CYCLODEXTRIN NEWS
VOLUME 30. No. 6. JUNE 2016 ISSN 0951-256X

Cyclodextrins in environmental technologies as shown in the 18th International Cyclodextrin Symposium

The environmental application of cyclodextrins was one of the focuses of the 18th International Cyclodextrin Symposium held in Gainesville on May 19-21, 2016. Two of the 4 invited lectures, 7 of 24 oral presentations and 6 of 31 posters were related to this topic.

Prof. Thomas Boving (University of Rhode Island, Kingston, USA) gave an overview on the CD-enhanced remediation (CDER) technologies [1]. Compared to the traditional pump & treat methods, which use simply water for the extraction of the contaminants from the soil, flushing the soil with HPBCD solution is an efficient technology reducing the treatment time with an order or two magnitudes as it was proved in several field tests. The enhanced solubility is an advantage in the *in situ* oxidation technologies (ISCO), too, therefore the combination of peroxone (O_3 + H_2O_2) activated sodium persulfate system and the solubility-increasing additive, HPBCD resulted in enhanced efficacy. HPBCD was found to lengthen the half life time of ozone. A field test conducted at a former fire-training area proved the beneficial effect of applying HPBCD. The major contaminants at the site, 1,1,1-trichloroethane, dichlorobenzene and tetrachloroethene were removed in this pilot-scale field test.

The European aspects were also shown (Eva Fenyvesi, CycloLab). In Europe most of the research was done on the catalytic effect of CDs in bioremediation of soils [2]. The benefits of RAMEB compared to HPBCD (higher solubilizing effect, enhanced decrease of octanol-water partition coefficient, elevated desorption of PAHs from aged contaminated soil, slow biodegradability and slight sorption to the soil) counterbalance the small price difference. A step-by-step scaling up of the technology was shown starting from the lab-scale biodegradability tests on soils spiked with transformer oil, through pilot scale experiment with aged contaminated soil to field demonstration at a highly contaminated site in a transformer station. The enhanced carbon dioxide content in soil air proved the increased microbial activity. The RAMEB-enhanced bioremediation resulted in reduced transformer oil content both in the soil and in the groundwater reducing the treatment time with 1–2 years.

In spite of the successful field demonstrations of the CD-enhanced technologies both in the US and in Europe, CDs are still not used for soil remediation (Why are CDs so unloved?) [3]. Is it possible that the stakeholders are not interested in applying efficient technologies?

Technical grade CDs usually with high salt content are used for environmental applications because of economic reasons. The presence of salts, however, has an influence on the partition of the contaminants between the phases including also CD as a pseudophase. A mathematical model describing the distribution of hydrocarbon contaminants in air–water–CD–solid sorbent system was introduced [4].

Novel filters were developed by Prof. Uyar’s group using electrospinning [5]. These nanofibers made of HPBCD, HPGCD and methylated BCD are useful for air filtration. To reduce their solubility electrospinning combined with cross-linking was applied. The obtained poly-BCD nanofibers can remove dyes and PAHs from model wastewater solutions. Various cross-linking agents were studied [6, 7]. Electrospinning combined with thermal curing using citric acid as cross-linking agent successfully decreased the water-solubility [7]. Flavor/fragrance releasing material was produced by electrospinning of volatile antibacterial agents, such as menthol, vanillin, eugenol, geraniol and allyl isothiocyanate to replace other antibacterial agents of higher environmental concern [8].

The colloid stability as well as the photocatalytic effect of nano titanium dioxide was improved by using carboxymethyl-BCD-polymer [9]. The photodegradation of methylene blue as model contaminant in wastewater was accelerated.

Isoprene was polymerized in an eco-friendly way in aqueous solution by free radical polymerization using isoprene complexed by RAMEB [10].

CD/poly(amideimide) complexes were developed as novel binders/dispersants for lithium ion battery. BCD modified with poly(acrylic acid) oligomer was useful to complex poly(amideimide) binder and make it water-soluble [11]. The complex improved the dispersion of carbon nano-materials in water and made possible to shift from N-methylpyrrolidone solvent to water.

Self-healable polymeric material reduce the production of plastic waste and consumption of material and energy. Several CD-based self-healable materials were demonstrated at the symposium:

- Terpolymerization of acrylamide bearing BCD and that carrying adamantane results transparent film with self-healing properties both in hydrogel and xerogel form [12].
- Macroscopic complex formation of ferrocene and adamantane gels as guest gels and BCD gel as host gel is behind the self-healing properties of these systems [13].
- Crosslinking poly(2-hydroxyethyl methacrylate) and single wall carbon nanotubes self-healing, conductive material was obtained [14].
- UV-protective coating was developed by decorating titanium dioxid surface with BCD, then adsorbing vinyl adamantane. The vinyl groups were then polymerized and the resulting polymer with self-healing and UV-protective properties was used as a coating [15].

References

1. Boving, T. Soil and groundwater remediation with cyclodextrin. ICS18, Gainesville, Florida, 19-21 May, 2016. Abstract Book, p. 17
2. Fenyvesi, É. Cyclodextrins in environmental technologies for soil remediation. *Ibid*, p. 19
3. Strattan, C.E. Why are cyclodextrins so unloved? *Ibid*, p. 107
4. Blanford, W. Methods for determining the distribution of hydrophobic organic chemicals in cyclodextrin–water–air–solid sorbent systems as a function of salinity, temperature and CD concentration. *Ibid*, p. 59
5. Celebioglu, A., Uyar, T. Molecular filtration performance of electrospun poly-cyclodextrin nanofibers. *Ibid*, p. 43
6. Celebioglu, A., Uyar, T. Optimization study on electrospinning of insoluble poly-cyclodextrin nanofibers. *Ibid*, p. 49
7. Ertas, Y., Celebioglu, A., Uyar, T. Water-insoluable cross-linked cyclodextrin/polybenzoxazine composite nanofibers by electrospinning for wastewater treatment. *Ibid*, p. 91
8. Aytac, Z., Yildiz, Z.I., Senirmaka, F.K. Keskin, N.O.S.Tekinay, T., Uyar, T. Electrospinning of polymer-free cyclodextrin/geraniol-inclusion complex nanofibers: enhanced shelf-life of geraniol with antibacterial and antioxidant properties. *Ibid*, p. 113
9. Agócs, T.Z., Puskás I., Varga, E., Molnár, M., Fenyvesi, É. Photocatalytic effect of cyclodextrin-stabilized nano titanium dioxide on degradation of wastewater pollutants. *Ibid*, p.125
10. Hilschmann, J., Kali, G., Wenz, G. Synthesis of hydrophilic polyisoprene polyrotaxanes by radical polymerization. *Ibid*, p. 93
11. Saito, R., Matsumoto, M. Cyclodextrin/poly(amideimide) complexes as novel binders/dispersants for lithium ion battery. *Ibid*, p. 81
12. Nakahata, M., Takashima, Y., Harada, A. Highly flexible, tough, and self-healable supramolecular polymeric materials using host–guest interaction. *Ibid*, p.160
13. Takashima, Y., Harada, A. Stimuli responsive supramolecular materials formed from cyclodextrin and guest molecules on polymers. *Ibid*, p.37
14. Guo, K.; Chen, J.; Li, B.-J.; Zhang, S. Supramolecular conductive materials with self-healing properties. *Ibid*, p. 135
15. Liang, X., Wang, L., Li, B.J., Zhang, S. TiO_2-based coatings with self-healing capacity. *Ibid*, p. 147

Éva Fenyvesi

CycloLab Cyclodextrin R&D Laboratory, Ltd.

Budapest, HUNGARY

BIBLIOGRAPHY & KEYWORDS

1. CDs: Derivatives, Production, Enzymes, Toxicity

Cuong, N. P.; Lee, W.-H.; Oh, I.-N.; Thuy, N. M.; Kim, D.-G.; Park, J.-T.; Park, K.-H.

Continuous production of pure maltodextrin from cyclodextrin using immobilized *Pyrococcus furiosus* thermostable amylase

Packed-bed reactor, Enzyme immobilization, β-Cyclodextrin

Process Biochemistry, 2016, 51, 282-287; DOI:10.1016/j.procbio.2015.11.022

Dura, A.; Rosell, C. M.

Physico-chemical properties of corn starch modified with cyclodextrin glycosyltransferase

Porous starches, Enzymatic modification, Pasting properties

International Journal of Biological Macromolecules, 2016, 87, 466-472; DOI:10.1016/j.ijbiomac.2016.03.012

Khuntawee, W.; Rungrotmongkol, T.; Wolschann, P.; Pongsawasdi, P.; Kungwan, N.; Okumura, H.; Hannongbua, S.

Conformation study of ε-cyclodextrin: Replica exchange molecular dynamics simulations

Large-ring cyclodextrin, CD10, ε-Cyclodextrin, Flip (turn) of the glucose subunits within the macrocyclic ring

Carbohydrate Polymers, 2016, 141, 99-105; DOI:10.1016/j.carbpol.2015.10.018

Ma, D.-Y.; Zhang, Y.-M.; Xu, J.-N.

The synthesis and process optimization of sulfobutyl ether β-cyclodextrin derivatives

1,4-Butane sultone, Sodium hydroxide solution, Average degree of substitution, NMR, HRMS, Capillary electrophoresis

Tetrahedron, 2016, 72, 3105-3112; DOI:10.1016/j.tet.2016.04.039

Manakov, A. Y.; Rodionova, T. V.; Aladko, L. S.; Villevald, G. V.; Lipkowski, J. S.; Zelenina, L. N.; Chusova, T. P.; Karpova, T. D.

α-Cyclodextrin–water binary system. New data on dehydration of α-cyclodextrin hexahydrate

Phase transformations, Phase diagram, DTA, DSC, Vapor pressure

The Journal of Chemical Thermodynamics, 2016, 101, 251-259; DOI:10.1016/j.jct.2016.06.008

Manas, N. H. A.; Bakar, F. D. A.; Illias, R. M.

Computational docking, molecular dynamics simulation and subsite structure analysis of a maltogenic amylase from *Bacillus lehensis* G1 provide insights into substrate and

product specificity

Hydrolysis activity on β-cyclodextrin to produce maltose, Homology modeling

Journal of Molecular Graphics and Modelling, 2016, 67, 1-13; DOI:10.1016/j.jmgm.2016.04.004

Maronpot, R. R.; Hobbs, C. A.; Davis, J.; Swartz, C.; Boyle, M.; Koyanagi, M.; Hayashi, S.-M.

Genetic and rat toxicity studies of cyclodextrin glucanotransferase

Bacterial reverse mutation assay, In vitro micronucleus assay, Comet assay, Genotoxicity assays, Enzymatically modified isoquercitrin, Sodium sulfate

Toxicology Reports, 2016, 3, 381-392; DOI:10.1016/j.toxrep.2016.03.002

Matencio, A.; Alcaraz-Gómez, M.; Hernandez-Gil, C. G.; García-Carmona, F.; Arias, B.; López-Nicolás, J.

A novel HPLC–LS method to analyze hydroxypropyl-beta-cyclodextrin in urine. Application to child with Niemann–Pick disease, type C

New Biotechnology, 2016, 33, 417-418; DOI:10.1016/j.nbt.2015.10.011

Nuvoli, D.; Alzari, V.; Nuvoli, L.; Rassu, M.; Sanna, D.; Mariani, A.

Synthesis and characterization of poly(2-hydroxyethylacrylate)/β-cyclodextrin hydrogels obtained by frontal polymerization

Swelling properties, Glass transition temperatures, Compression test

Carbohydrate Polymers, 2016, 150, 166-171; DOI:10.1016/j.carbpol.2016.05.017

Pereira, A. B.; Krieger, N.; Mitchell, D. A.

Fingerprinting of oligosaccharide-hydrolyzing enzymes that catalyze branched reaction schemes

Hydrolysis of maltoheptaose by a β-amylase, Hydrolysis of β-1,6-N-acetylglucosamine oligomers by DispersinB, Hydrolysis of galacturonic acid oligomers by an endopolygalacturonase, Specificity constant, Processivity

Biochemical Engineering Journal, 2016, 113, 93-101; DOI:10.1016/j.bej.2016.05.012

Saallah, S.; Naim, M. N.; Lenggoro, I. W.; Mokhtar, M. N.; Bakar, N. F. A.; Gen, M.

Immobilisation of cyclodextrin glucanotransferase into polyvinyl alcohol (PVA) nanofibres via electrospinning

Glutaraldehyde

Biotechnology Reports, 2016, 10, 44-48; DOI:10.1016/j.btre.2016.03.003

Tabary, N.; Garcia-Fernandez, M. J.; Danède, F.; Descamps, M.; Martel, B.; Willart, J.-F.

Determination of the glass transition temperature of cyclodextrin polymers

Plasticizers, Trehalose, Mannitol, β-cyclodextrin polymers, Amorphous state, DSC, X-ray diffraction

Carbohydrate Polymers, 2016, 148, 172-180; DOI:10.1016/j.carbpol.2016.04.032

Xu, Q.; Cao, Y.; Li, X.; Liu, L.; Qin, S.; Wang, Y.; Cao, Y.; Xu, H.; Qiao, D.

Purification and characterization of a novel intracellular α-amylase with a wide

variety of substrates hydrolysis and transglycosylation activity from *Paenibacillus* sp. SSG-1

Glycoside hydrolase, Hydrolyzing glycogen/cyclodextrin/pullulan

Protein Expression and Purification, 2016, *In Press*; DOI:10.1016/j.pep.2016.04.007

Zhang, Y.; Peng, Y.; Bin, Z.; Wang, H.; Lu, H.

Highly specific purification of *N*-glycans using phosphate-based derivatization as an affinity tag in combination with Ti^{4+}-SPE enrichment for mass spectrometric analysis

N-glycome, Maltoheptaose, Sialylated glycan

Analytica Chimica Acta, 2016, *In Press*; DOI:10.1016/j.aca.2016.05.042

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

Dai, C.; Yang, Z.; Yang, H.; Liu, Y.; Fang, J.; Chen, W.; Li, W.; Zhao, M.

Micelle-to-vesicle transition induced by β-cyclodextrin in mixed catanionic surfactant solutions

1-Hexadecyl-3-methylimidazolium chloride, Sodium oleate

Colloids and Surfaces A: Physicochemical and Engineering Aspects, 2016, 498, 1-6; DOI:10.1016/j.colsurfa.2016.03.040

Mirrahimi, F.; Salahinejad, M.; Ghasemi, J. B.

QSPR approaches to elucidate the stability constants between β-cyclodextrin and some organic compounds: Docking based 3D conformer

Lowest binding free energy, Hydrophobicity, Surface area, Shape of guest molecules, Complexation

Journal of Molecular Liquids, 2016, 219, 1036-1043; DOI:10.1016/j.molliq.2016.04.037

Roy, A.; Saha, S.; Roy, M. N.

Study to explore host-guest inclusion complexes of cyclodextrins with biologically active molecules in aqueous environment

L-asparagine, L-aspartic acid, Hydrophobic effect, H-bonding, Electrostatic forces, Structural effects

Fluid Phase Equilibria, 2016, 425, 252-258; DOI:10.1016/j.fluid.2016.06.013

Roy, M. N.; Roy, A.; Saha, S.

Probing inclusion complexes of cyclodextrins with amino acids by physicochemical approach

l-Leucine, l-Isoleucine, α- and β-Cyclodextrins, Hydrophobic effect, H-bonds, Structural effects

Carbohydrate Polymers, 2016, 151, 458-466; DOI:10.1016/j.carbpol.2016.05.100

Sivakumar, K.; Ragi, T.; Prema, D.; Stalin, T.

Experimental and theoretical investigation on the structural characterization and orientation preferences of 2-hydroxy-1-naphthoic acid/β-cyclodextrin host-guest inclusion complex

Cyclic voltammetry, Diffusion coefficient, Electron transfer rate constant, HOMO-LUMO, Electrostatic potential maps

Journal of Molecular Liquids, 2016, 218, 538-548; DOI:10.1016/j.molliq.2016.03.004

Sun, R.; Bisoyi, H. K.; Xie, M.; Li, Q.

Photo and redox dual-stimuli-directed reversible disassembly and reassembly of linear supramolecular polymer formed by orthogonal host-guest molecular recognition

Azobenzene, β-Cyclodextrin, 4,4´-Bipyridinium, Sulfonatocalix[4]arene

Dyes and Pigments, 2016, 132, 336-341; DOI:10.1016/j.dyepig.2016.04.026

3. CDs in Drug Formulation

Aytac, Z.; Uyar, T.

Antioxidant activity and photostability of α-tocopherol/β-cyclodextrin inclusion complex encapsulated electrospun polycaprolactone nanofibers

Vitamin E, Phase solubility studies, Bead-free nanofibers

European Polymer Journal, 2016, 79, 140-149; DOI:10.1016/j.eurpolymj.2016.04.029

Erdoğar, N.; Esendağlı, G.; Nielsen, T. T.; Şen, M.; Öner, L.; Bilensoy, E.

Design and optimization of novel paclitaxel-loaded folate-conjugated amphiphilic cyclodextrin nanoparticles

Active targeting to folate positive breast tumors, Initial burst release, Longer sustained release, Factorial design, Cancer

International Journal of Pharmaceutics, 2016, 509, 375-390; DOI:10.1016/j.ijpharm.2016.05.040

Gan, T. J.; Singla, N.; Daniels, S. E.; Lacouture, P. G.; Min, L. H.; Reyes, C. R.; Carr, D. B.

Cardiovascular safety of hydroxypropyl-β-cyclodextrin–diclofenac in the management of acute postsurgical pain: A pooled analysis of 2 randomized, double-blind, placebo- and active comparator–controlled phase III clinical trials

Nonsteroidal anti-inflammatory drugs, HP-β-CD, No added CV safety risk over placebo, Postoperative pain, Orthopedic surgery

Journal of Clinical Anesthesia, 2016, 31, 249-258; DOI:10.1016/j.jclinane.2016.01.020

Ijaz, M.; Ahmad, M.; Akhtar, N.; Laffleur, F.; Bernkop-Schnürch, A.

Thiolated α-cyclodextrin: The invisible choice to prolong ocular drug residence time

Cysteamine-conjugated α-cyclodextrin, Cysteine-rich substructures of the ocular mucus layer, Cytotoxicity, Irritation-masking effects, Cetirizine

Journal of Pharmaceutical Sciences, 2016, *In Press*; DOI:10.1016/j.xphs.2016.04.021

Ijaz, M.; Griessinger, J. A.; Mahmood, A.; Laffleur, F.; Bernkop-Schnürch, A.

Thiolated cyclodextrin: Development of a mucoadhesive vaginal delivery system for acyclovir

Sodium periodate, Cysteamine, Porcine vaginal mucosa, β-CD-SH derivatives

Journal of Pharmaceutical Sciences, 2016, 105, 1714-1720; DOI:10.1016/j.xphs.2016.03.009

Ji, Q.; Qiu, L.

Mechanism study of PEGylated polyester and β-cyclodextrin integrated micelles on drug resistance reversal in MRP1-overexpressed HL60/ADR cells

β-Cyclodextrin, Polylactic acid, Polycaprolactone, Polyethylene glycol, Human acute myeloid leukemia cells, Cytotoxicity, Multidrug resistance protein 1

Colloids and Surfaces B: Biointerfaces, 2016, 144, 203-213; DOI:10.1016/j.colsurfb.2016.04.012

Kicuntod, J.; Khuntawee, W.; Wolschann, P.; Pongsawasdi, P.; Chavasiri, W.; Kungwan, N.; Rungrotmongkol, T.

Inclusion complexation of pinostrobin with various cyclodextrin derivatives

Fingerroot, Anti-oxidative, Anti-inflammatory, Anti-cancer properties, β-CD, 2-HP-β-CD, 6-HP-β-CD, 2,6-DHP-β-CD, 2,6-DM-β-CD, Molecular dynamics simulations, Phase solubility

Journal of Molecular Graphics and Modelling, 2016, 63, 91-98; DOI:10.1016/j.jmgm.2015.11.005

Kim, J. E.; Lee, J. B.; Lee, W. J.; Heo, D. N.; Bae, M. S.; Park, S. A.; Kim, W.; Jeong, S. I.; Yim, Y.-M.; Kwon, I. K.

Development of poly(ε-caprolactone) scaffold loaded with simvastatin and beta-cyclodextrin modified hydroxyapatite inclusion complex for bone tissue engineering

Nanomedicine: Nanotechnology, Biology and Medicine, 2016, 12, 496-497; DOI:10.1016/j.nano.2015.12.143

Li, Z.; Li, H.; Wang, C.; Xu, J.; Singh, V.; Chen, D.; Zhang, J.

Sodium dodecyl sulfate/β-cyclodextrin vesicles embedded in chitosan gel for insulin delivery with pH-selective release

Pepsin stability, Dilution, Sustained release, Self-assembly

Acta Pharmaceutica Sinica B, 2016, *In Press*; DOI:10.1016/j.apsb.2016.03.003

Liang, Y.; Gao, W.; Peng, X.; Deng, X.; Sun, C.; Wu, H.; He, B.

Near infrared light responsive hybrid nanoparticles for synergistic therapy

7-(Diethylamino)-4-(hydroxymethyl)-2H-chromen-2-one, β-Cyclodextrins, Doxorubicin, AU nanorods or nanoparticles, In vivo anticancer activity study on breast cancer bearing mice, Photosolvolysis

Biomaterials, 2016, 100, 76-90; DOI:10.1016/j.biomaterials.2016.05.023

Lima, P. S.; Lucchese, A. M.; Araújo-Filho, H. G.; Menezes, P. P.; Araújo, A. A.; Quintans-Júnior, L. J.; Quintans, J. S.

Inclusion of terpenes in cyclodextrins: Preparation, characterization and pharmacological approaches

Bioavailability, Review

Carbohydrate Polymers, 2016, 151, 965-987; DOI:10.1016/j.carbpol.2016.06.040

Liu, W.; Wang, Y.; Yao, J.; Shao, Z.; Chen, X.

Tamoxifen-loaded silk fibroin electrospun fibers

2-Hydroxypropyl-β-cyclodextrin, Polymeric composites, Electrospinning, Fiber technology, Drug-loading, Controlled release

Materials Letters, 2016, 178, 31-34; DOI:10.1016/j.matlet.2016.04.177

Loh, G. O. K.; Tan, Y. T. F.; Peh, K. K.

Enhancement of norfloxacin solubility via inclusion complexation with β-cyclodextrin and its derivative hydroxypropyl-β-cyclodextrin

Amorphous form, Solvent evaporation method, Dissolution rate

Asian Journal of Pharmaceutical Sciences, 2016, 11, 536-546; DOI:10.1016/j.ajps.2016.02.009

Luo, X.; Xu, G.; Wei, J.; Chen, M.; Zhang, H.; Li, X.

Tunable release of chemotherapeutic and vascular disrupting agents from injectable fiber fragments potentiates combination chemotherapy

Hydroxycamptothecin, Combretastatin A-4, Hydroxypropyl-β-cyclodextrin, Sustained release, Release of multiple drugs, Blood vessel disruption, Antitumor efficacy, Metastasis inhibition

International Journal of Pharmaceutics, 2016, 506, 1-12; DOI:10.1016/j.ijpharm.2016.04.037

Maestrelli, F.; Bragagni, M.; Mura, P.

Advanced formulations for improving therapies with anti-inflammatory or anaesthetic drugs: A review

Limiting risks of abuse, Local anaesthetics, corticosteroids and non steroidal anti-inflammatory drugs, Micro- and nanotechnologies in pain management, Cyclodextrin complexation

Journal of Drug Delivery Science and Technology, 2016, 32, Part B, 192-205; DOI:10.1016/j.jddst.2015.09.011

de Medeiros, A. S.; Zoppi, A.; Barbosa, E. G.; Oliveira, J. I.; Fernandes-Pedrosa, M. F.; Longhi, M. R.; da Silva-Júnior, A. A.

Supramolecular aggregates of oligosaccharides with co-solvents in ternary systems for the solubilizing approach of triamcinolone

β-Cyclodextrin, 2-Hydroxypropyl-β-cyclodextrin, Randomly methylated β-cyclodextrin, Triethanolamine, N-methyl pyrrolidone, Ternary complexes

Carbohydrate Polymers, 2016, 151, 1040-4051; DOI:10.1016/j.carbpol.2016.06.044

Mogoşanu, G. D.; Grumezescu, A. M.; Bejenaru, C.; Bejenaru, L. E.

Polymeric protective agents for nanoparticles in drug delivery and targeting

Dextran, β-Cyclodextrin, Chitosan, Hyaluronic acid, Heparin, Gelatin, PEGylation

International Journal of Pharmaceutics, 2016, *In Press*; DOI:10.1016/j.ijpharm.2016.03.014

Moreira, M. P.; Andrade, G. R. S.; de Araujo, M. V. G.; Kubota, T.; Gimenez, I. F.

Ternary cyclodextrin polyurethanes containing phosphate groups: Synthesis and complexation of ciprofloxacin

Hexamethylenediisocyanate, Microwave irradiation, Antibiotic, β-Cyclodextrin, β-Glycerophosphate

Carbohydrate Polymers, 2016, 151, 557-564; DOI:10.1016/j.carbpol.2016.05.101

Muankaew, C.; Jansook, P.; Sigurđsson, H. H.; Loftsson, T.

Cyclodextrin-based telmisartan ophthalmic suspension: Formulation development for water-insoluble drugs

Hydroxypropyl methylcellulose, Ternary complex, γ-cyclodextrin

International Journal of Pharmaceutics, 2016, 507, 21-31; DOI:10.1016/j.ijpharm.2016.04.071

Oliveira, M. G.; Brito, R. G.; Santos, P. L.; Araújo-Filho, H. G.; Quintans, J. S.; Menezes, P. P.; Serafini, M. R.; Carvalho, Y. M.; Silva, J. C.; Almeida, J. R.; Scotti, L.; Scotti, M. T.; Shanmugam, S.; Thangaraj, P.; Araújo, A. A.; Quintans-Júnior, L. J.

α-Terpineol, a monoterpene alcohol, complexed with β-cyclodextrin exerts antihyperalgesic effect in animal model for fibromyalgia aided with docking study

Non-inflammatory chronic muscle pain model, Naloxone, Ondansetron, Active opioid and serotonin receptors

Chemico-Biological Interactions, 2016, 254, 54-62; DOI:10.1016/j.cbi.2016.05.029

Prabha, G.; Raj, V.

Formation and characterization of β-cyclodextrin (β-CD) – polyethyleneglycol (PEG) – polyethyleneimine (PEI) coated Fe_3O_4 nanoparticles for loading and releasing 5-Fluorouracil drug

Zeta potential, Encapsulation efficiency, Cytotoxicity, Drug delivery

Biomedicine & Pharmacotherapy, 2016, 80, 173-182; DOI:10.1016/j.biopha.2016.03.015

Ren, Y.; Liu, Y.; Niu, R.; Liao, X.; Zhang, J.; Yang, B.

Host-guest inclusion system of oleanolic acid with methyl-β-cyclodextrin: Preparation, characterization and anticancer activity

Job plot, Cytotoxicity, Human cancer cell lines HepG2

Journal of Molecular Structure, 2016, 1117, 1-7; DOI:10.1016/j.molstruc.2016.03.071

Ren, Y.; Liu, Y.; Yang, Z.; Niu, R.; Gao, K.; Yang, B.; Liao, X.; Zhang, J.

Solid inclusion complexes of oleanolic acid with amino-appended β-cyclodextrins (ACDs): Preparation, characterization, water solubility and anticancer activity

Induction of apoptosis of cancer cells

Materials Science and Engineering: C, 2016, 69, 68-76; DOI:10.1016/j.msec.2016.05.022

Roy, M. N.; Saha, S.; Kundu, M.; Saha, B. C.; Barman, S.

Exploration of inclusion complexes of neurotransmitters with β-cyclodextrin by physicochemical techniques

Dopamine hydrochloride, Tyramine hydrochloride, (±)-Epinephrine hydrochloride

Chemical Physics Letters, 2016, 655–656, 43-50; DOI:10.1016/j.cplett.2016.05.031

Santos, P. L.; Brito, R. G.; Oliveira, M. A.; Quintans, J. S.; Guimarães, A. G.; Santos, M. R.; Menezes, P. P.; Serafini, M. R.; Menezes, I. R.; Coutinho, H. D.; Araújo, A. A.; Quintans-Júnior, L. J.

Docking, characterization and investigation of β-cyclodextrin complexed with citronellal, a monoterpene present in the essential oil of *Cymbopogon* species, as an anti-hyperalgesic agent in chronic muscle pain model

Pre-clinical in vivo study, Glutamatergetic system, c-Fos

Phytomedicine, 2016, 23, 948-957; DOI:10.1016/j.phymed.2016.06.007

Shams, W. M.; Sanio, C.; Quinlan, M. G.; Brake, W. G.

17β-Estradiol infusions into the dorsal striatum rapidly increase dorsal striatal dopamine release *in vivo*

Single-probe microdialysis, Medial prefrontal cortex, Substantia nigra, Amphetamine

Neuroscience, 2016, 330, 162-170; DOI:10.1016/j.neuroscience.2016.05.049

Shan, L.; Tao, E.; Liu, K.; Tang, J.; Zhang, W.

The characteristics and pharmacodynamics of chitosan/phospholipid/alpha-cyclodextrin microspheres

Nanomedicine: Nanotechnology, Biology and Medicine, 2016, 12, 563; DOI:10.1016/j.nano.2015.12.326

e Silva, A. C. S.; Teixeira, M. M.

ACE inhibition, ACE2 and angiotensin-(1–7) axis in kidney and cardiac inflammation and fibrosis

Hydroxypropyl-β-CD, Renin angiotensin system, Angiotensin converting enzyme 2, Mas receptor, Alamandine

Pharmacological Research, 2016, 107, 154-162; DOI:10.1016/j.phrs.2016.03.018

de Sousa, S. M. R.; Guimarães, L.; Ferrari, J. L.; De Almeida, W. B.; Nascimento Jr., C. S.

A DFT investigation on the host/guest inclusion process of prilocaine into β-cyclodextrin

Qualitative structure property relationship, Hydrogen bonds, Dispersion effect, Theoretical calculations

Chemical Physics Letters, 2016, 652, 123-129; DOI:10.1016/j.cplett.2016.04.053

Tarasi, R.; Khoobi, M.; Niknejad, H.; Ramazani, A.; Ma'mani, L.; Bahadorikhalili, S.; Shafiee, A.

β-Cyclodextrin functionalized poly (5-amidoisophthalicacid) grafted Fe_3O_4 magnetic nanoparticles: A novel biocompatible nanocomposite for targeted docetaxel delivery

Thiol-lactam initiated radical polymerization, Carbodiimide activation, Tumor-targeting folic acid, Cell viability, Intracellular uptake ability, Superparamagnetic iron oxide

Journal of Magnetism and Magnetic Materials, 2016, 417, 451-459; DOI:10.1016/j.jmmm.2016.05.080

Thi, T. T. N.; Tran, T. V.; Tran, N. Q.; Nguyen, C. K.; Nguyen, D. H.

Hierarchical self-assembly of heparin-PEG end-capped porous silica as a redox sensitive nanocarrier for doxorubicin delivery

Adamantylamine, Initial burst effect, Self-assembly, Disulfide bond, Cyclodextrin, Host-

guest complex

Materials Science and Engineering: C, 2016, *In Press*; DOI:10.1016/j.msec.2016.04.085

Xu, J.; Xu, B.; Gao, J.; Liang, W.; Hu, Y.

Preparation and evaluation of folic acid receptor-targeted cyclodextrin complexes for anticancer drug delivery system

Nanomedicine: Nanotechnology, Biology and Medicine, 2016, 12, 541; DOI:10.1016/j.nano.2015.12.264

Yankovsky, I.; Bastien, E.; Yakovets, I.; Khludeyev, I.; Lassalle, H.-P.; Gräfe, S.; Bezdetnaya, L.; Zorin, V.

Inclusion complexation with β-cyclodextrin derivatives alters photodynamic activity and biodistribution of meta-tetra(hydroxyphenyl)chlorin

Methyl-β-cyclodextrin, 2-Hydroxypropyl-β-cyclodextrin, HT29 tumor bearing mice, Aggregation, Photosensitizer

European Journal of Pharmaceutical Sciences, 2016, 91, 172-182; DOI:10.1016/j.ejps.2016.06.012

Zhang, J.-Q.; Jiang, K.-M.; Xie, X.-G.; Jin, Y.; Lin, J.

Water-soluble inclusion complexes of trans-polydatin by cyclodextrin complexation: Preparation, characterization and bioactivity evaluation

β-CD, γ-CD, Bioavailability, Naturally occuring hydrophobic polyphenolic compounds

Journal of Molecular Liquids, 2016, 219, 592-598; DOI:10.1016/j.molliq.2016.03.054

Zhang, P.; Liu, X.; Hu, W.; Bai, Y.; Zhang, L.

Preparation and evaluation of naringenin-loaded sulfobutylether-β-cyclodextrin/chitosan nanoparticles for ocular drug delivery

Ionic gelation of chitosan with SBE-β-CD, Moderate sustained-release effect, Nonirritating

Carbohydrate Polymers, 2016, 149, 224-230; DOI:10.1016/j.carbpol.2016.04.115

Zhao, H.; Gao, J.; Liu, R.; Zhao, S.

Stimulus-responsiveness and methyl violet release behaviors of poly(NIPAAm-co-AA) hydrogels chemically crosslinked with β-cyclodextrin polymer bearing methacrylates

N-isopropylacrylamide, Acrylic acid, UV-initiated free radical polymerization, Controlled release, Thermo- and pH-sensitive hydrogels, Swelling ratio, Controlled release carriers

Carbohydrate Research, 2016, 428, 79-86; DOI:10.1016/j.carres.2016.04.018

4. CDs in Cell Biology

Denz, M.; Haralampiev, I.; Schiller, S.; Szente, L.; Herrmann, A.; Huster, D.; Müller, P.

Interaction of fluorescent phospholipids with cyclodextrins

Methylated α-, β- and γ-cyclodextrins, NBD, BODIPY, Membrane structure, Membrane dynamics

Chemistry and Physics of Lipids, 2016, 194, 37-48; DOI:10.1016/j.chemphyslip.2015.07.017

Feng, Q.; Wei, K.; Lin, S.; Xu, Z.; Sun, Y.; Shi, P.; Li, G.; Bian, L.

Mechanically resilient, injectable, and bioadhesive supramolecular gelatin hydrogels crosslinked by weak host-guest interactions assist cell infiltration and *in situ* tissue regeneration

Aromatic residues of gelatin, Photo-crosslinkable acrylated β-cyclodextrin, Self healing, Hydrogel-tissue adhesion, Hydrophobic drugs, Bone regeneration, Biomaterial carrier

Biomaterials, 2016, 101, 217-228; DOI:10.1016/j.biomaterials.2016.05.043

García-Robles, A. A.; Company-Albir, M. J.; Megías-Vericat, J. E.; Fernández-Megía, M. J.; Pérez-Miralles, F. C.; López-Briz, E.; Alcalá-Vicente, C.; Galeano, I.; Casanova, B.; Poveda, J. L.

Use of 2 hydroxypropyl-beta-cyclodextrin therapy in two adult Niemann Pick Type C patients

Toxicity, Intrathecal

Journal of the Neurological Sciences, 2016, 366, 65-67; DOI:10.1016/j.jns.2016.04.048

Gutierrez, E. M.; Seebacher, N. A.; Arzuman, L.; Kovacevic, Z.; Lane, D. J.; Richardson, V.; Merlot, A. M.; Lok, H.; Kalinowski, D. S.; Sahni, S.; Jansson, P. J.; Richardson, D. R.

Lysosomal membrane stability plays a major role in the cytotoxic activity of the anti-proliferative agent, di-2-pyridylketone 4,4-dimethyl-3-thiosemicarbazone (Dp44mT)

Reactive oxygen species, Cholesterol extraction using methyl-β-cyclodextrin, Lysosomal membrane permeabilization, Autophagy

Biochimica et Biophysica Acta (BBA) - Molecular Cell Research, 2016, 1863, 1665-1681; DOI:10.1016/j.bbamcr.2016.04.017

Ikonen, E.; Blom, T.

Lipoprotein-mediated delivery of BODIPY-labeled sterol and sphingolipid analogs reveals lipid transport mechanisms in mammalian cells

Controlling plasma cholesterol levels

Chemistry and Physics of Lipids, 2016, 194, 29-36; DOI:10.1016/j.chemphyslip.2015.08.013

Inanc, M. E.; Uysal, O.; Ata, A.

Cryopreservation and evaluation of Akkaraman ram semen with cholesterol and 7-dehydrocholesterol loaded cyclodextrin

Animal Reproduction Science, 2016, 169, 107; DOI:10.1016/j.anireprosci.2016.03.035

Kondo, Y.; Tokumaru, H.; Ishitsuka, Y.; Matsumoto, T.; Taguchi, M.; Motoyama, K.; Higashi, T.; Arima, H.; Matsuo, M.; Higaki, K.; Ohno, K.; Irie, T.

***In vitro* evaluation of 2-hydroxyalkylated β-cyclodextrins as potential therapeutic agents for Niemann-Pick Type C disease**

Dysfunctional intracellular cholesterol trafficking, 2-Hydroxyethyl-β-cyclodextrin, 2-Hydroxybutyl-β-cyclodextrin, 2-Hydroxypropyl-β-cyclodextrin

Molecular Genetics and Metabolism, 2016, 118, 214-219; DOI:10.1016/j.ymgme.2016.04.014

Li, W.; Liu, H.; Liu, P.; Yin, D.; Zhang, S.; Zhao, J.

Sphingosylphosphorylcholine promotes the differentiation of resident Sca-1 positive

cardiac stem cells to cardiomyocytes through lipid raft/JNK/STAT3 and β-catenin signaling pathways

β-Cyclodextrin as a lipid raft breaker

Biochimica et Biophysica Acta (BBA) - Molecular Cell Research, 2016, 1863, 1579-1588; DOI:10.1016/j.bbamcr.2016.04.006

Odnoshivkina, Y. G.; Sytchev, V. I.; Petrov, A. M.

Cholesterol regulates contractility and inotropic response to β2-adrenoceptor agonist in the mouse atria: Involvement of Gi-protein–Akt–NO-pathway

Cholesterol depletion with methyl-β-cyclodextrin, NO-synthase, Signaling, Ca^{2+}, Fenoterol

Journal of Molecular and Cellular Cardiology, 2016, *In Press*; DOI:10.1016/j.yjmcc.2016.05.001

Parks, A.; Marceau, F.

Lysosomotropic cationic drugs induce cytostatic and cytotoxic effects: Role of liposolubility and autophagic flux and antagonism by cholesterol ablation

Chloroquine, Hydroxychloroquine, Amiodarone, Quinacrine, Lidocaine, Procainamide, Inhibitors of cholesterol, β-cyclodextrin or lovastatin, Antiproliferative effect, Cation trapping

Toxicology and Applied Pharmacology, 2016, 305, 55-65; DOI:10.1016/j.taap.2016.06.006

Ridi, R. E.; Tallima, H.; Migliardo, F.

Biochemical and biophysical methodologies open the road for effective schistosomiasis therapy and vaccination

Extraction of surface membrane cholesterol by methyl-β-cyclodextrin, Sphingomyelin, Arachidonic acid, Hydrogen bond barrier, Elastic incoherent and quasi-elastic neutron scattering

Biochimica et Biophysica Acta (BBA) - General Subjects, 2016, *In Press*; DOI:10.1016/j.bbagen.2016.03.036

Saybolt, M.; Anwaruddin, S.; Hamamdzic, D.; Schaer, T. P.; Wilensky, R.

Cyclodextrins affect positive arterial wall remodeling in atherosclerotic injury model

Journal of the American College of Cardiology, 2016, 67, 164; DOI:10.1016/S0735-1097(16)30165-6

5. CDs in Food, Cosmetics and Agrochemicals

Aree, T.; Jongrungruangchok, S.

Enhancement of antioxidant activity of green tea epicatechins in β-cyclodextrin cavity: Single-crystal X-ray analysis, DFT calculation and DPPH assay

(−)-Epicatechin, (−)-Epigallocatechin, (−)-Epicatechin gallate, (−)-Epigallocatechin gallate

Carbohydrate Polymers, 2016, 151, 1139-1151; DOI:10.1016/j.carbpol.2016.05.113

Cheong, A. M.; Nyam, K. L.

Improvement of physical stability of kenaf seed oil-in-water nanoemulsions by addition of β-cyclodextrin to primary emulsion containing sodium caseinate and Tween 20

Hibiscus cannabinus L., High pressure homogenization

Journal of Food Engineering, 2016, 183, 24-31; DOI:10.1016/j.jfoodeng.2016.03.012

Cheong, A. M.; Tan, C. P.; Nyam, K. L.

In vitro evaluation of the structural and bioaccessibility of kenaf seed oil nanoemulsions stabilised by binary emulsifiers and β-cyclodextrin complexes

Two-stage dynamic in vitro digestion, Total phenolic contents, Hibiscus cannabinus L., Lipolysis, Tocopherols, Phytosterols

Journal of Food Engineering, 2016, 189, 90-98; DOI:10.1016/j.jfoodeng.2016.06.002

Valarini Jr., O.; Dantas, J. H.; Barão, C. E.; Zanoelo, E. F.; Cardozo-Filho, L.; de Moraes, F. F.

Formation of inclusion compounds of (+)catechin with β-cyclodextrin in different complexation media: Spectral, thermal and antioxidant properties

Maceration without solvent, by involving hexane and supercritical carbon dioxide as complexation media

The Journal of Supercritical Fluids, 2016, *In Press*; DOI:10.1016/j.supflu.2016.06.005

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

Release studies of trans-anethole from β-cyclodextrin solid inclusion complexes by Multiple Headspace Extraction

Freeze-drying, Co-precipitation, Loading capacity, Encapsulation efficiency, Effect of the preparation method, temperature and humidity

Carbohydrate Polymers, 2016, *In Press*; DOI:10.1016/j.carbpol.2016.06.079

Li, Y.; Chen, Y.; Li, H.

Recovery and purification of cholesterol from cholesterol-β-cyclodextrin inclusion complex using ultrasound-assisted extraction

Duck yolk oil, Reflux extraction, Soxhlet extraction, Response surface methodology, Optimization

Ultrasonics Sonochemistry, 2017, 34, 281-288; DOI:10.1016/j.ultsonch.2016.05.032

de Lima Petito, N.; da Silva Dias, D.; Costa, V. G.; Falcão, D. Q.; de Lima Araujo, K. G.

Increasing solubility of red bell pepper carotenoids by complexation with 2-hydroxypropyl-β-cyclodextrin

Natural pigment in food, Bioactive substances

Food Chemistry, 2016, 208, 124-131; DOI:10.1016/j.foodchem.2016.03.122

Mallardo, S.; Vito, V. D.; Malinconico, M.; Volpe, M. G.; Santagata, G.; Lorenzo, M. L. D.

Poly(butylene succinate)-based composites containing β-cyclodextrin/d-limonene inclusion complex

Bioactive food packaging, Melt compounding, Phase separated morphology, Thermal stabilization

European Polymer Journal, 2016, 79, 82-96; DOI:10.1016/j.eurpolymj.2016.04.024

Yim, W. T.; Bhandari, B.; Jackson, L.; James, P.

Repellent effects of *Melaleuca alternifolia* (tea tree) oil against cattle tick larvae (*Rhipicephalus australis*) when formulated as emulsions and in β-cyclodextrin inclusion complexes

Acaricides, Resistance, Microparticles, Controlled release

Veterinary Parasitology, 2016, 225, 99-103; DOI:10.1016/j.vetpar.2016.06.007

Yuan, C.; Du, L.; Zhang, G.; Jin, Z.; Liu, H.

Influence of cyclodextrins on texture behavior and freeze-thaw stability of kappa-carrageenan gel

Hardness, Springiness, Gumminess, Gel network

Food Chemistry, 2016, 210, 600-605; DOI:10.1016/j.foodchem.2016.05.014

6. CDs for other Industrial Applications

Charles, J.; Bradu, C.; Morin-Crini, N.; Sancey, B.; Winterton, P.; Torri, G.; Badot, P.-M.; Crini, G.

Pollutant removal from industrial discharge water using individual and combined effects of adsorption and ion-exchange processes: Chemical abatement

Cross-linked polysaccharide-based biosorbents (starch and cyclodextrin), Cyclodextrin polymer, Removing organic and metallic pollutants, Polycontaminated effluent

Journal of Saudi Chemical Society, 2016, 20, 185-194; DOI:10.1016/j.jscs.2013.03.007

Dindulkar, S. D.; Jeong, D.; Kim, H.; Jung, S.

Functionalized β-cyclodextrin as supramolecular ligand and their $Pd(OAc)_2$ complex: Highly efficient and reusable catalyst for Mizoroki–Heck cross-coupling reactions in aqueous medium

Iodo- and bromo-arenes, Recyclability, Operational simplicity

Carbohydrate Research, 2016, 430, 85-94; DOI:10.1016/j.carres.2016.04.024

El-Kafrawy, A. F.; El-Saeed, S. M.; Farag, R. K.; El-Saied, H. A.-A.; Abdel-Raouf, M. E.-S.

Adsorbents based on natural polymers for removal of some heavy metals from aqueous solution

Carboxymethyl-β-cyclodextrin, poly(ethylene glycol)-β-cyclodextrin and their magnetic counterparts, Copper, Lead

Egyptian Journal of Petroleum, 2016, *In Press*; DOI:10.1016/j.ejpe.2016.02.007

Haw, C.; Chiu, W.; Khanis, N. H.; Rahman, S. A.; Khiew, P.; Radiman, S.; Abd-Shukor, R.; Hamid, M. A. A.

Tin stearate organometallic precursor prepared SnO_2 quantum dots nanopowder for aqueous- and non-aqueous medium photocatalytic hydrogen gas evolution

QDs highly water soluble, β-CD, Ligand exchange

Journal of Energy Chemistry, 2016, *In Press*; DOI:10.1016/j.jechem.2016.04.006

He, Y.; Zhang, C.; Wu, F.; Xu, Z.

Fabrication study of a new anticorrosion coating based on supramolecular nanocontainer

Multi-walled carbon nanotubes, β-Cyclodextrin, Self-healing, Encapsulated corrosion inhibitor

Synthetic Metals, 2016, 212, 186-194; DOI:10.1016/j.synthmet.2015.10.022

He, Y.-C.; Tao, Z.-C.; Di, J.-H.; Chen, L.; Zhang, L.-B.; Zhang, D.-P.; Chong, G.-G.; Liu, F.; Ding, Y.; Jiang, C.-X.; Ma, C.-L.

Effective asymmetric bioreduction of ethyl 4-chloro-3-oxobutanoate to ethyl (*R*)-4-chloro-3-hydroxybutanoate by recombinant *E. coli* CCZU-A13 in [Bmim]PF_6-hydrolyzate media

HP-β-cyclodextrin, Enhancing the biosynthesis

Bioresource Technology, 2016, 214, 411-418; DOI:10.1016/j.biortech.2016.04.134

Hu, J.; Wang, Y.; Su, X.; Yu, C.; Qin, Z.; Wang, H.; Hashmi, M. Z.; Shi, J.; Shen, C.

Effects of RAMEB and/or mechanical mixing on the bioavailability and biodegradation of PCBs in soil/slurry

tri-CBs, tetra-CBs, Highly chlorinated polychlorinated biphenyls (PCBs), Bacterial communities

Chemosphere, 2016, 155, 479-487; DOI:10.1016/j.chemosphere.2016.04.084

Kaboudin, B.; Salemi, H.; Mostafalu, R.; Kazemi, F.; Yokomatsu, T.

Pd(II)-β-cyclodextrin complex: Synthesis, characterization and efficient nanocatalyst for the selective Suzuki-Miyaura coupling reaction in water

Aryl boronic acids, Aryl halides, Synthesis of unsymmetrical biaryls

Journal of Organometallic Chemistry, 2016, *In Press*; DOI:10.1016/j.jorganchem.2016.06.007

Mathew, A.; Parambadath, S.; Barnabas, M. J.; Kim, S. Y.; Kim, D. W.; Rao, K. M.; Park, S. S.; Ha, C.-S.

Snap-top nanocontainer for selective recovery of nickel ions from seawater

β-Cyclodextrin, Gatekeeper, Step wise adsorption studies, MCM-41, Cryptate

Microporous and Mesoporous Materials, 2016, *In Press*; DOI:10.1016/j.micromeso.2016.04.033

Rosa, Y. M. L.; Busto, M. D.; Ortega, N.; Pilar-Izquierdo, M. C.; Palacios, D.; Gómez-Ramos, S.

Immobilization of lipases from *Rhizomucor miehei* in β-cyclodextrin polymers: Pretreatment with olive oil and operational stability in esterification reactions

New Biotechnology, 2016, 33, 429; DOI:10.1016/j.nbt.2015.10.044

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

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

Benzaldehyde, Glycol

Chinese Journal of Chemical Engineering, 2016, 24, 146-150; DOI:10.1016/j.cjche.2015.06.008

Xiong, Z.; Lin, H.; Liu, F.; Yu, X.; Wang, Y.; Wang, Y.

A new strategy to simultaneously improve the permeability, heat-deformation resistance and antifouling properties of polylactide membrane via bio-based β-cyclodextrin and surface crosslinking

Bio-based pore forming agent β-cyclodextrin, Protein resistance, Heat-deformation resistance, Crystallization, Fouling resistance

Journal of Membrane Science, 2016, 513, 166-176; DOI:10.1016/j.memsci.2016.04.036

Zhang, J.; Xu, D.; Qian, W.; Zhu, J.; Yan, F.

Host–guest inclusion complexes derived heteroatom-doped porous carbon materials

Carbonization, Nitrogen-doped porous carbon material, Supercapacitors electrode

Carbon, 2016, 105, 183-190; DOI:10.1016/j.carbon.2016.04.034

7. CDs in Sensing and Analysis

Badea, S.-L.; Niculescu, V. C.; Ionete, R.-E.; Eljarrat, E.

Advances in enantioselective analysis of chiral brominated flame retardants. Current status, limitations and future perspectives

Chiral stationary phases, Permethylated β-cyclodextrin, Hexabromocyclododecane

Science of The Total Environment, 2016, *In Press*; DOI:10.1016/j.scitotenv.2016.05.148

Cagliero, C.; Galli, S.; Galli, M.; Elmi, I.; Belluce, M.; Zampolli, S.; Sgorbini, B.; Rubiolo, P.; Bicchi, C.

Conventional and enantioselective gas chromatography with microfabricated planar columns for analysis of real-world samples of plant volatile fraction

Planar columns coated with a cyclodextrin derivative 6I–VII-O-TBDMS-3I–VII-O-ethyl-2I–VII-O-ethyl-β-cyclodextrin, Micro-GC, Planar columns, Essential oils, Headspace sampling

Journal of Chromatography A, 2016, 1429, 329-339; DOI:10.1016/j.chroma.2015.12.037

Duan, H.; Wang, X.; Wang, Y.; Sun, Y.; Li, J.; Luo, C.

An ultrasensitive lysozyme chemiluminescence biosensor based on surface molecular imprinting using ionic liquid modified magnetic graphene oxide/β-cyclodextrin as supporting material

Ionic liquid modified Fe_3O_4@dopamine/graphene oxide/β-cyclodextrin, Surface molecularly imprinted polymer, Multiple binding sites, Langmuir isotherm

Analytica Chimica Acta, 2016, 918, 89-96; DOI:10.1016/j.aca.2016.03.008

Ghanem, A.; Adly, F. G.; Sokerik, Y.; Antwi, N. Y.; Shenashen, M. A.; El-Safty, S. A.

Trimethyl-β-cyclodextrin-encapsulated monolithic capillary columns: Preparation, characterization and chiral nano-LC application

Reversed-phase chiral nano-liquid chromatography, In situ encapsulation approach, Enantioseparation

Talanta, 2016, *In Press*; DOI:10.1016/j.talanta.2016.06.027

Kim, S. H.; Sharker, S. M.; In, I.; Park, S. Y.

Surface patterned pH-sensitive fluorescence using β-cyclodextrin functionalized poly(ethylene glycol)

pH Fluorescent sensor, Phenylboronic acid, Rhodamine-CD complex

Carbohydrate Polymers, 2016, 147, 436-443; DOI:10.1016/j.carbpol.2016.04.036

Liu, Z.; Xue, Q.; Guo, Y.

Sensitive electrochemical detection of rutin and isoquercitrin based on SH-β-cyclodextrin functionalized graphene-palladium nanoparticles

Electric conductivity and electrocatalytic activity of graphene, Host-guest recognition, Pharmaceuticals or human serum

Biosensors and Bioelectronics, 2016, *In Press*; DOI:10.1016/j.bios.2016.04.056

Mauri-Aucejo, A.; Amorós, P.; Moragues, A.; Guillem, C.; Belenguer-Sapiña, C.

Comparison of the solid-phase extraction efficiency of a bounded and an included cyclodextrin-silica microporous composite for polycyclic aromatic hydrocarbons determination in water samples

Cyclodextrin-silica bounding, Preconcentration

Talanta, 2016, 156–157, 95-103; DOI:10.1016/j.talanta.2016.05.011

Mohandoss, S.; Sivakamavalli, J.; Vaseeharan, B.; Stalin, T.

Host-guest molecular recognition based fluorescence on-off-on chemosensor for nanomolar level detection of Cu^{2+} and $Cr_2O_7^{2-}$ ions: Application in XNOR logic gate and human lung cancer living cell imaging

1,5-Dihydroxyanthraquinone, β-Cyclodextrin, Colorimetric recognition, Fluorescence quenching, Bio-imaging fluorescent probe, Inclusion complex, Molecular docking, DFT calculation

Sensors and Actuators B: Chemical, 2016, 234, 300-315; DOI:10.1016/j.snb.2016.04.148

Pérez-Míguez, R.; Marina, M. L.; Castro-Puyana, M.

Enantiomeric separation of non-protein amino acids by electrokinetic chromatography

Anionic cyclodextrins as chiral selectors, Sulfated-α-CD, Sulfated-γ-CD, Citrulline, Food supplements

Journal of Chromatography A, 2016, *In Press*; DOI:10.1016/j.chroma.2016.06.058

Rong, L.; Liu, Q.; Wang, J.; Zeng, H.; Yang, H.; Chen, X.

Enantioseparation of (*RS*)-ibuprofen by closed recycling high-speed counter-current chromatography using hydroxypropyl-β-cyclodextrin as chiral selector

Closed recycling elution mode, Two-phase solvent system

Tetrahedron: Asymmetry, 2016, 27, 301-306; DOI:10.1016/j.tetasy.2016.03.001

Song, K.; Kai, R.; Lu, C.; Gao, L.; Wang, G.; Guo, L.

Towards two up-conversion optical sensing systems for cysteine detection: Synthesis, characterization and sensing performance

Rhodamine derivatives as chemosensors, Sulfur substituent effect

Sensors and Actuators B: Chemical, 2016, 236, 249-256; DOI:10.1016/j.snb.2016.06.005

Yan, Z.; Ma, H.; Fan, D.; Hu, L.; Pang, X.; Gao, J.; Wei, Q.; Wang, Q.

An ultrasensitive sandwich-type electrochemical immunosensor for carcino embryonie antigen based on supermolecular labeling strategy

β-CDs functionalized multiwalled carbon nanotube, Adamantanecarboxylic acid, Ferrocenecarboxylic acid, Magnetic $Fe_3O_4@SiO_2$ *core-shell nanoparticles, Host-guest recognition*

Journal of Electroanalytical Chemistry, 2016, *In Press*; DOI:10.1016/j.jelechem.2016.05.043

Yu, P.; Zhang, X.; Xiong, E.; Zhou, J.; Li, X.; Chen, J.

A label-free and cascaded dual-signaling amplified electrochemical aptasensing platform for sensitive prion assay

Transmissible spongiform encephalopathies, Ferrocenecarboxylic acid, Competitive guest of β-cyclodextrin, Rhodamine B, Ordered mesoporous carbon, Exonuclease III

Biosensors and Bioelectronics, 2016, 85, 471-478; DOI:10.1016/j.bios.2016.05.047

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