah, S.; Patel, R.; Soniwala, M.; Chavda, J.

Development and optimization of press coated tablets of release engineered valsartan for pulsatile delivery

Job's plot, β-Cyclodextrin, Dissolution efficiency, Plackett-Burman screening design, Continuous absorption-dissolution

Drug development and industrial pharmacy, 2015, In Press

Shi, Q.; Zhang, L.; Liu, M.; Zhang, X.; Zhang, X.; Xu, X.; Chen, S.; Li, X.; Zhang, J.

Reversion of multidrug resistance by a pH-responsive cyclodextrin-derived nanomedicine in drug resistant cancer cells

Acetalated α-cyclodextrin, Decreased Pgp expression, Attenuated Pgp ATPase activity, Reduced intracellular ATP level, Drug delivery

Biomaterials, 2015, 67, 169-182; DOI:10.1016/j.biomaterials.2015.07.023

Tarakaramarao, C.; Chowdary, K. P. R.

Formulation development of valsartan tablets employing β-CD, crospovidone and SLS: Optimization by 23 factorial design

Anti hypertensive drug, Enhancing the dissolution rate

World Journal of Pharmaceutical Research, 2015, 4, 992-1000

Tarakaramarao, C.; Chowdary, K. P. R.

Optimization of irbesartan tablet formulation by 22 factorial design

Anti hypertensive drug, Direct compression method, Dissolution rate

World Journal of Pharmacy and Pharmaceutical Sciences, 2015, 4, 277-285

Tarakaramarao, C.; Chowdary, K. P. R.

Optimization of irbesartan tablet formulation by 23 factorial design employing β-CD, crospovidone and SLS

Anti hypertensive drug, Enhancing the dissolution rate

World Journal of Pharmaceutical Research, 2015, 4, 1593-1601

Tassonyi, E.; Pongrácz, A.; Nemes, R.; Asztalos, L.; Lengyel, S.; Fülesdi, B.

Reversal of pipecuronium-induced moderate neuromuscular block with sugammadex in the presence of a sevoflurane anesthetic: A randomized trial

γ-Cyclodextrin derivative, Single-center, randomized, double-blind, 5-group parallel-arm study, Train-of-four count

Anesthesia and analgesia, 2015, 121, 373-380; DOI:10.1213/ANE.0000000000000766

Teo, B. M.; Yang, C.; Kjems, J.; Ogaki, R.; Thomsen, R. P.

Ultrastable green fluorescence carbon dots with high quantum yield for bioimaging and use as theranostic carriers

Oligoethylenimine/β-cyclodextrin, Heating method in phosphoric acid, Nanocomplexes with hyaluronic acid, Cytotoxicity, Doxorubicin loaded nanocomplexes, Lung cancer cells

Journal of Materials Chemistry B: Materials for Biology and Medicine, 2015, 3, 4577-4584; DOI:10.1039/C5TB00467E

Theodossiou, T. A.; Goncalves, A. R.; Yannakopoulou, K.; Skarpen, E.; Berg, K.

Photochemical internalization of tamoxifens transported by a "Trojan-horse" nanoconjugate into breast-cancer cell lines

Porphyrin-β-cyclodextrin conjugate, Endosomal membrane rupture, Tamoxifen release into the cytosol, Drug delivery, Antitumor

Angewandte Chemie, International Edition, 2015, 54, 4885-4889; DOI:10.1002/anie.201500183

Tonglairoum, P.; Ngawhirunpat, T.; Rojanarata, T.; Panomsuk, S.; Kaomongkolgit, R.; Opanasopit, P.

Fabrication of mucoadhesive chitosan coated polyvinylpyrrolidone/cyclodextrin/ clotrimazole sandwich patches for oral candidiasis

Electrospinning, Nanofibers, Initial fast release, Thiolated chitosan, Hydroxypropyl-β-cyclodextrin

Carbohydrate Polymers, 2015, 132, 173-179; DOI:10.1016/j.carbpol.2015.06.032

Toomari, Y.; Namazi, H.; Akbar, E. A.

Synthesis of the dendritic type β-cyclodextrin on primary face via click reaction applicable as drug nanocarrier

Methotrexate, Cytotoxic effect, Inclusion complex

Carbohydrate Polymers, 2015, 132, 205-213; DOI:10.1016/j.carbpol.2015.05.087

Torrens, F.; Castellano, G.

Computational study of nanosized drug delivery from cyclodextrins, crown ethers and hyaluronan in pharmaceutical formulations

Co-solvents of polyanions in water

Current topics in medicinal chemistry, 2015, 15, 1901-1913

Udrescu, L.; Fulias, A.; Ledeti, I.; Vlase, G.; Barvinschi, P.; Kurunczi, L.; Sbarcea, L.

Host-guest system of zofenopril and randomly methylated β-cyclodextrin. Preparation, characterization and solubility

Angiotensin converting enzyme inhibitor, RAMEB, Kneading method, Water solubility, Inclusion complex

Revista de Chimie (Bucharest, Romania), 2015, 66, 17-20

Unal, H.; Ozturk, N.; Bilensoy, E.

Formulation development, stability and anticancer efficacy of core-shell cyclodextrin nanocapsules for oral chemotherapy with camptothecin

Amphiphilic cyclodextrin derivative per-modified on the primary face 6OCAPRO, Chitosan, Caco-2 cell line, Permeation of CPT across Caco-2 cells, Drug delivery

Beilstein Journal of Organic Chemistry, 2015, 11, 204-212; DOI:10.3762/bjoc.11.22

Wang, Y.; Yao, Y.; Liu, H.; Ma, X.; Lv, T.; Yuan, D.; Xiao, X.; Yin, J.; Song, Y.

Itraconazole can inhibit malignant pleural effusion by suppressing lymphangiogenesis in mice

Hydroxypropyl-β-cyclodextrin, Lymphatic micro vessel density, Vascular endothelial

growth factor-c

Translational lung cancer research, 2015, 4, 27-35, DOI:10.3978/j.issn.2218-6751.2014.11.03

Watanabe, K.; Suzuki, T.; Kitagishi, H.; Kano, K.

Reaction between a haemoglobin model compound and hydrosulphide in aqueous solution

Fe(III)-porphyrin, Cyclodextrin dimer possessing a pyridine-linker, Reversible ligand exchange

Chemical Communications (Cambridge, United Kingdom), 2015, 51, 4059-4061; DOI:10.1039/C5CC00057B

Wei, H.; Yu, C.-Y.

Cyclodextrin-functionalized polymers as drug carriers for cancer therapy

Mini-review, CD-functionalized polymers

Biomaterials Science, 2015, 3, 1050-1060; DOI:10.1039/c4bm00417e

Wilson, L. D.; Verrall, R. E.

A volumetric and NMR study of cyclodextrin-inhalation anesthetic complexes in aqueous solutions

Halothane, Forane, DM-β-CD, HP-β-CD, β-CD, α-CD, TM-β-CD

Canadian Journal of Chemistry, 2015, 93, 815-821; DOI:10.1139/cjc-2014-0549

Wintgens, V.; Lorthioir, C.; Dubot, P.; Sébille, B.; Amiel, C.

Cyclodextrin/dextran based hydrogels prepared by cross-linking with sodium trimetaphosphate

Swelling ratio, Polyelectrolyte character, Methylene blue, Benzophenone, β-Cyclodextrin

Carbohydrate Polymers, 2015, 132, 80-88; DOI:10.1016/j.carbpol.2015.06.038

Wu, L.; Qiao, Y.; Wang, L.; Guo, J.; Wang, G.; He, W.; Yin, L.; Zhao, J.

A self-microemulsifying drug delivery system (SMEDDS) for a novel medicative compound against depression: A preparation and bioavailability study in rats

Compared with the solid dispersion and cyclodextrin inclusion

AAPS PharmSciTech, 2015, In Press; DOI:10.1208/s12249-014-0280-y

Xu, X.; Hu, J.; Wu, X.; Chen, X.; Shen, D.

A kind of thermal responsive micro-gel with "core-chain" structure

Cross-linked cyclodextrin core, Poly N-iso-Pr acrylamide, Methylene blue, Controlled release

Gaofenzi Cailiao Kexue Yu Gongcheng, 2015, 31, 19-25

Yang, C.-H.; Tsai, Y.; Ting, W.-J.; Pai, P.-Y.; Chang, S.-H.; Ho, T.-J.; Lin, J.-Y.; Tsai, F.-J.; Padama, V. V.; Huang, C.-Y.

Anti-apoptosis effects on hearts of SHSST cyclodextrin complex in a carbon tetrachloride-induced cirrhotic cardiomyopathy rat model

Silymarin, Baicalein, San Huang Shel Shin Tang (SHSST), β-Cyclodextrin modified SHSST

The Chinese journal of physiology, 2015, 58, 38-45; DOI:10.4077/CJP.2015.BAD286

Yang, Z.; Xiao, Z.; Ji, H.

Solid inclusion complex of terpinen-4-ol/β-cyclodextrin: Kinetic release, mechanism and its antibacterial activity

Thermal stability, Hydrogen bonds

Flavour and Fragrance Journal, 2015, 30, 179-187; DOI:10.1002/ffj.3229

Yousaf, A. M.; Kim, D. W.; Oh, Y.-K.; Yong, C. S.; Kim, J. O.; Choi, H.-G.

Enhanced oral bioavailability of fenofibrate using polymeric nanoparticulated systems: Physicochemical characterization and *in vivo* investigation

HP-β-CD, Solvent-evaporation method, Bioavailability

International Journal of Nanomedicine, 2015, 10, 1819-1830; DOI:10.2147/IJN.S78895

Yu, H.; Sun, J.; Zhang, Y.; Zhang, G.; Chu, Y.; Zhuo, R.; Jiang, X.

pH- And β-cyclodextrin-responsive micelles based on polyaspartamide derivatives as drug carrier

Poly(aspartic acid)-ethanediamine-g-adamantane/methyloxy polyethylene glycol, Micelles, Doxorubicin, Cytotoxicity

Journal of Polymer Science, Part A: Polymer Chemistry, 2015, 53, 1387-1395; DOI:10.1002/pola.27584

Zan, M.; Li, J.; Huang, M.; Lin, S.; Luo, D.; Luo, S.; Ge, Z.

Near-infrared light-triggered drug release nanogels for combined photothermal-chemotherapy of cancer

Supramolecular self-assembly from adamantine-conjugated copolymer, β-Cyclodextrin-functionalized poly(amidoamine) (PAMAM) dendrimer, Stimuli-triggered drug release, Cytotoxicity

Biomaterials Science, 2015, 3, 1147-1156; DOI:10.1039/c5bm00048c

Zhang, L.; Zhang, Q.; Wang, X.; Zhang, W.; Lin, C.; Chen, F.; Yang, X.; Pan, W.

Drug-in-cyclodextrin-in-liposomes: A novel drug delivery system for flurbiprofen

Co-evaporation, Co-ground, Co-lyophilization, β-CD, HP-β-CD, SBE-β-CD, In vitro, In vivo, Bioavailability

International Journal of Pharmaceutics, 2015, 492, 40-45; DOI:10.1016/j.ijpharm.2015.07.011

Zhang, Y.; Chen, T.; Yuan, P.; Tian, R.; Hu, W.; Tang, Y.; Jia, Y.; Zhang, L.

Encapsulation of honokiol into self-assembled pectin nanoparticles for drug delivery to HepG2 cells

Cytotoxicity, Hydroxypropyl-β-cyclodextrin, Cell apoptosis, Cellular uptake

Carbohydrate Polymers, 2015, 133, 31-38; DOI:10.1016/j.carbpol.2015.06.102

Zhang, D.; Wei, Y.; Chen, K.; Gong, H.; Han, S.; Guo, J.; Li, X.; Zhang, J.

Engineering of biocompatible pH-responsive nanovehicles from acetalated cyclodextrins as effective delivery systems for tumor therapy

2-Ethoxypropene, Docetaxel, Antitumor activity, Melanoma-bearing nude mouse model

Journal of Biomedical Nanotechnology, 2015, 11, 923-941; DOI:10.1166/jbn.2015.2009

Zhang, D.; Wang, M.-Y. & Yang, L.

Progress in new formulation studies of artemisinins

New drug delivery system, Cyclodextrin complex, Review

Zhongguo Yaoxue Zazhi (Beijing, China), 2015, 50, 189-193; DOI:10.11669/cpj.2015.03.001

Zhang, Z.; Lv, Q.; Gao, X.; Chen, L.; Cao, Y.; Yu, S.; He, C.; Chen, X.

pH-Responsive poly(ethylene glycol)/poly(L-lactide) supramolecular micelles based on host-guest interaction

Benzimidazole-terminated poly(ethylene glycol), β-Cyclodextrin-modified poly(L-lactide), Doxorubicin, Tumor inhibition, Reduced systemic toxicity, pH Controlled release

ACS Applied Materials & Interfaces, 2015, 7, 8404-8411; DOI:10.1021/acsami.5b01213

Zhang, Y.; Wu, L.; Hu, Q.; Chen, B.; Wu, B.; Xue, W.

Functionally modified hyperbranched polyglycerols for drug delivery

Supramolecular self-assembly, Cyclodextrin host-guest interactions, Review

Yingyong Huaxue, 2015, 32, 367-378; DOI:10.11944/j.issn.1000-0518.2015.04.140246

Zhang, W.; Zhou, X.; Liu, T.; Ma, D.; Xue, W.

Supramolecular hydrogels co-loaded with camptothecin and doxorubicin for sustainedly synergistic tumor therapy

Hyperbranched polyglycerol derivative, α-Cyclodextrin, Blood compatibility, Non-cytotoxicity

Journal of Materials Chemistry B: Materials for Biology and Medicine, 2015, 3, 2127-2136; DOI:10.1039/C4TB01971G

Zhao, Y.; Sun, C.; Shi, F.; Firempong, C. K.; Yu, J.; Xu, X.; Zhang, W.

Preparation, characterization, and pharmacokinetics study of capsaicin via hydroxypropyl-beta-cyclodextrin encapsulation

Pharmacokinetics parameters, Gastric irritation, Oral bioavailability

Pharmaceutical biology, 2015, In Press

Zhao, J.; Zhang, H.-Y.; Sun, H.-L.; Liu, Y.

Supramolecular nanoassemblies of an amphiphilic porphyrin-cyclodextrin conjugate and their morphological transition from vesicle to network

5-(4'-Dodecyloxyphenyl)-10,15,20-tri(permethyl-β-CD)-modified ZnII-porphyrin, Click reaction, Controlled-release, Doxorubicin

Chemistry - A European Journal, 2015, 21, 4457-4464; DOI:10.1002/chem.201405943

Zhou, S.; Sha, H.; Ke, X.; Liu, B.; Wang, X.; Du, X.

Combination drug release of smart cyclodextrin-gated mesoporous silica nanovehicles

Dual drug loading, Simultaneous and cascade release, γ-Cyclodextrin

Chemical Communications (Cambridge, United Kingdom), 2015, 51, 7203-7206; DOI:10.1039/C5CC00585J

Zoghbi, A.; Wang, B.

Carvedilol solubility enhancement by inclusion complexation and solid dispersion: Review

Antihypertensive drug, Inclusion comples with cyclodextrin, Solvent evaporation method, Fusion method, Kneading method, Spray drying method

Journal of Drug Delivery and Therapeutics, 2015, 5, 1-8

4. CDs in Cell Biology

Fitzgerald, K. A.; Guo, J.; Tierney, E. G.; Curtin, C. M.; Malhotra, M.; Darcy, R.; O'Brien, F. J.; O'Driscoll, C. M.

The use of collagen-based scaffolds to simulate prostate cancer bone metastases with potential for evaluating delivery of nanoparticulate gene therapeutics

Docetaxel treatment, Nanoparticles containing siRNA formulated using a modified cyclodextrin, siRNA delivery, 3D bone cancer in vitro model

Biomaterials, 2015, 66, 53-66; DOI:10.1016/j.biomaterials.2015.07.019

Huang, J.; Tan, D.; Wang, Y.; Liu, C.; Xu, J.; Wang, J.

Egg drop syndrome virus enters duck embryonic fibroblast cells via clathrin-mediated endocytosis

Methyl-β-cyclodextrin, Entry pathway, Chlorpromazine

Virus Research, 2015, 210, 69-76; DOI:10.1016/j.virusres.2015.07.014

Maarup, T. J.; Chen, A. H.; Porter, F. D.; Farhat, N. Y.; Ory, D. S.; Sidhu, R.; Jiang, X.; Dickson, P. I.

Intrathecal 2-hydroxypropyl-beta-cyclodextrin in a single patient with Niemann–Pick C1

Lumbar puncture, Hearing loss, Plasma 24-(S)-hydroxycholesterol

Molecular Genetics and Metabolism, 2015, 116, 75-79; DOI:10.1016/j.ymgme.2015.07.001

Naseer, Z.; Ahmad, E.; Aksoy, M.; Küçük, N.; Serin, İ.; Ceylan, A.; Boyacıoğlu, M.; Kum, C.

Protective effect of cholesterol-loaded cyclodextrin pretreatment against hydrogen peroxide induced oxidative damage in ram sperm

Cryo-induced damage, Motility, Viability, Membrane integrity

Cryobiology, 2015, 71, 18-23; DOI:10.1016/j.cryobiol.2015.06.007

Sidhu, R.; Jiang, H.; Schaffer, J. E.; Ory, D. S.; Jiang, X.; Farhat, N. Y.; Carrillo-Carrasco, N.; Woolery, M.; Ottinger, E.; Porter, F. D.

A validated LC-MS/MS assay for quantification of 24(S)-hydroxycholesterol in plasma and cerebrospinal fluid

Support a NIH sponsored clinical trial of HP-β-CD in Niemann-Pick type C1 patients, Biomarker, Cholesterol metabolism, Two-dimensional liquid chromatography-tandem mass spectrometry

Journal of lipid research, 2015, 56, 1222-1233; DOI:10.1194/jlr.D058487

Tarasev, M.; Chakraborty, S.; Alfano, K.

RBC mechanical fragility as a direct blood quality metric to supplement storage time

Hemolysis, Albumin, Methyl-β-cyclodextrin

Military medicine, 2015, 180, 150-157; DOI:10.7205/MILMED-D-14-00404

Tatti, M.; Motta, M.; Tartaglia, M.; Salvioli, R.; Scarpa, S.; Di, B. S.; Cianfanelli, V.

BCM-95 and (2-hydroxypropyl)-β-cyclodextrin reverse autophagy dysfunction and deplete stored lipids in Sap C-deficient fibroblasts

Gaucher disease, Accumulation of glucosylceramide, Clearance of cholesterol and ceramide

Human molecular genetics, 2015, 24, 4198-4211; DOI:10.1093/hmg/ddv153

Terauchi, M.; Ikeda, G.; Nishida, K.; Tamura, A.; Yamaguchi, S.; Harada, K.; Yui, N.

Supramolecular polyelectrolyte complexes of bone morphogenetic protein-2 with sulfonated polyrotaxanes to induce enhanced osteogenic differentiation

α-Cyclodextrin threaded onto a linear polymer, Osteoprogenitor cells, Negligible anticoagulant activity and cytotoxicity

Macromolecular Bioscience, 2015, 15, 953-964; DOI:10.1002/mabi.201500032

Yue, H.-Y.; Xu, J.

Cholesterol regulates multiple forms of vesicle endocytosis at a mammalian central synapse

Methyl-β-cyclodextrin, Vesicle endocytosis

Journal of Neurochemistry, 2015, 134, 247-260; DOI:10.1111/jnc.13129

Zhou, M.; Duan, Q.; Li, Y.; Yang, Y.; Hardwidge, P. R.; Zhu, G.

Membrane cholesterol plays an important role in enteropathogen adhesion and the activation of innate immunity via flagellin-TLR5 signaling

Lipid rafts, Sphingolipid, Methyl-β-cyclodextrin, Toll-like receptor 5

Archives of Microbiology, 2015, 197, 797-803; DOI:10.1007/s00203-015-1115-2

Zuckerman, J. E.; Gale, A.; Wu, P.; Ma, R.; Davis, M. E.

siRNA Delivery to the glomerular mesangium using polycationic cyclodextrin nanoparticles containing siRNA

Chronic kidney disease, Tissue-specific targeting, Gene-specific silencing effects, Targeting ligands mannose or transferrin

Nucleic Acid Therapeutics, 2015, 25, 53-64; DOI:10.1089/nat.2014.0505

5. CDs in Food, Cosmetics and Agrochemicals

Kfoury, M.; Auezova, L.; Greige-Gerges, H.; Fourmentin, S.

Promising applications of cyclodextrins in food: Improvement of essential oils retention, controlled release and antiradical activity

Food preservatives, Food packaging, Multiple headspace extraction, ABTS$^+$ scavenging

Carbohydrate Polymers, 2015, 131, 264-272; DOI:10.1016/j.carbpol.2015.06.014

Prabu, S.; Swaminathan, M.; Sivakumar, K.; Rajamohan, R.

Preparation, characterization and molecular modeling studies of the inclusion complex of caffeine with beta-cyclodextrin

Kneading, Co-precipitation, Benesi-Hildebrand plot, FT–IR, DSC

Journal of Molecular Structure, 2015, 1099, 616-624; DOI:10.1016/j.molstruc.2015.07.018

Ramirez-Estrada, K.; Osuna, L.; Moyano, E.; Bonfill, M.; Tapia, N.; Cusido, R. M.; Palazon, J.

Changes in gene transcription and taxane production in elicited cell cultures of *Taxus* × *media* and *Taxus globosa*

Elicitors, Cephalomannine, 10-Deacetyltaxol, Taxol, Baccatin III

Phytochemistry, 2015, 117, 174-184; DOI:10.1016/j.phytochem.2015.06.013

Rutenberg, R.; Bernstein, S.; Paster, N.; Fallik, E.; Poverenov, E.

Antimicrobial films based on cellulose-derived hydrocolloids. A synergetic effect of host–guest interactions on quality and functionality

Antifungal activity, Biodegradable active films, Bio-active hydrocolloids, Controlled release, β-Cyclodextrin, Propionic acid

Colloids and Surfaces B: Biointerfaces, 2015, In Press; DOI:10.1016/j.colsurfb.2015.06.022

Singh, V.; Jadhav, S. B.; Singhal, R. S.

Interaction of polyphenol oxidase of *Solanum tuberosum* with β-cyclodextrin: Process details and applications

Anti-browning agent, Pineapple, Apple, Pear, β-cyclodextrin, Inhibition

International Journal of Biological Macromolecules, 2015, 80, 469-474; DOI:10.1016/j.ijbiomac.2015.07.010

Uchida, R.; Iwamoto, K.; Nagayama, S.; Miyajima, A.; Hirota, T.; Okamoto, H.; Fukumi, H.; Terao, K.; Okamoto, H.; Ikuta, N.

Effect of γ-cyclodextrin inclusion complex on the absorption of R-α-lipoic acid in rats

Cofactor for mitochondrial enzymes, Antioxidant, α-, β- or γ-Cyclodextrins, Intraduodenal administration, Nutritional supplement

International journal of molecular sciences, 2015, 16, 10105-10120; DOI:10.3390/ijms160510105

Wang, X.; Yuan, Y.; Yue, T.

The application of starch-based ingredients in flavor encapsulation

Review, Cyclodextrins, Hydrolized starches, Octenyl succinic anhydride starches, Porous starches, Wall material, Food

Starch/Staerke, 2015, 67, 225-236; DOI:10.1002/star.201400163

Xin, M.; Zhang, E.-Z.; He, Q.-G.; Yang, R.-G.; Huang, Z.-Y.; Su, Y.-B.; Huang, M.-K.

Drying aids for processing mango powder by spray drying

drying aid mango powder spray drying

Shipin Keji, 2015, 40, 282-286

Yu, C.; Fan, T.; Guo, X.; Wu, X.

Inclusion complexes of γ-cyclodextrin with pendimethalin

Water-based pesticide formulations

Gaodeng Xuexiao Huaxue Xuebao, 2015, 36, 306-309; DOI:10.7503/cjcu20140316

6. CDs for other Industrial Applications

Biswas, A.; Appell, M.; Liu, Z.; Cheng, H.

Microwave-assisted synthesis of cyclodextrin polyurethanes

α-CD, β-CD, γ-CD, Diisocyanates, Organic-soluble, Water-insoluble, Removal of undesirable materials, NMR

Carbohydrate Polymers, 2015, 133, 74-79; DOI:10.1016/j.carbpol.2015.06.044

Chauke, V. P.; Maity, A.; Chetty, A.

High-performance towards removal of toxic hexavalent chromium from aqueous solution using graphene oxide-alpha cyclodextrin-polypyrrole nanocomposites

Langmuir isotherm, Adsorption capacities, Cr(VI) removal

Journal of Molecular Liquids, 2015, 211, 71-77; DOI:10.1016/j.molliq.2015.06.044

Cho, E.; Tahir, M. N.; Choi, J. M.; Kim, H.; Yu, J.-H.; Jung, S.

Novel magnetic nanoparticles coated by benzene- and β-cyclodextrin-bearing dextran, and the sorption of polycyclic aromatic hydrocarbon

Click reaction from alkyne-modified dextran and benzyl azide or mono-6-O-deoxy-monoazido β-cyclodextrin

Carbohydrate Polymers, 2015, 133, 221-228; DOI:10.1016/j.carbpol.2015.06.089

Cui, L.; Wang, Y.; Gao, L.; Hu, L.; Wei, Q.; Du, B.

Removal of Hg(II) from aqueous solution by resin loaded magnetic β-cyclodextrin bead and graphene oxide sheet: Synthesis, adsorption mechanism and separation properties

Magnetic performance, Adsorption capacity, Freundlich isotherm

Journal of Colloid and Interface Science, 2015, 456, 42-49; DOI:10.1016/j.jcis.2015.06.007

Fedorova, A. A.; Fedulin, A. I.; Morozov, I. V.

New method of beta-$NaYF_4$: Yb^{3+}, Er^{3+} synthesis by using beta-cyclodextrin

Complex fluorides, Metal fluoroacetates hydrates, Pyrohydrolysis

Journal of Fluorine Chemistry, 2015, 178, 173-177; DOI:10.1016/j.jfluchem.2015.07.003

Miyamoto, T.; Zhu, Q.; Igrashi, M.; Kodama, R.; Maeno, S.; Fukushima, M.

Catalytic oxidation of tetrabromobisphenol A by iron(III)-tetrakis(*p*-sulfonatephenyl)porphyrin catalyst supported on cyclodextrin polymers with potassium monopersulfate

γ-Cyclodextrin polymer, Turnover frequency, Landfill leachates, Humic acid

Journal of Molecular Catalysis B: Enzymatic, 2015, 119, 64-70; DOI:10.1016/j.molcatb.2015.06.002

Silva, N.; Arellano, E.; Castro, C.; Yutronic, N.; Lang, E.; Chornik, B.; Jara, P.

Cyclodextrin inclusion compound crystals for growth of Cu-Au core-shell nanoparticles

2α-Cyclodextrin/decylamine inclusion compound, Nanoelectronics

Journal of Inclusion Phenomena and Macrocyclic Chemistry, 2015, 82, 497-504; DOI:10.1007/s10847-015-0531-x

Tang, J.; Shi, Z.; Berry, R. M.; Tam, K. C.

Mussel-inspired green metallization of silver nanoparticles on cellulose nanocrystals and their enhanced catalytic reduction of 4-nitrophenol in the presence of β-cyclodextrin

Polydopamine, Nanohybrids, Nanocatalyst

Industrial & Engineering Chemistry Research, 2015, 54, 3299-3308; DOI:10.1021/acs.iecr.5b00177

Tao, F.; Wang, Q.

Aqueous radical addition-coupling polymerization using nitroso benzene/cyclodextrin complex for synthesis of hydrophilic periodic polymer

Me_2-β-cyclodextrin, Poly(ethylene glycol) bis(α-bromoisobutyrate), Cu/ligand

RSC Advances, 2015, 5, 46007-46010; DOI:10.1039/C5RA02371H

Telegdi, J.; Trif, L.; Mihály, J.; Nagy, E.; Nyikos, L.

Controlled synthesis and characterization of biodegradable, stereomer co-polycondensates of L-malic acid

β-Cyclodextrin as co-monomer, Optical activity

Journal of Thermal Analysis and Calorimetry, 2015, 121, 663-673; DOI:10.1007/s10973-015-4624-y

Tong, R.; Wang, L.; Yu, H.; Zain-ul-Abdin; Khalid, H.; Akram, M.; Chen, Y.

Redox and Temperature Dual Responsive Gel Based on Host-Guest Assembly

Shape transformation, Tissue engineering, Polyacrylamide-based hydrogel, Ferrocene, β-Cyclodextrin, Temperature sensitive switch

Journal of Inorganic and Organometallic Polymers and Materials, 2015, 25, 1053-1059; DOI:10.1007/s10904-015-0210-9

Wan, Y.; Wang, X.; Liu, N.

The reactivity of phenancyl bromide under β-cyclodextrin as supramolecular catalyst: A computational survey

Hydrogen bonds, Reactivity and electrophilicity, Carbocationic intermediate

Journal of Molecular Modeling, 2015, 21, 131; DOI:10.1007/s00894-015-2680-7

Wang, L.; Wang, P.; Liu, Y.; Zheng, L.; Sun, Q.; Qiu, S.; Liu, C.

Effects of phenylhydrazine-4-sulfonic acid on the reduction of GO and preparation of hydrophilic graphene with broad pH stability and antioxidant activity

Graphene oxide, Hydrophilic graphene, Polyvinyl alcohol, Polyethylene glycol, Cyanides, Cyclodextrin

RSC Advances, 2015, 5, 38696-38705; DOI:10.1039/C4RA15454A

Wang, G.; Wang, Y.; Hu, S.; Deng, N.; Wu, F.

Cysteine-β-cyclodextrin enhanced phytoremediation of soil co-contaminated with phenanthrene and lead

Ryegrass, Bioconcentration factor, Unplanted soil, Planted soil

Environmental Science and Pollution Research, 2015, 22, 10107-10115; DOI:10.1007/s11356-015-4210-7

Wei, B.; Romero-Zerón, L.; Rodrigue, D.

Improved viscoelasticity of xanthan gum through self-association with surfactant: β-Cyclodextrin inclusion complexes for applications in enhanced oil recovery

Interlocking effect, Sandpack flood tests, In situ permeability modifier

Polymer Engineering & Science, 2015, 55, 523-532; DOI:10.1002/pen.23912

Xia, D.; Jiang, S.; Li, L.; Xiang, Y.; Zhu, L.

The biomimetic catalytic synthesis of acetal compounds using β-cyclodextrin as catalyst

Acetalation reaction, Benzaldehyde

Chinese Journal of Chemical Engineering, 2015, In Press; DOI:10.1016/j.cjche.2015.06.008

Yamashita, S.; Igarashi, M.; Hayashi, C.; Shitara, T.; Nomoto, A.; Shibasaki, M.; Mizote, T.

Identification of self-growth-inhibiting compounds lauric acid and 7-(Z)-tetradecenoic acid from *Helicobacter pylori*

Replace serum, 2,6-Di-O-methyl-cyclodextrin

Microbiology (Reading, England)year, 2015, 161, 1231-1239; DOI:10.1099/mic.0.000077

Yang, T.; Fang, L.; Nopo-Olazabal, C.; Condori, J.; Nopo-Olazabal, L.; Balmaceda, C.; Medina-Bolivar, F.

Enhanced production of resveratrol, piceatannol, arachidin-1, and arachidin-3 in hairy root cultures of peanut co-treated with methyl jasmonate and cyclodextrin

Elicitor treatment, Synergistic effect on resveratrol synthase gene expression, Methyl-β-cyclodextrin

Journal of Agricultural and Food Chemistry, 2015, 63, 3942-3950; DOI:10.1021/jf5050266

Yoshida, Y.; Terao, K.; Ishida, Y.

Monochlorotriazinyl-β-cyclodextrin: A new advanced material for high functionalization of fiber

Sen'i Gakkaishi, 2015, 71, P22-P25; DOI:10.2115/fiber.71.P-22

Zhang, N.; Shen, J.; Pasquinelli, M. A.; Hinks, D.; Tonelli, A. E.

Formation and characterization of an inclusion complex of triphenyl phosphate and β-cyclodextrin and its use as a flame retardant for polyethylene terephthalate

PET films embedded with uncomplexed β-CD and TPP, Reduce the exposure of hazardous chemicals to humans

Polymer Degradation and Stability, 2015, 120, 244-250; DOI:10.1016/j.polymdegradstab.2015.07.014

Zhang, H.-J.; Liu, Y.-N.; Wang, M.; Wang, Y.-F.; Deng, Y.-R.; Cui, M.-L.; Ren, X.-L.; Qi, A.-D.

One-pot β-cyclodextrin-assisted extraction of active ingredients from Xue–Zhi–Ning basing its encapsulated ability

Traditional Chinese medicine formula, Rubrofusarin gentiobioside, 2,3,5,4′-Tetrahydroxy-stilbene-2-O-β-D-glucoside, Emodin, Nuciferine, Quercetin, Apparent formation constant, Stability, Dissolution rate

Carbohydrate Polymers, 2015, 132, 437-443; DOI:10.1016/j.carbpol.2015.06.072

Zhang, X.; Li, H.; Cao, M.; Shi, L.; Chen, C.

Adsorption of basic dyes on β-cyclodextrin functionalized poly (styrene-alt-maleic anhydride)

Grafting reaction, Pseudo-second-order model

Separation Science and Technology (Philadelphia, PA, United States), 2015, 50, 947-957; DOI:10.1080/01496395.2014.978461

Zhao, K. K.; Zhang, W.; Zhang, H. D.; Du, H.; Li, Q.; Wang, S. Y.; Wang, Y.

A molecular imprinted polymers with β-cyclodextrin for adsorption of paeoniflorin

β-Cyclodextrin, Epichlorohydrin, Microspheres

Asian Journal of Chemistry, 2015, 27, 1435-1438; DOI:10.14233/ajchem.2015.18230

7. CDs in Sensing and Analysis

Alvira, E.

Theoretical study of the separation of valine enantiomers by β-cyclodextrin with different solvents: a molecular mechanics and dynamics simulation

Chiral selector, Polarity of solvents,

Tetrahedron: Asymmetry, 2015, 26, 853-860; DOI:10.1016/j.tetasy.2015.06.013

Bertaso, A.; Musile, G.; Gottardo, R.; Seri, C.; Tagliaro, F.

Chiral analysis of methorphan in opiate-overdose related deaths by using capillary electrophoresis

(2-Hydroxypropyl)-β-cyclodextrin, Dextromethorphan, Levomethorphan

Journal of Chromatography B, 2015, 1000, 130–135; DOI:10.1016/j.jchromb.2015.07.024

Dsugi, N. F. A.; Elbashir, A. A.; Suliman, F. E. O.

Supramolecular interaction of gemifloxacin and hydroxyl propyl β-cyclodextrin spectroscopic characterization, molecular modeling and analytical application

Highly sensitive spectrofluorometric method for the determination of GFX, Inclusion complex, HPβCD

Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, 2015, 151, 360-367; DOI:10.1016/j.saa.2015.06.031

Garrido, J.; Rahemi, V.; Borges, F.; Brett, C.; Garrido, E.

Carbon nanotube β-cyclodextrin modified electrode as enhanced sensing platform for the determination of fungicide pyrimethanil

Polyaniline film, Pyrimethanil in pome fruit (apples)

Food Control, 2015, 60, 7-11; DOI:10.1016/j.foodcont.2015.07.001

Hua, Z.; Qin, Q.; Bai, X.; Wang, C.; Huang, X.

β-Cyclodextrin inclusion complex as the immobilization matrix for laccase in the fabrication of a biosensor for dopamine determination

Inclusion complex of β-cyclodextrin and benzaldehyde, Reduced graphene oxide modified screen-printed carbon electrodes

Sensors and Actuators B: Chemical, 2015, 220, 1169-1177; DOI:10.1016/j.snb.2015.06.108

Huang, H.; Yang, X.; Wang, K.; Wang, Q.; Guo, Q.; Huang, J.; Liu, J.; Guo, X.; Li, W.; He, L.

Amplified fluorescence detection of DNA based on catalyzed dynamic assembly and host–guest interaction between β-cyclodextrin polymer and pyrene

Pyrene labeled at the 5'-termini, Mix-and-detect amplification method, Enzyme-free, Nucleic acid detection

Talanta, 2015, 144, 529-534; DOI:10.1016/j.talanta.2015.06.087

Jiang, R.; Lin, W.; Wen, S.; Zhu, F.; Luan, T.; Ouyang, G.

Development of a full automation solid phase microextraction method for investigating the partition coefficient of organic pollutant in complex sample

Humic acid, Fetal bovine serum, Depletion method, Complex matrix

Journal of Chromatography A, 2015, 1406, 27-33; DOI:10.1016/j.chroma.2015.06.018

Li, J.; Sun, M.; Wei, X.; Zhang, L.; Zhang, Y.

An electrochemical aptamer biosensor based on "gate-controlled" effect using β-cyclodextrin for ultra-sensitive detection of trace mercury

Hg^{2+} analysis, SH-β-CD, Gold electrode, Thionine, Sensitivity

Biosensors and Bioelectronics, 2015, 74, 423-426; DOI:10.1016/j.bios.2015.06.061

Lin, Y.; Zhou, J.; Tang, J.; Tang, W.

Cyclodextrin clicked chiral stationary phases with functionalities-tuned enantioseparations in high performance liquid chromatography

Clicking per-4-chloro-3-methylphenylcarbamoylated mono-6A-azido-β-CD and per-5-chloro-2-methylphenylcarbamoylated mono-6A-azido-β-CD onto alkynylated silica support

Journal of Chromatography A, 2015, 1406, 342-346; DOI:10.1016/j.chroma.2015.06.051

Liu, Y.-C.; Chang, S.-W.; Chen, C.-Y.; Chien, I.-C.; Lin, C.-H.

Separation and determination of cold medicine ingredients by capillary zone electrophoresis using sulfated β-cyclodextrin as an electrolyte modifier and chiral selector

Randomly sulfated-β-CD, Electrolyte modifier

Journal of the Chinese Chemical Society (Weinheim, Germany), 2015, 62, 191-196; DOI:10.1002/jccs.201400276

Mitra, A. K.; Ghosh, S.; Sau, A.; Saha, C.; Basu, S.

Solution phase photophysics of 5,7-dimethoxy-2,3,4,9-tetrahydro-1H-carbazol-1-one: Analysing the lineaments of a new fluorosensor to probe different micro-environments

Fluorophore, Micelles, Reverse micelles, β-Cyclodextrin, Cetyltrimethylammonium bromide, Sodium dodecyl sulphate, Triethylamine, Magnetic field effect, Laser flash photolysis

Journal of Luminescence, 2015, 167, 233-248; DOI:10.1016/j.jlumin.2015.06.048

Poór, M.; Kunsági-Máté, S.; Sali, N.; Kőszegi, T.; Szente, L.; Peles-Lemli, B.

Interactions of zearalenone with native and chemically modified cyclodextrins and their potential utilization

Mycotoxin, Fusarium, Liver cells, Toxin uptake, Fluorescence spectroscopy, Detoxification

Journal of Photochemistry and Photobiology B: Biology, 2015, 151, 63-68; DOI:10.1016/j.jphotobiol.2015.07.009

Sha, J.; Song, Y.; Liu, B.; Lü, C.

Host-guest-recognition-based polymer brush-functionalized mesoporous silica nanoparticles loaded with conjugated polymers: A facile FRET-based ratiometric probe for Hg^{2+}

Sensor, Poly(p-phenylenevinylene), Spirolactam rhodamine-linked adamantane, Mercury ion-recognition element

Microporous and Mesoporous Materials, 2015, 218, 137-143; DOI:10.1016/j.micromeso.2015.07.014

Singh, V.; Nand, A.; Sarita; Zhang, J.; Zhu, J.

Non-specific adsorption of serum and cell lysate on 3D biosensor platforms: A comparative study based on SPRi

α-Cyclodextrin, Surface initiated polymerization, Surface plasmon resonance imaging, Dextran

Arabian Journal of Chemistry, 2015, In Press; DOI:10.1016/j.arabjc.2015.06.037

Tong, S.; Zhang, H.; Shen, M.; Ito, Y.; Yan, J.

Application and comparison of high-speed countercurrent chromatography and high performance liquid chromatography in preparative enantioseparation of α-substitution mandelic acids

Hydroxypropy-β-cyclodextrin, Sulfobutyl ether-β-cyclodextrin, Chiral mobile phase additives

Separation Science and Technology (Philadelphia, PA, United States), 2015, 50, 735-743; DOI:10.1080/01496395.2014.959602

Troć, A.; Zimnicka, M.; Danikiewicz, W.

Separation of catechin epimers by complexation using ion mobility mass spectrometry

Heptakis(2,6-di-O-methyl)-β-cyclodextrin, Mixed dimer complexes

Journal of Mass Spectrometry, 2015, 50, 542-548; DOI:10.1002/jms.3560

Wang, W.; Wong, N.-K.; Sun, M.; Yan, C.; Ma, S.; Yang, Q.; Li, Y.

Regenerable fluorescent nanosensors for monitoring and recovering metal ions based on photoactivatable monolayer self-assembly and host-guest interactions

α-Cyclodextrin-containing surface conjugated with photoisomerizable azobenzene, Cu^{2+}, Fe^{3+}, Hg^{2+}

ACS Applied Materials & Interfaces, 2015, 7, 8868-8875; DOI:10.1021/acsami.5b01509

Xiao, P.; Weibel, N.; Dudal, Y.; Corvini, P. F.-X.; Shahgaldian, P.

A cyclodextrin-based polymer for sensing diclofenac in water

Fluorescent dye, Increase in fluorescence polarization, Wastewater

Journal of Hazardous Materials, 2015, 299, 412-416; DOI:10.1016/j.jhazmat.2015.06.047

Xue, F.; Gao, Z.-Y.; Sun, X.-M.; Yang, Z.-S.; Yi, L.-F.; Chen, W.

Electrochemical determination of environmental hormone nonylphenol based on composite film modified gold electrode

Thiol-β-cyclodextrin, Graphene hybrid-modified Au electrode

Journal of the Electrochemical Society, 2015, 162, H338-H344; DOI:10.1149/2.0271506jes

Yang, J.-R.; Xie, S.-M.; Liu, H.; Zhang, J.-H.; Yuan, L.-M.

Metal-organic framework $InH(D\text{-}C_{10}H_{14}O_4)_2$ for improved enantioseparations on a chiral cyclodextrin stationary phase in GC

Peramylated cyclodextrin, Indium camphoric acid metal-organic framework

Chromatographia, 2015, 78, 557-564; DOI:10.1007/s10337-015-2863-5

Yang, C.; Spinelli, N.; Perrier, S.; Defrancq, E.; Peyrin, E.

Macrocyclic host-dye reporter for sensitive sandwich-type fluorescent aptamer sensor

Adenosine aptamer fragment, Dual reporting dye inclusion

Analytical Chemistry (Washington, DC, United States), 2015, 87, 3139-3143; DOI:10.1021/acs.analchem.5b00341

Yang, G.; Yang, Z.; Mu, C.; Fan, X.; Tian, W.; Wang, Q.

A dual stimuli responsive fluorescent probe carrier from a double hydrophilic block copolymer capped with β-cyclodextrin

RAFT polymerization, Click reaction, Micelle formation

Polymer Chemistry, 2015, 6, 3382-3386; DOI:10.1039/C5PY00255A

Yang, Y.; Gao, F.; Cai, X.; Yuan, X.; He, S.; Gao, F.; Guo, H.; Wang, Q.

β-Cyclodextrin functionalized graphene as a highly conductive and multi-site platform for DNA immobilization and ultrasensitive sensing detection

Glassy carbon electrode, Impedance-based hybridization test, 2,4,6-Trichloro-1,3,5-triazine, DNA biosensor

Biosensors and Bioelectronics, 2015, 74, 447-453; DOI:10.1016/j.bios.2015.06.018

Yi, Y.; Sun, H.; Zhu, G.; Zhang, Z.; Wu, X.-Y.

Sensitive electrochemical determination of rhodamine B based on cyclodextrin-functionalized nanogold/hollow carbon nanospheres

Per-6-thio-β-cyclodextrin, Glassy carbon electrode

Analytical Methods, 2015, 7, 4965-4970; DOI:10.1039/C5AY00654F

Yu, J.; Liang, X.; Wang, Z.; Guo, X.; Guo, X.; Sun, T.

Separation of folinic acid diastereomers in capillary electrophoresis using a new cationic β-cyclodextrin derivative

Mono-6-deoxy-6-piperidine-β-cyclodextrin

PloS one, 2015, 10, e0120216; DOI:10.1371/journal.pone.0120216

Zarei, K.; Fatemi, L.; Kor, K.

Stripping voltammetric determination of nicardipine using β-cyclodextrin incorporated carbon nanotube-modified glassy carbon electrode

Electrochemical sensor, Surface morphology

Journal of Analytical Chemistry, 2015, 70, 615-620; DOI:10.1134/S1061934815050184

Zhang, S.; Li, Z.; Wang, C.; Wang, Z.

Cyclodextrin-functionalized reduced graphene oxide as a fiber coating material for the solid-phase microextraction of some volatile aromatic compounds

Sol-gel technique, Hydroxypropy-β-cyclodextrin, Volatile aromatic compounds

Journal of Separation Science, 2015, 38, 1711-1720; DOI:10.1002/jssc.201401363

Zhang, F.; Zhao, Y.-Y.; Chen, H.; Wang, X.-H.; Chen, Q.; He, P.-G.

Sensitive fluorescence detection of lysozyme using a tris(bipyridine)ruthenium(II) complex containing multiple cyclodextrins

Photoactive metallocyclodextrins, ssDNAs/aptamers

Chemical Communications (Cambridge, United Kingdom), 2015, 51, 6613-6616; DOI:10.1039/C5CC00428D

Zhang, Q.; Guo, J.; Xiao, Y.; Crommen, J.; Jiang, Z.

Comparative evaluation of a one-pot strategy for the preparation of β-cyclodextrin-functionalized monoliths: Effect of the degree of amino substitution of β-cyclodextrin on the column performance

Mono(6-amino-6-deoxy)-β-cyclodextrin, Heptakis(6-amino-6-deoxy)-β-cyclodextrin, Glycidyl methacrylate, Peptides, Chiral acids, Enantioseparation

Journal of Separation Science, 2015, 38, 1813-1821; DOI:10.1002/jssc.201500124

Zhang, L.; Hu, W.; Yu, L.; Wang, Y.

Click synthesis of a novel triazole bridged AIE active cyclodextrin probe for specific detection of Cd^{2+}

Tetraphenylethene, Selective turn-on fluorescence response

Chemical Communications (Cambridge, United Kingdom), 2015, 51, 4298-4301; DOI:10.1039/C4CC09769F

Zhang, Z.-X.; Zhu, Y.-X.; Zhang, Y.

Simultaneous determination of 9-ethylphenanthrene, pyrene and 1-hydroxypyrene in an aqueous solution by synchronous fluorimetry using the double scans method and hydroxyl-propyl beta-cyclodextrin as a sensitizer

Binding and complexation energies

Talanta, 2015, 144, 836-843; DOI:10.1016/j.talanta.2015.05.067

Zhang, J.-H.; Zhang, M.; Xie, S.-M.; He, P.-G.; Yuan, L.-M.

A novel inorganic mesoporous material with a nematic structure derived from nanocrystalline cellulose as the stationary phase for high-performance liquid chromatography

β-Cyclodextrin HPLC columns

Analytical Methods, 2015, 7, 3448-3453; DOI:10.1039/C5AY00551E

Zhao, Y.; Wang, L.; Guo, Z.; Chi, X.; Ma, X.; Qi, Y.; Fang, S.; Li, X.; Liang, X.

Enhanced multi-phosphopeptide enrichment and Nano LC-ESI-qTOF-MS detection strategy using click OEG-CD matrix

Protein digestion products, Olio(ethylene glycol), Liquid chromatography-electrospray

ionization-quadrupole time of flight-mass spectrometry, α-Casein

Chemical Research in Chinese Universities, 2015, 31, 44-52; DOI:10.1007/s40242-014-4179-7

Zhao, Z.; Shen, G.; Gu, L.

Preparation and application of DL-lysine-β-cyclodextrin/carbon nanotube modified electrode

Cyclic voltammetry, Selectivity

Zhongguo Wuji Fenxi Huaxue, 2015, 5, 70-74; DOI:10.3969/j.issn.2095-1035.2015.01.020

Edited and produced by: CYCLOLAB
Homepage: www.cyclolab.hu
H-1525 P.O. 435, Budapest, Hungary
Tel.: (+361)347-6060
Fax.: (+361)347-6068
e-mail: cyclolab@cyclolab.hu