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CDs AGAINST CHEMICAL WEAPONS

The chemical weapons have got again into the focus of interest after the chemical attack in Syria in August. United Nations inspectors have confirmed that the nerve agent sarin was used.

Another reason to write on chemical warfares is that the Nobel Peace Prize of 2013 has been awarded to the Organisation for the Prohibition of Chemical Weapons (OPCW) "for its extensive efforts to eliminate chemical weapons". The OPCW came into existence in 1997, when the first 100 nations signed the Chemical Weapons Convention (CWC). Since then the OPCW has worked to check the implementation of the CWC. Today there are just four nations that have not signed: Angola, Egypt, North Korea and South Sudan. (Syria signed in September.) A further two nations have signed but not ratified the convention: Israel and Myanmar.

According to the CWC, any toxic chemical, regardless of its origin, is considered a chemical weapon unless it is used for purposes that are not prohibited. One of the major categories is that of the nerve agents (such as sarin, soman, cyclohexylsarin, tabun, VX) (Fig. 1). Vesicating or blistering agents (such as mustards) are also well known for the public (Fig. 2).

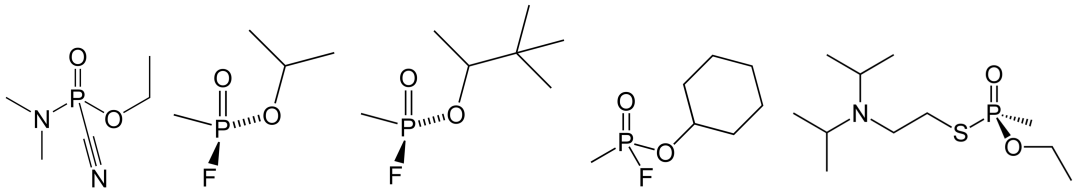

Figure 1: Chemical formulas of the organophosphorous nerve agents (OPs): tabun (GA), sarin (GB), soman (GD), cyclohexylsarin (GF) and VX

Figure 2: Chemical formulae of sulfur mustard (mustard gas) and O-mustard

Organophosphorus nerve agents (OPs) are irreversible inhibitors of acetylcholinesterase (AcChE) [1]. The symptoms after exposure to a nerve agent include shortness of breath, disorientation, runny nose, eye irritation, blurred vision, nausea, vomiting, general weakness, and eventual loss of consciousness. Large inhalation exposures are likely to kill people immediately.

Mustards are good alkylating agents. They alkylate DNA and induce programmed cell death (apoptosis). They are mutagenic, carcinogenic and cause severe skin, eye and mucosal pain and irritation. Within 24 hours of exposure, victims experience intense itching and skin irritation, which gradually turns into large blisters filled with yellow fluid wherever the mustard agent contacted the skin [2]. Exposure to high doses can be fatal.

There are not so many possibilities to treat people exposed to chemical warfare. Atropine and pralidoxime chloride are antidotes for nerve agent toxicity; however, pralidoxime must be administered within minutes to a few hours following exposure (depending on the specific agent) to be effective. Treatment consists of supportive measures and repeated administration of antidotes. Applying bioscavangers, such as AcChE and some other esterases is a novel approach, but these proteins have low stability and efficiency [3].

Current treatment of nerve agent and mustard poisoning has limited efficacy and more efficient medical countermeasures need to be developed that provide higher survival rates, eliminate or reduce enduring adverse effects to survivors, and significantly reduce or eliminate the need for repeated administration of therapeutic drugs.

How can CDs help against nerve agents and mustard?

Catalysing the inactivation

It has been known already since 1970 from the works of van Hooidonk *et al*. that similarly to esterases CDs catalyse the hydrolysis of phosphates and phosphonates including also the nerve agents [4]. While αCD was found effective for sarin [5], βCD catalyzed the degradation of soman [6]. None of them inactivated tabun and VX [7].

Much better results were obtained with derivatives of βCD containing nucleophilic substituent iodosobenzoic acid (IBA, Fig. 3) or oxim [8,9]. The nerve agent trapped by the

CD cavity reacts with the nucleophilic group previously grafted on the CD and cleaves the P-X (N, F, S) bond.

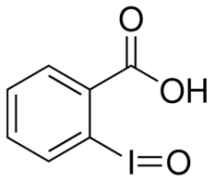

Figure 3: Chemical formula of iodosobenzoic acid (IBA)

All the tested G-type agents were efficiently degraded in the presence of βCD-IBA. In addition, enantioselective degradation of cyclosarin (GF) was observed [10].

The ability of CD-IBA to detoxify various nerve agents decreased in the order cyclosarin > sarin > tabun >> VX. No detoxification of VX could be detected [11]. Recently the IBA-βCD was further modified by an imidazole group on the glucopyranose moiety adjacent to that with IBA [12]. The imidazole substituent deprotonates IBA to transform it to anionic form thus mimicking the mechanism of some hydrolases.

HPBCD can solubilize sarin simulant trimethyl phosphate (TMP), mustard simulant 2-chloroethyl ethyl sulfide (2-CEES) and methyl parathion. In the presence of HPBCD/IBA complex a part of CEES was hydrolyzed and the other part of CEES was oxidized by IBA inside of the complex. The complex was successfully applied for decomposition of disiopropyl fluorophosphates (DFP), an organophosphorous insecticide used earlier mixed with mustard as chemical warfare agent. The mechanism is P-F cleavage, after DFP molecules entered into the cavity of HPBCD [13].

Protective wear is proposed based on functionalized polymer nanofibre membranes from PVC polymer fabricated with βCD, IBA, a blend of βCD + IBA, and IBA-substituted βCD. These functionalized nanofibres were found effective for the decontamination of paraoxon, a nerve agent stimulant [14].

As βCD-IBA cannot detoxify tabun, another CD derivative: CD substituted with hydroxamic acid (CDHA) was synthesized [15]. βCD derivatives monosubstituted by a 2-pyridin-aldoxime moiety at O-2 position proved to be able to hydrolyse tabun [9]. The highest activity was observed for a βCD containing a 4-formylpyridinium oxime residue in O-6-position of one glucose subunit. Comparison of the activity of this compound with that of an analogue in which the cyclodextrin ring was replaced by a glucose residue

demonstrated that the cyclodextrin is not necessary for activity but beneficial. The mode of action of the cyclodextrin involves covalent modification of its oxime group rendering the scavenger inactive after reaction with the tabun molecule [16,17]. Covalently bound soman-βCD conjugate was found by FAB/MS and FAB/MS/MS as the main product identified from the reaction of βCD and soman, as well [18].

Artificial enzymes based on CDs were patented as catalytic coating for the degradation of chemical warfare agents [19].

Solubilizing and stabilizing the drugs against poisoning by nerve agents

Pyridostigmine bromide, a potent anticholinesterase drug [20] and ondansetron used against vomiting [21] as a cure for symptoms caused by nerve agents were complexed by CD to obtain formulations with improved stability, bioavailability and taste.

Enantioselective analysis of nerve agents

The chiral analysis of nerve agents is important because there exist significant differences in the reported toxicity and AChE inhibition rates of the various stereoisomers. All four stereoisomers of soman, and the two-two isomers of the other nerve agents were successfully resolved on 2,6-di-O-pentyl-3-O-butyryl γCD staztionary phase [22,23].

A fast, sensitive and easily applicable GC-MS assay was developed for the chiral quantification of tabun and VX, respectively, in biological samples using βCD capillary column (Supelco BetaDex 225) and Hydrodex-β-TBDAc column [24,25].

A sensitive, stochastic nanopore-based analytical method was described for the detection of cyclohexyl methylphosphonic acid (CMPA) and pinacolyl methylphosphonate (PMPA), hydrolytes of nerve agents soman and cyclosarin, resp. The method uses a multi-functionalized α-hemolysin protein ion channel as the sensing element, with a host molecule βCD lodged in the lumen of the channel as a molecular adapter. The capture and release of CMPA/PMPA by the βCD host caused current modulations in the nanopore [26]. Sarin, tabun, and VX hydrolysis products, as well as other common pesticides, do not interfere with detection of the analytes [27].

The properly designed CD derivatives can effectively detoxify the nerve agents. The most active CDs could be immobilized on textiles in order to develop protective equipments [28]. They could be also used by injection to treat intoxicated persons, or to design hemofilters for an out-patient detoxification by an extra-corporeal treatment. Thus, these various scavengers devices could be applied at various stages after an attack by chemical warfare agents.

In addition to detoxification, CDs can be used in the traditional way for improving the formulations of the antidotes and other drugs used for relief of the symptoms after a chemical attack. The CD-containing stationary phases and nanopores are useful in the analysis of nerve agents.

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Cyclodextrin Nanosponge, Raman Scattering

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Ruthenium Polypyridines, DSSC, Solar Cell, Titanium Dioxide

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Non-Covalent Complex; Lithium Ion; Dissociation Constant; Mass Spectrometry; Density Functional Theory Calculation

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Nanostructural Dynamical-Change; Polyhedral Oligomeric Silsesquioxane (POSS); Supramolecular Self-assembly

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Molecular Recognition; Pillararenes; Unsaturated Hydrocarbons; Supra Molecular Chemistry

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MIP; Surface Sol-Gel Process; Nanofiltration; Adsorption Property; Molecular Recognition; Flexible Film; Reconfiguration; Tailorability

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HPBCD; Inclusion Compound; Propylgallate

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Harmane, Cancer Cell Photosensitizer, Prototropism, Surfactant–Cyclodextrin Interaction, Fluorescence Spectroscopy, Fluorescence Decay

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Guest Molecular Recognition; Cyclodextrin Complex; Ion Chromatography; Phase-Transition; K^+; Water; Release; Sensors; Na^+; Aggregation

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Single Polymer Composite, Poly(epsilon-Caprolactone)

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Cucurbituril, Cyclodextrin, Pseudorotaxane, Self-assembly

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Calf Thymus DNA, Beta-cyclodextrin, Naringenin, Naringin

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Pentanoic Acid, Protontransfer Reaction, Single Relaxational Absorption

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Basic Nitrogen, Benzimidazoles, Hydrogen Bonding Interactions, Steric Factor, Binding Energy, Hydrogen Bonds, Slow Dynamics, Fluorescence, 2-(2'-Pyridyl)Benzimidazole

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Amorphization, Moringa Coagulant, Solubility Enhancement, Synergism, Ternary Solid Dispersions

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3. CDs in Drug Formulation

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Poly-B-Cyclodextrin; Chitosan; Multilayer System; Paclitaxel; Simvastatin; Intra Stent Restenosis (ISR) Model

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Complexes of amphiphilic cyclodextrins and tributyltin(IV) porphyrin derivatives as potential nanotherapeutics against melanoma

Organotin(IV)-Porphyrin, Cytotoxicity

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Orally Fast Disintegrating Tablets, Meloxicam, Meloxicam-beta-Cyclodextrin Inclusion Complex

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Nanosponges, Nitroxyl Radicals, Paramagnetic Materials, Swelling, Hydrogels

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Midazolam, Stability, NMR, HPLC, Mass Spectrometry

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Heptakis(2-Oligo(Ethyleneoxide)-6-Hexadecylthio)-Beta-CD, Docetaxel, Zinc-Phthalocyanine

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Folate-Appended Beta-CDs having a Caproic Acid as a Spacer, Polypseudoroxanes of α-CD or γ-CD with Pegylated Protein, Glucuronylglucosyl-Beta-CD Conjugates With PAMAM, Niemann-Pick Disease Type C, Chronic Myelogenous Leukemia, Familial Amyloid Polyneuropathy, Septic Shock Inhibitor

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Epichlorohydrin, Glycidyltrimetrylammonium Chloride, Quaternary Ammonium Groups

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Cyclodextrin-Coated Glyconanoparticles, Anti-Cancer Drug, Methotrexate

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Carbon Nanotubes, Acyclovir, Click Coupling, HSV-1

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Self-assembled cyclodextrin nanoparticles as drug carriers

Aggregates, Mucosa, Ophthalmic

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Surfactins modulate the lateral organization of fluorescent membrane polar lipids: a new tool to study drug:membrane interaction and assessment of the role of cholesterol and drug acyl chain length

Yeast Plasma-Membrane, Fluid-Mosaic Model, Biological-Membranes, Cell-Membranes, Simple Sphingolipids, Human Erythrocytes, Domains, Rafts, Sphingosine, Depletion

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Dissolution properties and physical characterization of telmisartan-chitosan solid dispersions prepared by mechanochemical activation

Water-Soluble Drugs, Systems, Release, Cyclodextrin, Naproxen

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Drug precipitation inhibitors in supersaturable formulations

Water-Soluble Drugs, Increased Oral Bioavailability, Solid Dispersion, Delivery-Systems, Crystal-Growth, In-Vitro, Enhanced Dissolution, Salbutamol Sulfate, Beta-cyclodextrin, Complex-Formation

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Oral delivery of anticancer drugs: challenges and opportunities

Solid-Lipid Nanoparticles, Caco-2 Cell Monolayers, In-Vitro Evaluation, Vitamin-E-Tpgs, P-Glycoprotein Inhibitors, Methyl-beta-cyclodextrin, Poorly Absorbable Drugs, Wheat-Germ-Agglutinin, Enhanced Paclitaxel Bioavailability, Polyamidoamine PAMAM Dendrimers

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Hydrophilic versus hydrophobic porogens for engineering of poly(lactide-co-glycolide) microparticles containing risedronate sodium

Pulmonary Drug-Delivery, Large-Porous-Particles, PLGA Microparticles, In-Vitro

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Synthesis of paclitaxel-conjugated beta-cyclodextrin polyrotaxane and its antitumor activity

Pseudo-Polyrotaxane, Drug-Delivery, Nanoparticles, Photodimerization, Accumulation, Penetration

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Pigment Epithelial-Cells, C-60, Cytotoxicity, Phototoxicity

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Pharmaceutical Applications, Complexation, Bioavailability, Delivery, State, Acid

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N-Trimethyl Chitosan,, Protein Transduction Domains, Hairless Mouse Skin, Cationic End-Group, Therapeutic System, Poly(amidoamine) Dendrimers

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Microsponge, Nanosponge, Topical preparations

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Mesoporous silica nanoparticles, Drug delivery, Biocompatibility, cytotoxicity, Functionalization

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Mass-Transport Analysiscyclodextrin, Dexamethasone, Transport Modelanimal Experiment, Cell Strain CACO 2, Intestine Mucosa Permeability, Membrane Permeability, Nonhuman, Prediction, Rat

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Mass-Spectrometry, Ginsenoside RG3, Cells, Proliferation, Metabolites, RH2

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Ketoprofen, Freeze drying, Compressibility, Solubility, Dissolution, Stability

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Hydrogel, Chitosan, Contact Lenses

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Hydrocortisone, Diffusion coefficient, Aqueous solutions

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Human Cytochrome-P450 2D6, Chinese Herbal Medicine, Molecular Docking, Delivery Systems, Folate, Doxorubicin, Cardiotoxicity, Anthracyclines

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folic acidDOX, Polyrotaxane, azide-ethylene click chemistry, Micelles, tumor-targeting

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Fast-Dissolving Tablets, Drug-Delivery, Systems, Rabbit, Model

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Enhanced Oral Bioavailability, In-Vitro Characterization, Drug-Delivery Systems, Bile-Salt, Absorption, Pharmacokinetics, Nanoparticles, Encapsulation, Itraconazole

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Drug-Delivery Systems, Pharmacological Properties, Therapeutic Efficacy, Lipid Emulsion, Bioavailability, Cyclodextrin

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Cytotoxicity, Insulin, Synthesis, Carboxymethyl-hydroxypropyl-beta-cyclodextrin

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Cyclodextrin polymer, Ethoxzolamide solubilization, Glaucoma, Acrylic hydrogel, Inclusion complex, Sustained release

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Retinoic Acid, Anemometry, Atomic Force Microscopy, Colorimetry, Drug formulation, Drug Stability, Drug Storage, Lipid Vesicle, Particle Size, Photon Correlation Spectroscopy, Zeta Potential

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Cyclodextrin, Dissolution Rate, Ebastine, Inclusion complex, Phase solubility

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Cyclodextrin, Mitomycin, Controlled Release, Sustained Release, Anti-Proliferative, Drug Delivery, Glaucoma, Filtration Surgery

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Cyclic Voltammetry, Cyclodextrin Complexes, Electrochemical Determination, Gold Electrode, Square Wave Voltammetry

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Controlled Release, Elementary Osmotic Pump, Glipizide, Metformin Hydrochloride, Zero Order

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Characterization, Complexation, Cyclodextrins, FTIR, Norfloxacin, Polymorphism, Solid state NMR, X-ray diffractometry

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Cefixime, L-arginine, Inclusion compounds, Spray drying, Ternary complex, Molecular modeling

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Catechin, Herbal medicine, Re-epithelialization, Transdermal delivery

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Bi-Weekly Dosing, Myelosuppression, Neutropenia, Fatiguenanopharmaceutical, Phase 1/2a, Polymer Conjugate Camptothecin, Solid Tumor

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Biphase-Drug Delivery Systems, Controlled Release, Dendrosomes, Linear-Dendritic Copolymers, Supramolecules

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Biodegradable Hydrogels, Drug Release, Ibuprofen, Inclusion Complex, Methylene Bisacrylamide, Photoinitiation, Poly lactic-co-glycolic acid, Polyethylene Glycol Diacrylate, Polyethylene Glycols, Hydrogels

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Bioavailability of Extravascular Injection, Cyclodextrins, In-Vitro Prediction, Poorly Soluble Drugs, Post-Injection Drug Precipitation

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beta-Cyclodextrin complexation technique, Exemestane, Biotransformation, Arthrobacte simplex

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beta-cyclodextrin, Interactions, N-sulfamoyloxazolidinones, NBO analysis, Oniom calculations, Optimisation, PM3

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Beta-cyclodextrin, Factorial Design

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Beta-cyclodextrin, Drug Benznidazole, Formulations, Solubility, Therapy, Systems

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beta-cyclodextrin, DLS, DSC, FT-IR, Ibuprofen, In vitro permeation, Non-ionic surfactant vesicles

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Beta-cyclodextrin, Chitosan, Diabetes, Glipizide, In vitro permeation, Transdermal drug delivery

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Beta-cyclodextrin, Cellular Uptake, Delivery, Cisplatin, Taxol, Nanoformulations

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Beta-cyclodextrin, Anal fissures, Nitroglycerin, Ointment, Prolonged release

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Beta-cyclodextrin, Acetylcholinesterase, Strategies

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Benzimidazole, Cyclodextrin Modified Glucose Oxidase, Glucose, Capping Phenomenon, Chemical Analysis, Chemical Reaction, Chemical Structure, Proton Transport, Substitution Reaction

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Arsenic, Brain Tumors, Cancer, Glioblastoma, Glioma

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Aqueous Medium, Ground-State Interactions, On-Demand Release, Picosecond Time, Steady-State Absorption, Supramolecular Complexes, Targeted Drug Delivery, Transmission Electron

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Antifungal, Itraconazole, Pharmacodynamics, Pharmacokinetics, Toxicodynamics

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Antibacterial activity, Biofilm, Cyclodextrin, Pathogenic bacteria, Quorum sensing, Triclosan

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Angiotensin-(1-7), Erectile Dysfunction, Fibrosis, Hydroxypropyl-Cyclodextrin, Hypercholesterolemia, Mas Receptor, Oxidative Stress

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Alpha-cyclodextrin, Block-Copolymer

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Alkaliphilic bacteria, Cyclodextrin glycosyl transferase, Lonar lake, Paenibacillus sp L55, Taguchi DOE

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AIF, Apoptosis, CytC, Smac/Diablo and CASP-3, Sugammadex

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Aerosols, Cyclodextrin, Metered-dose inhaler, Nanosuspension, Sildenafil citrate, Sildenafil-cyclodextrin complex: Int. J. Pharm. (2013)

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Preparation of gastric soluble enrofloxacin granules with short-time delayed release properties

Acrylic resin, Dissolution, Enrofloxacin, Granules, Short-time delayed release

Li, D.; Zhao, H.; Ma, G.: Beijing Huagong Daxue Xuebao Ziran Kexueban/Journal of Beijing University of Chemical Technology (Natural Science Edition), 2013, 40, 98-102

β-Cyclodextrin-complexed (-)-linalool produces antinociceptive effect superior to that of (-)-linalool in experimental pain protocols

acetic acid, Analgesic agent, Beta cyclodextrin derivative, Capsaicin, carrageenan, Glutamic acid, Linalool, terpene, Tumor necrosis factor alpha, animal experiment, Antiinflammatory activity, Antinociception, article, Biological activity, Drug structure, Hot plate test, Leukocyte migration, Locomotion, male, Nonhuman, pain, Peritoneal fluid, Peritonitis, priority journal, Rat, writhing test, Cinnamomum verum, Lamiaceae, Lauraceae, Mentha, Mus, Rodentia

Quintans-Junior, L. J.; Barreto, R. S. S.; Menezes, P. P.; Almeida, J. R. G. S.; Viana, A. F. S. C.; Oliveira, R. C. M.; Oliveira, A. P.; Gelain, D. P.; de Lucca Jr., W.; Araujo, A. A. S.: Basic and Clinical Pharmacology and Toxicology, 2013, 113, 167-172; DOI:10.1111/bcpt.12087

Model predicting impact of complexation with cyclodextrins on oral absorption

Absorption, Bioavailability, Cyclodextrins, Low-solubility drugs, Modeling

Gamsiz, E. D.; Thombre, A. G.; Ahmed, I.; Carrier, R. L.: Biotechnology and Bioengineering, 2013, 110, 2536-2547; DOI:10.1002/bit.24932

Analgesic efficacy and safety of a novel injectable formulation of diclofenac compared with intravenous ketorolac and placebo after orthopedic surgery: a multicenter, randomized, double-blinded, multiple-dose trial

2 hydroxypropyl beta cyclodextrin, Diclofenac, ketorolac, Morphine, placebo, adult, Aged, analgesia, Article, controlled study, Double blind procedure, Drug efficacy, Drug safety, Female, human, Major clinical study, Male, multicenter study, Orthopedic surgery, Postoperative pain, Priority journal, Randomized controlled trial

Daniels, S.; Melson, T.; Hamilton, D.A.; Lang, E.; Carr, D.B.: Clinical Journal of Pain, 2013, 29, 655-663; DOI:10.1097/AJP.0b013e318270f957

Synthesis and characterization of thiolated carboxymethyl chitosan-graft-cyclodextrin nanoparticles as a drug delivery vehicle for albendazole

1,6-Hexamethylene Diisocyanate, Carboxymethyl Chitosan

Alamdarnejad, G.; Sharif, A.; Taranejoo, S.; Janmaleki, M.; Kalaee, M.R.; Dadgar, M.; Khakpour, M.: J. Mater. Sci.: Mater. Med., 2013, 24, 1939-1949; DOI:10.1007/s10856-013-4947-9

4. CDs in Cell Biology

Cyclovector - a versatile platform technology for delivery of RNAi-based therapeutics

Click Chemistry, Pre-Clinical Case Studies, Huntington's Disease, Prostate Cancer, Neurodegenerative Diseases

O'Driscoll, C. M.: IL-05 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Application of flow cytometry for estimation of lipid content changes induced by arachidonic acid and methyl-beta-cyclodextrin in the lipid bodies of epithelial cells

Unsaturated Fatty-Acids, Nile-Red, Eicosanoid Formation, Body Formation, Droplets, Cholesterol, Triglycerides, Trafficking, Macrophage, Perilipin

Fock, E. M.; Fedorova, E. V.; Parnova, R. G.: Biologicheskie Membrany, 2013, 30, 221-229; DOI:10.7868/S0233475513020047

Supramolecular host-guest pseudocomb conjugates composed of multiple star polycations tied tunably with a linear polycation backbone for gene transfection

Transfer Radical Polymerization, Beta-cyclodextrin Cores, Poly(glycidyl methacrylate), Delivery, Polymers, Nanoparticles, Vectors, Copolymer

Hu, Y.; Chai, M. Y.; Yang, W. T.; Xu, F. J.: Bioconjug. Chem., 2013, 24, 1049-1056; DOI:10.1021/bc400115e

Cetuximab enhances trail-induced gastric cancer cell apoptosis by promoting [disc] formation in lipid rafts

TRAIL, Cetuximab, DISC, Lipid rafts, Gastric cancer

Xu, L.; Hu, X.; Qu, X.; Hou, K.; Huachuan Zheng; Yunpeng Liu: Biochemical and Biophysical Research Communications, 2013, 439(2), 285–290; DOI:10.1016/j.bbrc.2013.08.040

Cationic and pegylated amphiphilic cyclodextrins: co-formulation opportunities for neuronal sirna delivery

Small Interfering RNA, Intracellular Trafficking, Nonviral Vectors

O'Mahony, A. M.; Ogier, J.; Darcy, R.; Cryan, J. F.; O'Driscoll, C. M.: PLOS ONE, 2013, 8; DOI:10.1371/journal.pone.0066413

Hyperglycemia-induced protein kinase C β(2) activation induces diastolic cardiac dysfunction in diabetic rats by impairing caveolin-3 expression and akt/enos signaling

Induced Rhoa Activation, Nitric-oxide Synthase, Contractile Dysfunction, Myocardial Dysfunction, Glut-4 Translocation, N-acetylcysteine, Heart-failure, Growth-factor, Cardiomyopathy, Inhibition

Lei, S.; Li, H.; Xu, J.; Liu, Y.; Gao, X.; Wang, J.; Ng, K. F. J.; Lau, W. Bond; Ma, X-L.; Rodrigues, B.; Irwin, M. G.; Xia, Z.: Diabetes, 2013, 62, 2318-2328; DOI:10.2337/db12-1391

Synthesis, characterization, and evaluation of pluronic-based beta-cyclodextrin polyrotaxanes for mobilization of accumulated cholesterol from niemann-pick type c fibroblasts

Inclusion Complexes, Drug-Delivery, Poly(Propylene Glycol), Poly(Ethylene Glycol), Alpha-Cyclodextrin, Self-Diffusion, Every Organ, Disease, Mouse, Gene

Collins, C. J.; McCauliff, L. A.; Hyun, S-H.; Zhang, Z.; Paul, L. N.; Kulkarni, A.; Zick, K.; Wirth, M.; Storch, J.; Thompson, D. H.: Biochemistry, 2013, 52, 3242-3253; DOI:10.1021/bi3010889

N-glycosylation modulates the membrane sub-domain distribution and activity of glucose transporter 2 in pancreatic beta cells

Glycosylation, N-acetylglucosaminyltransferase-IVa, Lipid Raft-microdomain

Ohtsubo, K.; Takamatsu, S.; Gao, C.; Korekane, H.; Kurosawa, T. M.; Taniguchi, N.: Biochemical and Biophysical Research Communications, 2013, 434(2), 346-351; DOI:10.1016/j.bbrc.2013.03.076

Procyanidins can interact with caco-2 cell membrane lipid rafts: involvement of cholesterol

Deoxycholate, Flavanols, Flavonoid-membrane interactions, Lipid rafts, Membrane cholesterol, Procyanidin

Verstraeten, S.V.; Jaggers, G.K.; Fraga, C.G.; Oteiza, P.I.: Biochimica et Biophysica Acta - Biomembranes, 2013, 1828, 2646-2653; DOI:10.1016/j.bbamem.2013.07.023

Interleukin-1β alters the sensitivity of cannabinoid CB1 receptors controlling glutamate transmission in the striatum

Cytokines, Endocannabinoid System, Glutamate, Inflammation, Neurodegeneration, Synaptic Transmission

De Chiara, V.; Motta, C.; Rossi, S.; Studer, V.; Barbieri, F.; Lauro, D.; Bernardi, G.; Centonze, D.: Neuroscience, 2013, 250, 232-239; DOI:10.1016/j.neuroscience.2013.06.069

A versatile approach towards the compaction, decompaction, and immobilization of dna at interfaces by using cyclodextrins

DNA, Interfaces, Monolyers, Self-assembly

Gonzalez-Perez, A.; Ruso, J. M.: ChemPhysChem, 2013, 14, 2544-2553; DOI:10.1002/cphc.201300234

Epigallocatechin-3-gallate reduces inflammation induced by calcium pyrophosphate crystals *in vitro*

Chemokines, Cytokines, Epigallocatechin-3-gallate, Inflammation, Osteoarthritis

Oliviero, F.; Sfriso, P.; Scanu, A.; Fiocco, U.; Spinella, P.; Punzi, L.: Frontiers in Pharmacology, 2013, 4, art_number 51; DOI:10.3389/fphar.2013.00051

Lipid efflux mediated by alkylphospholipids in HEPG2 cells

Cellular Cholesterol Efflux, Plasma-Membrane Cholesterol, Endoplasmic-Reticulum, Human Fibroblasts, Sphingomyelin, Miltefosine

Rios-Marco, P.; Segovia, J. L.; Jimenez-Lopez, J. M.; Marco, C.; Carrasco, M. P.: Cell Biochem. Biophys., 2013, 66, 737-746; DOI:10.1007/s12013-013-9518-7

Curcumin inhibits the proliferation of airway smooth muscle cells *in vitro* and *in vivo*

Caveolin 1, Curcumin, Mitogen Activated Protein Kinase, Platelet Derived Growth Factor, Cell Infiltration, Cell Proliferation, Comparative Study, Dysphoria, Dyspnea Respiratory Tract Inflammation, Smooth Muscle Fiber, Tachypnea, Western Blotting

Zeng, X.; Cheng, Y.; Qu, Y.; Xu, J.; Han, Z.; Zhang, T.: International Journal of Molecular Medicine, 2013, 32, 629-636; DOI:10.3892/ijmm.2013.1425

The effect of cholesterol addition, buffer, and ph on equine sperm stored at 5 oc

Buffer, Cholesterol, Cooling, pH, Semen, Stallion

Crespilho, A. M.; Spizziri, B. E.; Meyers, M.; Graham, J. K.: Journal of Equine Veterinary Science, 2013, 33, 663-666; DOI:10.1016/j.jevs.2012.09.004

Epidermal stem cells manipulated by pDNA-vegf165/cyd-pei nanoparticles loaded gelatin/β-tcp matrix as a therapeutic agent and gene delivery vehicle for wound healing

Beta-cyclodextrin-Linked Polyethylenimine, Epidermal Stem Cells, Gelatin/Beta-Tricalcium Phosphate Scaffold, Nonviral Gene Delivery, Wound Repair And Regeneration

Peng, L-H.; Wei, W.; Qi, X-T.; Shan, Y-H.; Zhang, F-J.; Chen, X.; Zhu, Q-Y.; Yu, L.; Liang, W-Q.; Gao, J-Q.: Molecular Pharmaceutics, 2013, 10, 3090-3102; DOI:10.1021/mp400162k

Detection of cd133 (prominin-1) in a human hepatoblastoma cell line (huh-6 clone 5)

ASEM, Cancer Stem Cell, Filopodia, Lamellipodia, Methyl-beta-cyclodextrin, Nanogold

Akita, M.; Tanaka, K.; Murai, N.; Matsumoto, S.; Fujita, K.; Takaki, T.; Nishiyama, H.: Microscopy Research and Technique, 2013, 76, 844-852; DOI:10.1002/jemt.22237

Oral formulation of angiotensin-(1-7) improves lipid metabolism and prevents high-fat diet-induced hepatic steatosis and inflammation in mice

Angiotensina-(1.7), Fatty liver, Lipid metabolism, Obesity, Visceral steatosis, congenital

Feltenberger, J. D.; Andrade, J. M. O.; Paraiso, A.; Barros, L. O.; Filho, A. B. M.; Sinisterra, R. D. M.; Sousa, F. B.; Guimarães, A. L. S.; De Paula, A. M. B.; Campagnole-Santos, M. J.; Qureshi, M.; Dos Santos, R. A. S.; Santos, S. H. S.: Hypertension, 2013, 62, 324-330; DOI:10.1161/HYPERTENSIONAHA.111.00919

5. CDs in Food, Cosmetics and Agrochemicals

Encapsulation of apple polyphenols in β-CD nanosponges

Rutin, Phloridzin, Chlorogenic acid

Ramirez-Ambrosi, M.; Caldera, F.; Trotta, F.; Gallo, B.; Berrueta, L. A.: P-18 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Electrospun polylactic acid nanofibers incorporating gallic acid-cyclodextrin inclusion complex

Antioxidant Activity, Food Packaging

Aytac, Z.; Uyar, T.: P-22 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Investigation of anethole and estragole complexation with cyclodextrins

Alpha-, Beta-, Gamma-CD, HPBCD, RAMEB, CRYSMEB

Kfoury, M.; Auezova, L.; Greige, H.; Mallard, I.; Fourmentin, S.: OP-12 Abstract Book of 3rd European Conference on Cyclodextrins, Oct. 02-04, 2013, Antalya, Turkey

Preparation and physicochemical characterization of the supramolecular inclusion complex of naringin dihydrochalcone and hydroxypropyl-β-cyclodextrin

Sweetener, Antioxidant, Naringin Dihydrochalcone, Hydroxypropyl-Beta-Cyclodextrin, Inclusion Complex, Supramolecule, Physicochemical Property

Liu, B.; Zhu, X.; Zeng, J.; Zhao, J.: Food Research International, 2013, 54(1), 691–696; DOI:10.1016/j.foodres.2013.08.007

The effect of caseinate on inclusion complexes of γ-cyclodextrin for oxidative stabilization of fish oil

Polyunsaturated Fatty-Acids, Sodium Caseinate, Encapsulation, Stability, Emulsions

Lee, C-M.; Kim, M-H.; Na, H-S.; Kim, J.; Lee, K-Y.: Biotechnology and Bioprocess Engineering, 2013, 18, 507-513; DOI:10.1007/s12257-012-0752-4

Host-guest molecular interactions in vanillin/amylose inclusion complexes

Inclusion complex, Amylose, Fourier transformed infrared spectroscopy (FT-IR), Circular dichroism (CD), Differential scanning calorimetry (DSC)

Rodriguez, S. D.; Bernik, D. L.: Applied Spectroscopy, 2013, 67, 884-891; DOI:10.1366/12-06981

Prevalent and persistent *escherichia coli* o157:h7 strains on farms are selected by bovine passage

E. coli O157:H7, Pulsed-Field Gel Electrophoresis, Evolution, Bovine Passage, Population Dynamics, Pathogen Prevalence

Jeong, K. C.; Hiki, O.; Kang, M. Y.; Park, D.; Kaspar, C. W.: Veterinary Microbiology, 2013, 162(2–4), 912-920; DOI:10.1016/j.vetmic.2012.11.034

Fe-pillared clay mineral-based formulations of imazaquin for reduced leaching in soil

Controlled release formulation, Cyclodextrin, Herbicide, Imazaquin, Montmorillonite, Pillared clay

Undabeytia, T.; Galan-Jimenez, M.C.; Gomez-Pantoja, E.; Vazquez, J.; Casal, B.; Bergaya, F.; Morillo, E.: Applied Clay Science (2013); DOI:10.1016/j.clay.2013.07.001

Off-flavor precursors in soy protein isolate and novel strategies for their removal

Beta-cyclodextrin, Oleosins, Phospholipase A(2), Ultrasound, Off-Flavor, Soy Protein Isolate, Seed Oil Bodies, Supercritical Carbon-Dioxide, Lipid Monolayers, Aqueous-Solution, 11s Globulin

Damodaran, S.; Arora, A.: Annu. Rev. Food Sci. Technol., 2013, 4, 327-346; DOI:10.1146/annurev-food-030212-182650

β-Cyclodextrin as a photostabilizer of the plant growth regulator 2-(1-naphthyl) acetamide in aqueous solution

2-(1-Naphthyl)-acetamide, Photodegradation, Photoprotector, Plant Growth Regulator

Da Silva, E. S.; Burrows, H. D.; Wong-Wah-Chung, P.; Sarakha, M.: Journal of Inclusion Phenomena and Macrocyclic Chemistry, 2013, 1-8; DOI:10.1007/s10847-013-0355-5

Encapsulation and controlled release of antifungal propionic acid utilizing biodegradable active films based on natural polymers

Active Packing, Propionic Acid, Antimicrobial Films, Biodegradable Films, Encapsulation, Controlled Release

Poverenov, Elena; Granit, Rina; Gabai, Shiran: European Food Research And Technology, 2013, 237, 19-26; DOI:10.1007/s00217-013-2011-0

6. CDs for other Industrial Applications

Modification of synthetic polymers using amphiphilic cyclodextrins

Self-Assembled Layers, Coat Efficacy, Coat Stability, Contact Angle Measurments

Lumholdt, L.; Nielsen, T. T.; Larsen, K. L.: P-37 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Trapping of volatile organic compounds by amphiphilic cyclodextrin functionalized polypropylene nonwovens

Pollutants, Textile, Multi-Layers

Lumholdt, L.; Fourmentin, S.; Nielsen, T. T.; Larsen, K. L.: P-36 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Functionalization of cellulose acetate nanofibers with cyclodextrins by using 'click' chemistry

Phenanthrene, Filtration, Azide-beta-CD, Insoluble CD-Polymers

Celebioglu, A.; Demirci, S.; Uyar, T.: P-61 Abstract Book of 3rd European Conference on Cyclodextrins, October 2-4, 2013, Antalya, Turkey

Biodiesel fuel production from waste cooking oil by the inclusion complex of heteropoly acid with bridged bis-cyclodextrin

Transesterification, Fatty Acid Methyl Estersbiodiesel, Bridged Bis-Cyclodextrin, Heteropoly Acid, Waste Cooking Oil

Zou, C.; Zhao, P.; Shi, L.; Huang, S.; Luo, P.: Bioresource Technology (2013); DOI:10.1016/j.biortech.2013.07.149

Phosphane-phosphite chelators built on a alpha-cyclodextrin scaffold: application in Rh-catalysed asymmetric hydrogenation and hydroformylation

Regioselective A,B-Functionalisation of a Methylated Alpha-cyclodextrin, Rhodium Complexes, asymmetric Catalysis, Cavitands, Cyclodextrins, Phosphane Li-Gands, Platinum, Rhodium

Jouffroy, M.; Semeril, D.; Armspach, D.; Matt, D.: European Journal of Organic Chemistry (2013); DOI:10.1002/ejoc.201300854

Designing a photoresponsive molecularly imprinted system on a silicon wafer substrate surface

Polymer, Wettability, Separation, Nanotubes, Membranes, Binding

Wang, D.; Xie, D.; Shi, W.; Sun, S0; Zhao, C.: Langmuir, 2013, 29, 8311-8319; DOI:10.1021/la401201w

New approach to the reduction of recombination in dye-sensitised solar cells via complexation of oxidised species

Polyethyleneglycol Dimethyl Ether, ab initio, Dye-Sensitised Solar Cells, Electrochemical Impedance Spectra, Intensity Modulated Photovoltage Spectroscopies Iodide/Triiodide Redox Couples

Song, H-K.; Yoon, J.; Won, J.; Kim, H.; Yeom, M. S.: Journal of Nanoscience and Nanotechnology, 2013, 13, 5136-5141; DOI:10.1166/jnn.2013.7509

Machine learning models for predicting pahs bioavailability in compost amended soils

Polycyclic Aromatic-Hydrocarbons, Hydroxypropyl-beta-cyclodextrin, Artificial Neural-Networks, Contaminated Soils, Extraction Technique, Black-Box, Biodegradation, Degradation, Remediation, Adsorption

Wu, G0; Kechavarzi, C.; Li, X.; Wu, S.; Pollard, S. J. T.; Sui, H.; Coulon, F.: Chemical Engineering Journal, 2013, 223, 747-754; DOI:10.1016/j.cej.2013.02.122

Oxidative cleavage of C=C bond of cinnamaldehyde to benzaldehyde in the presence of β-cyclodextrin under mild conditions

Oxidative Cleavage, Cinnamaldehyde, Natural Benzaldehyde, Hydrogen Peroxide

Chen, H-Y.; Yang, Z-J.; Zhou, X-T.; Ji, H-B.: Supramolecular Chemistry, 2013, 24, 247-254; DOI:10.1080/10610278.2012.655277

Fe_3O_4 nanoparticle-supported Cu(II)-beta-cyclodextrin complex as a magnetically recoverable and reusable catalyst for the synthesis of symmetrical biaryls and 1,2,3-triazoles from aryl boronic acids

One-Pot Synthesis, Cross-Coupling Reactions, Arylboronic Acids, Copper Nanoparticles, Beta-cyclodextrin, Alkaline-Solution

Kaboudin, B.; Mostafalu, R.; Yokomatsu, T.: Green Chemistry, 2013, 15, 2266-2274; DOI:10.1039/c3gc40753e

Coassembly of block copolymer and randomly methylated β-cyclodextrin: from swollen micelles to mesoporous alumina with tunable pore size

Heterogeneous Catalysis, Amphiphilic Triblock Copolymers, High Surface Area, Large Pore Volume, Mesoporous Alumina, Micellar Growth, Block Copolymers, Mesoporous Materials

Bleta, R.; Machut, C.; Leger, B.; Monflier, E.; Ponchel, A.: Macromolecules, 2013, 46, 5672-5683; DOI:10.1021/ma4008303

Adsorbent for chromium removal based on graphene oxide functionalized with magnetic cyclodextrin–chitosan

Graphene, Adsorption, Langmuir, Cr(VI), Adsorption

Li, L.; Fan, L.; Sun, M.; Qiu, H.; Li, X.; Duan, H.; Luo, C.: Colloids and Surfaces B: Biointerfaces, 2013, 107(0), 76-83; DOI:10.1016/j.colsurfb.2013.01.074

New textiles of biocidal activity by introduce insecticide in cotton-poly (GMA) copolymer containing β-CD

Glycidyl Methacrylate, Permethrin, Bioallethrin, Radiation, Beta-cyclodextrin, Grafting.

Hebeish, A.; EL-Sawy, S. M.; Ragaei, M.; Hamdy, I. A.; El-Bisi, M. K.; Abdel-Mohdy, F. A.: Carbohydrate Polymers, 2013, (0), -; DOI:10.1016/j.carbpol.2013.08.002

Ferrous chloride-induced modification on thermal properties of polyvinyl chloride

Glass-Transition Temperature, Flight Mass-Spectrometry, Decomposition Behavior, Poly(Vinyl Chloride), Beta-cyclodextrin

Xu, R. R.; Song, L. X.; Teng, Y.; Xia, J.: Thermochimica Acta, 2013, 565, 205-210; DOI:10.1016/j.tca.2013.05.009

Sorption of metal ions by poly(ethylene glycol)/β-CD hydrogels leads to gel-embedded metal nanoparticles

Gel Networks, Inorganic Nanoparticle, Large Dimensions, Metal Salt, Molecular Precursor, Polyurethane Foam, Metal Nanoparticles, Polyethylene Glycols

Ionita, G.; Marinescu, G.; Ilie, C.; Anghel, D.F.; Smith, D.K.; Chechik, V.: Langmuir, 2013, 29, 9173-9178; DOI:10.1021/la401541p

Synthesis of fragranced dyes and their application to cotton textiles

Fragranced Dye, Modified Reactive Dye, Olfactometry, Perfumed Fabric

Chattopadhyay, D.P.; Doctor, S.J.: Journal of Textile and Apparel, Technology and Management, 2013, 8, 4

Surface modification of electrospun polyester nanofibers with cyclodextrin polymer

for the removal of phenanthrene from aqueous solution

Electrospinning, Cyclodextrin Polymer, Nanofibers, Polyester, Phenathrene

Kayaci, F.; Aytac, Z.; Uyar, T.: Journal of Hazardous Materials, 2013, 261(0), 286-294; DOI:10.1016/j.jhazmat.2013.07.041

The effect of organics on the structure and magnetization of electro-synthesised magnetite nanoparticles

Electro-Oxidation, Magnetite Nanoparticles, Organic Molecules, Structural Properties, Magnetization

Mosivand, S.; Monzon, L. M. A.; Ackland, K.; Kazeminezhad, I.; Coey, J. M. D.: Journal Of Nanoparticle Research, 2013, 15; DOI:10.1007/s11051-013-1795-y

A facile preparation of palladium nanoclusters supported on hydroxypropyl-β-cyclodextrin modified fullerene [60] for formic acid oxidation

Electrochemically Active Surface Area, Formic Acid Oxidation, Palladium Nanoclusters

Bai, Z.; Niu, L.; Chao, C.; Yan, Y.; Cui, Q.; Yang, L.; Qiao, J.; Jiang, K.: International Journal of Electrochemical Science, 2013, 8, 10068-10079

Nanoporous cyclodextrin-based co-polymeric microspheres for encapsulation of active components

Drug-Delivery-Systems, Beta-cyclodextrin, Microcapsules, Separation

Mathapa, B. G.; Paunov, V. N.: Journal Of Materials Chemistry B, 2013, 1, 3588-3598; DOI:10.1039/c3tb20481b

DNA binding and oxidative cleavage studies of supramolecular copper(II) complex based on beta-cyclodextrin

Copper(II) Complex, DNA Binding, Inclusion Complex, Nuclease Activity

Tang, S-P.; Feng, Y-L.; Xu, Z-F.; Wang, D-P.: Asian Journal of Chemistry, 2013, 25, 7397-7400

Antimicrobial polymer films functionalized with cyclodextrins

Chemical Treatment, Cold Plasma Treatment, Polymeric Films, Monochlorotriazinyl-beta-cyclodextrin

Grigoriu, A-M.; Luca, C.; Horoba, E.; Dunca, S.: Revista de Chimie, 2013, 64, 606-611

Nanomaterials with enzyme-like characteristics (nanozymes): next-generation artificial enzymes

Cerium Oxide Nanoparticles, Peroxidase-Like Activity, Fe3O4 Magnetic Nanoparticles, Linked-Immunosorbent-Assay, Hydrogen-Peroxide, Glucose Detection, Catalytic-Activity

Wei, H.; Wang, E.: Chemical Society Reviews, 2013, 42, 6060-6093; DOI:10.1039/c3cs35486e

Self-assembly of three-dimensional interconnected graphene-based aerogels and its application in supercapacitors

Carbohydrate, Graphene Aerogels, Graphene Oxide, Hydrothermal, Microcosmic Morphologies, Self-Assembling, Supercapacitors

Ji, C-C.; Xu, M-W.; Bao, S-J.; Cai, C-J.; Lu, Z-J.; Chai, H.; Yang, F.; Wei, H.: Journal of Colloid and Interface Science, 2013, 407, 416-424; DOI:10.1016/j.jcis.2013.06.054

Preparation of carboxymethyl chitosan-graft-β-cyclodextrin modified silica gel and preconcentration of cadmium

Cadmium, beta-Cyclodextrin, Carboxymethyl chitosan

Lü, H.; An, H.; Wang, X.; Xie, Z.: International Journal of Biological Macromolecules, 2013, 61(0), 359-362; DOI:10.1016/j.ijbiomac.2013.07.023

The influence of solvent properties on the performance of polysulfone/beta-cyclodextrin polyurethane mixed-matrix membranes

Blends, Membranes, Morphology, Polyurethanes, Properties and Characterization

Adams, F.V.; Nxumalo, E.N.; Krause, R.W.M.; Hoek, E.M.V.; Mamba, B.B.: Journal of Applied Polymer Science, 2013, 130, 2005-2014; DOI:10.1002/app.39378

Preparation and characterization of thermal-responsive non-woven poly (propylene) materials grafted with n-isopropylacrylamide/β-cyclodextrin

Beta-Cyclodextrin, Poly(N-Isopropylacrylamide) Hydrogels, Sensitive Hydrogels, Controlled-Release, Drug-Delivery, Textiles

Amiri, S.; Zadhoush, A.; Mallakpour, S.; Larsen, K. L.; Duroux, L.: Journal of Industrial Textiles, 2013, 43, 116-131; DOI:10.1177/1528083712449474

An approach to the Paal-Knorr pyrroles synthesis in the presence of β-cyclodextrin in aqueous media

Beta-cyclodextrin, Paal-Knorr, Pyrrole, Water

Duan, F-J.; Ding, J-C.; Deng, H-J.; Chen, D-B.; Chen, J-X.; Liu, M-C.; Wu, H-Y.: Chinese Chemical Letters, 2013, 24, 793-796; DOI:10.1016/j.cclet.2013.05.012

β-Cyclodextrin-assisted synthesis of Biginelli adducts under solvent-free conditions

Heterocyclic compouds, Organocatalyst

Liberto, N. A.; De Paiva Silva, S.; De Fatima, A.; Fernandes, S. A.: Tetrahedron, 2013, 69, 8245-8249; DOI:10.1016/j.tet.2013.07.024

The mechanical bond: a work of art

Catenanes, Chemical Topology, Knots, Rotaxane, Template-Directed Synthesis, Metal-Organic Framework, Mesoporous Silica Nanoparticles, Artificial Molecular Muscles, Tunnel-Junction Devices, Thermodynamic Control, Borromean Rings, Interlocked Molecules, Olefin Metathesis, Alpha-cyclodextrin

Bruns, C. J.; Stoddart, J. F.: Top. Curr. Chem. (2012), 323, 19-72; DOI:10.1007/128_2011_296

Facile synthesis and characterisation of hexagonal magnetite nanoplates

Facile Synthesis, Formation Mechanism, Hexagonal Fe, Hydrothermal Routes, Magnetic Studies, Room Temperature, Metabolism, Urea, Crystal Structure, Transmission Electron Microscopy, X Ray Diffraction

Zhu, J.; Li, D.; Jiang, D.; Chen, M.: Micro and Nano Letters, 2013, 8, 383-385; DOI:10.1049/mnl.2013.0152

A palladium complex with functionalized beta-cyclodextrin: a promising catalyst featuring recognition abilities for Suzuki-Miyaura coupling reactions in water

Aryl Chlorides, Nanoparticles, Chemistry, Ligand, Pharmaceuticals, Derivatives, Oxidation, Alcohols, Acids, Heck-reaction

Zhang, G.; Luan, Y.; Han, X.; Wang, Y.; Wen, X.; Ding, C.; Gao, J.: Green Chemistry, 2013, 15, 2081-2085; DOI:10.1039/c3gc40645h

Cyclodextrin-$[RuCl_2(arene)]_2$ conjugates: another way to enhance the enantioselectivity of aromatic ketones reduction by aromatic ligands' volume

Artificial metalloenzyme, Asymmetric hydrogenation, Cyclodextrin, Enantioselectivity, Ligand's volume

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Phenylene Ethynylene Oligomers, Responsive Conjugated Polymers, Differential-Overlap Technique, Transition-Metal-Complexes, Chiroptical Properties, Intermediate Neglect, Conformational Dynamics, Density Functionals, Alpha-Cyclodextrin, Length Dependence

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Performance Liquid-Chromatography, Chiral Stationary Phases, Beta-cyclodextrin Conjugate, Column Classification

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Milk powder, Rapid determination, Silver nanoparticles, Surface-enhanced Raman spectroscopy

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Lysosomal Storage Disease, Neuronal Degeneration, Therapy Approaches, Behavioral Performance

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Hydroxypropyl-beta-cyclodextrin, Freely Dissolved Concentration, Pah Bioavailability, Contaminated Soils, Polychlorinated-Biphenyls, Environmental-Pollutants, Enhanced Solubilization, Extraction Technique, Pesticide Pollution, Biodegradation

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Electrokinetic Chromatography, Enantioresolution, Highly Sulfated Beta-cyclodextrin, Partial Least Squares, Quantitative Structure-Property Relationships

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DNA recognition, Environment-sensitive, Fluorimetric method, DNA, Fluorescence, Fluorophores, Oligonucleotides, RNA

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Differential pulse voltammetry, Hydrocarbon chains, Hydrophobic interactions, Inclusion complex, Modified glassy carbon electrode, N-Tetradecylamine (TDA), Supramolecular interactions, Uric acids, Cyclic voltammetry, Cyclodextrins, Electrochemical impedance spectroscopy, Glass, Organic acids, Glass membrane electrodes

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Luminescence, Ruthenium, Sensors

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Dopamine, Fast Response Time, Poly(3-octylthiophene), Pretreatment Procedure, Solid Contacts, Ion Selective Electrodes, Polymeric Membranes, Neurophysiology

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Chromatographic Separations, Cosmetic Products, Environmentally-Friendly, European Union Regulations, Mobile-Phase Composition, Simultaneous Determinations

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Chirality, Space Analysis, Volatile Organics

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Chiral HPLC, Cyclodextrin Phases, Isochromene, Principal Component Analysis

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Cetyltrimethylammonium Bromide, Direct Electron Transfer, Electrical Conductivity, Fast Electron Transfer, Single-Walled Carbon Nanotubes (SWCN), Glucose Sensors

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Cell Suspension Cultures, Daucus Carota, Daucus Carota L, Extracellular Medium, Methyl Jasmonate, Phytosterol

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Capillary Electrophoresis, Chiral Separation, Ondansetron Hydrochloride

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Cancer Diagnostics, Clinical Translation, Inorganic Nanoparticle, Phenols, Plasma Diagnostics, Structural Dynamics

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Beta-cyclodextrin/Kaoline Composites, Bisphenol A, Molecularly Imprinted Particles, Selective Recognition, Surface Imprinting Technique

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Beta-cyclodextrin, Ferrocene, Physical Crosslinking

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Beta-cyclodextrin, Excitation Spectra, Inclusion Complex, Quantitative Analysis, Sdbs

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Beta-cyclodextrin, Enantiomeric Separation, Gel Chromatography, Growth-Mechanism

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Beta-cyclodextrin, Diclofenac, Inclusion complex, NBO, ONIOM, PM3

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Beta-Cyclodextrin, Click Chemistry, Hydrophilic Interaction Liquid Chromatography, Monolithic Columns

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Beta-cyclodextrin, Chiral Separation, Inclusion Complex, Stationary Phases, Behavior, Columns, Systems

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Benesi-Hildebrand Equation, Binding Capacities, Fluorescence Emission, Fluorescence Quenching, Binding Energy, Ruthenium, Vitamins, Rubidium Compounds

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Beer, Mannose, Maltosaccharides, HPAEC, PAD

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Basic pharmaceuticals, Capillary electrophoresis, Chiral separations, Sulfated cyclodextrins, Sulfated Cyclofructan 6

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Baclofen, Excipients, Compatibility/incompatibility, Infrared spectroscopy, Multivariate analysis

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Dextran, Glycoside Hydrolase Family 66

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Aqueous Medium, Copper (II) sensor, Flavone Modified Cyclodextrin, Fluorescent Histidine Sensor

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Cell membrane morphology analysis using an infrared sensor system

Antisymmetric Stretch, Cholesterol Reduction, Infra-Red Sensor, Madin-Darby Canine Kidneys, Dermatology, Infrared Detectors, Oncology, Platinum Compounds, Thin Layer Chromatography, Morphology

Van Den Driesche, S.; Iuliano, F.; Haiden, C.; Pucciarelli, D.; Breiteneder, H.; Pastorekova, S.; Hafner, C.; Vellekoop, M.J.: Sensors and Actuators, B: Chemical, 2013, 179, 150-156; DOI:10.1016/j.snb.2012.10.139

Anti-allergic cellulose support at the epidermis-environment interface

Anti-Allergic Properties, Atopic Dermatitis, Contact Dermatitis, Monochlorotriazinyl-beta-cyclodextrin, Fourier Transform Infrared Spectroscopy, Scanning Electron Microscopy, Humidity Profile

Hritcu, M.; Radu, C.-D.; Ferri, A.; Grigoriu, A.; Oproiu, L.-C.: Cellulose Chemistry and Technology, 2013, 47, 257-266

Ion selective phosphotungestate and β-cyclodextrin based membrane electrodes for stability-indicating determination of midodrine hydrochloride

Alpha Adrenergic Receptor Stimulating Agent, Midodrine, Tungsten Derivative, Ion Selective Electrode

Elzanfaly, E. S.; Zaazaa, H. E.; Merey, H. A.: Acta Chimica Slovenica, 2013, 60, 256-262

Allylated cyclodextrins as effective affiniBal planar bragg grating sensor

Allylated Cyclodextrin, Bragg Grating, Gas detection, Optical sensor, Volatile aromatic hydrocarbons

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Separation of 5-lipoxygenase metabolites using cyclodextrin-modified microemulsion electrokinetic chromatography and head column field-amplified sample stacking

5-Lipoxygenase, Arachidonic Acid, Eicosatetraenoic Acid, Leukotriene, Microemulsion Electrokinetic Chromatography

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Comparative evaluation of microbial and chemical methods for assessing 4-chlorophenol biodegradation in soil

Biodegradation Potentials, Contaminant Concentrations, Integrated Methodology, Microbial Community Analysis, Bioremediation, Phenols, Soil Testing, Biodegradation

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Testing the effect of the cavity size and the number of molecular substitutions in host-guest complexes formed by 2-hydroxypropyl-cyclodextrins and n-octyl-β-D-glucopyranoside

2-Hydroxypropyl cyclodextrin, N-Octyl-Beta-D-Glucopyranoside, Demicellization Heat

Concha-Santos, S.; Pérez-Casas, S.; Brocos, P.; Piñeiro, Á.: The Journal of Chemical Thermodynamics, 2013, 67, 112–119; DOI:10.1016/j.jct.2013.08.003

Complex formation of fenchone with α-cyclodextrin: NMR titrations

Chiral Recognition, Diastereomeric Complexes, Sequential Association Constants

Nowakowski, M.; Ejchart, A.: Journal of Inclusion Phenomena and Macrocyclic Chemistry, 2013, 1-6; DOI:10.1007/s10847-013-0356-4

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