Technology Innovation News Survey

Entries for February 1-15, 2019

Market/Commercialization Information

REMOVAL AND PROPER DISPOSAL OF EQUIPMENT AND OIL FROM NORFORK LAKE POWER PLANT SWITCHYARD

Department of the Army, U.S. Army Corps of Engineers, USACE District, Little Rock, AR.
Federal Business Opportunities, Solicitation W9127S19Q0032, 2019

The Contractor shall provide all personnel, equipment, supplies, facilities, transportation, tools, materials, supervision, sampling materials, and other items and non-personal services necessary to sample and remove all equipment listed in the contract, ancillary temporary storage containers, cleanup materials, and PCB oil located within the equipment listed within the Norfork Lake Power Plant Switchyard in accordance with all local, state, and federal regulations. The Contractor shall package and label all PCBs and dispose of same off Government property at an approved permitted site. All equipment is currently not in use and is disconnected and stored in the Power Plant switchyard. The Government will not provide any equipment, manpower, or materials for this contract. The requirement is a total small business set-aside, size standard $38.5M. Period of performance is 90 days after date of award. Quotes are due via email no later than 10:00 AM CT on April 10, 2019.
https://www.fbo.gov/spg/USA/COE/DACA03/W9127S19Q0032/listing.html

CLEAN STEEL FRAMES AND STRUCTURES, BUILDING 2

Department of the Air Force, Air Force Materiel Command, AFRL/RIK, Rome, NY.
Federal Business Opportunities, Solicitation FA875119RA002, 2019

This acquisition is a total small business set-aside, NAICS code 562910, size standard $20.5M. The Contractor shall furnish all labor, equipment, devices, and materials and perform all work required to clean and remediate steel frame and related surfaces in Information Directorate (RI) Building 2, Rome, NY 13441. RI has identified structural steel and related surfaces that are coated with accumulated dust, which has been sampled and analyzed for the presence of metals, PCBs, and asbestos. Elevated concentrations of metals were identified on surfaces throughout the building. The anticipated period of performance is 180 days after contract award. The estimated magnitude of construction is between $500,000 and $1M. Award will be a firm-fixed-price contract resulting from a competitive negotiated RFP. Proposals are due by 3:00 PM ET on April 3, 2019.
https://www.fbo.gov/spg/USAF/AFMC/AFRLRRS/FA875119RA002/listing.html

SLUDGE MANAGEMENT SERVICES

Department of the Interior, Bureau of Reclamation, Billings, MT.
Federal Business Opportunities, Solicitation 140R6019Q0014, 2019

This acquisition is a 100% small business set-aside under NAICS code 562211. The Bureau of Reclamation, Great Plains Region has a requirement for storage, transportation, and disposal services of metal hydrozide sludge at the Leadville Mine Drainage Tunnel Water Treatment Plant located near Leadville, Colorado. All details of the solicitation are posted on FedConnect at https://www.fedconnect.net/FedConnect/?doc=140R6019Q0014&agency=DOI [Note: It might be necessary to copy and paste the URL into your browser for direct access]. Period of performance is one 12-month base period and four 12-month options. Offers are due by 2:00 PM MT on April 9, 2019.

ENVIRONMENTAL REMEDIATION SERVICES

U.S. Army Corps of Engineers, USACE District, Seattle, WA.
Federal Business Opportunities, Solicitation PANNWD-19-P-002961, 2019

The purpose of this Sources Sought is to gain knowledge of the capabilities and qualifications of interested small business firms that have the demonstrated capabilities to meet the project requirements, and to address any questions, recommendations, or concerns from Industry. Responses to this notice will be used by the Government to make appropriate acquisition planning decisions. The proposed work is to be performed under NAICS code 562910 (Remediation Services). The type of remediation services to be provided include the full range of methods, technologies, and supporting activities necessary to inspect, maintain, and monitor granular active carbon (GAC) treatment systems, sample private wells, and provide bottled water service to impacted residences in the vicinity of Fairchild AFB, Washington. Responses (3 pages max) must be received by 10:00 AM PT on March 29, 2019.
https://www.fbo.gov/spg/USA/COE/DACA67/PANNWD-19-P-002961/listing.html

$35M RAPID RESPONSE 5 (RR5) SINGLE-AWARD TASK-ORDER CONTRACT (SATOC)

U.S. Army Corps of Engineers, USACE District, Omaha, NE.
Federal Business Opportunities, Solicitation W9128F-19-R-0016, 2019

This solicitation is a competitive 8(a) set-aside for an IDIQ single-award task-order contract (SATOC) for rapid response/immediate response, environmental remediation services (ERS) and other mission-related support services under NAICS code 562910 in support of the U.S. Army Corps of Engineers and its customers within the United States, including Alaska, Hawaii, and U.S. outlying areas. Time-sensitive ERS projects are initiated to maintain regulatory compliance, restore property from the effects of environmental spills or releases, mitigate unstable situations, and prevent or minimize future releases to protect human life, public health, and/or the environment. The total amount of the contract awarded under this solicitation shall not exceed $35M. This contract will have a base performance period of three years plus one 2-year option period, or until the $35M contract limit is reached, whichever occurs first. Offers must be received by 2:00 PM CT on April 8, 2019.
https://www.fbo.gov/spg/USA/COE/DACA45/W9128F-19-R-0016/listing.html

2019 OPTIMIZED REMEDIATION CONTRACT FOR HILL AFB, UT

Department of the Army, U.S. Army Corps of Engineers, USACE District, Sacramento, CA.

Federal Business Opportunities, Solicitation W91238-19-R-0050, 2019

The Army wishes to gain knowledge of the interest, capabilities, and qualifications of the large and small business communities possessing the technical/management expertise to execute environmental remediation activities, including environmental services, minor construction, and A-E services at Hill AFB. The Draft Performance Work Statement attached to the FBO notice defines the scope of Environmental Remediation activities to achieve performance objectives at 23 Installation Restoration Program sites and two Military Munitions Response Program sites. The applicable NAICS code will be 562910 (Environmental Remediation Services), small business size standard $20.5M. The firm-fixed-price contract resulting from the proposed solicitation will be for a 10-year period. Capabilities statements are due by 8:00 AM PT on March 29, 2019.
https://www.fbo.gov/spg/USA/COE/DACA05/W91238-19-R-0050/listing.html

Cleanup News

FINAL FIFTH FIVE-YEAR REVIEW REPORT FOR SACRAMENTO ARMY DEPOT SACRAMENTO, SACRAMENTO COUNTY, CALIFORNIA

U.S. Department of the Army, 162 pp, 2018

The Sacramento Army Depot (SAAD) opened in 1942 as an electronics maintenance facility primarily responsible for equipment receipt, storage, issue, repair, and disposal. Historical activities resulted in soil (metals, pesticides, PCBs, PAHs, VOCs, and SVOCs) and groundwater (VOCs) contamination. The site consists of three Operational Units: the South Post Burn Pits/Corrective Action Management Unit (CAMU) (OU1), South Post Plume (OU2), and Parking Lot 3 Plume (OU3). OU1 was remedied via excavation, capping, and soil vapor extraction, which removed ~138 pounds of VOCs (~98%) from the soil. OU2 groundwater was treated via extraction, ultraviolet light, and chemical oxidation through 120 wells placed 1981-2009. Groundwater in OU3 was treated using carbon adsorption at the wellhead and discharge to a sanitary sewer. OU1 has met all remediation goals, whereas the other two have not met Remedial Action Objectives and continue to be remediated. https://semspub.epa.gov/work/09/100009829.pdf

FIFTH FIVE-YEAR REVIEW REPORT FOR THE MARATHON BATTERY COMPANY SUPERFUND SITE PUTNAM COUNTY, NEW YORK

U.S. EPA Region 2, 34 pp, 2018

The Marathon Battery Company manufactured nickel-cadmium batteries from 1952-1979. Discharge from the plant contaminated the Hudson River and Foundry Cove via a wastewater treatment system. Samples indicated contamination as high as 120,000 mg/kg Cd and 130,000 mg/kg Ni in the building rafters, and up to 600 mg/kg Cd on facility grounds. Cd concentrations up to 67 mg/kg were found in soils in the adjacent residential yards. Chlorinated VOCs and inorganics were detected in the groundwater underlying the plant grounds. The selected remedy included dredging; excavating and capping or backfilling excavated areas; marsh restoration; decontamination of the former facility; and continued monitoring of the site. In May 2013, three additional air sparge (AS) wells and three additional vapor monitoring point wells were installed as part of the AS/SVE groundwater pilot study. The system removed 30 lbs of VOCs by May 2014. Continuous sparging of the groundwater with ozone took place from June 2017 to June 2018. Groundwater monitoring will be evaluated for one year to determine the success of this effort.
https://semspub.epa.gov/work/02/550203.pdf

MEMORANDUM: COLUMBIA STEEL PLANNED REMOVAL ACTION: LOWLANDS AREA, ECSI #104

State of Oregon, Department of Environmental Quality (DEQ), 11 pp, 2018

This memo documents DEQ remedial decision-making on a portion of the Columbia Steel site in Portland to address dioxin contamination present in the site's Lowland Area. Remedial alternatives are constrained by seasonal (winter/spring) inundation of the Lowland Area. The proposed removal action consists of excavation and off-site landfill disposal of shallow soil from SU-13 (the most heavily contaminated area remaining on site) and in situ sequestration of dioxin contamination in remaining units (>520 pg/g PRG) using granular activated carbon (GAC). In and around SU-13 where the highest dioxin concentration (4,850 pg/g) was found, ~235 yd^3 of contaminated surface soil will be removed to ~18" bgs, and GAC will be applied to the excavation "leave surface" as a measure of protection. In six of the remaining 12 Lowland Area SUs, which encompass a natural area >2 acres, soil removal is neither practical nor cost effective. Application of GAC as a contaminant sequestration agent is expected to result in a significant reduction (up to 90%) in dioxin bioavailability. Analysis indicates that sufficient GAC should be applied to represent a 3% concentration, by weight, within the top 6" of site soil, which is ~53 yd^3 GAC on a dry weight basis. GAC would be hydrated prior to application as a weighting measure and applied as slurry during the dry season. *See this Strategy Recommendation and other site documents at*
https://www.deq.state.or.us/Webdocs/Forms/Output/FPController.ashx?SourceIdType=11&SourceId=104&Screen=Load.

SUSTAINABLE REMEDIATION COMBINING MOBILE DUAL PHASE EXTRACTION WITH CONCURRENT INJECTION OF A CARBON-BASED AMENDMENT

Barranco, F. and D. Hoyt.
AEHS Foundation 34th Annual International Conference on Soils, Sediments, Water and Energy, 15-18 October 2018, Amherst, MA. Abstract only, p 173, 2018

A study was conducted at a former Air Force tank farm to capitalize in an accelerated fashion on combining aggressive petroleum mass removal (free product and dissolved phase) by mobile dual-phase extraction (MDPE) with an innovative, in situ approach for promoting attenuation of residually entrapped and dissolved-phase mass. Following free-phase recovery, continued use of MDPE was simultaneously employed to recover additional contaminant mass (dissolved phase) and to maximize in situ emplacement of remedial amendment, an injectable carbon combined with chemical oxidants and oxygen-generating compounds. Over this 1-acre site, 48 extraction points were utilized with 167 surrounding injection points in a systematic grid fashion. Vacuum with MDPE was achieved at extraction points concurrently and just beyond the typical radius of influence for a given injection point. During extraction, amendment was injected and evenly distributed throughout the treatment area. The placement of injection and extraction points was designed and field-adjusted to achieve hydraulic capture and control. Results illustrate the performance of this combined, accelerated cleanup as well as the green and sustainable metrics (calculated via Sitewise™) of this treatment versus alternate approaches.

Demonstrations / Feasibility Studies

FIELD TEST OF ELECTROKINETICALLY-DELIVERED THERMALLY ACTIVATED PERSULFATE FOR REMEDIATION OF CHLORINATED SOLVENTS IN CLAY

Head, N.A., Master's thesis, University of Western Ontario, 160 pp, 2018

This field-scale study investigated the novel approach of applying electrokinetics (EK) to enhance the delivery of persulfate and electrical resistance heating (ERH) to activate the delivered persulfate for low-permeability soil remediation. Results demonstrated that EK has the potential to enhance delivery, where the overall mass of persulfate that was observed to be delivered into the chlorinated solvent-impacted clay formation of the field site being a factor of both EK and advection. The application of ERH to activate the delivered persulfate was found to be precluded by catalytic reactions involving naturally occurring iron. Significant chlorinated solvent reduction was observed in groundwater (>80%) resulting from chemical oxidation and dilution from advective flux.
https://ir.lib.uwo.ca/cgi/viewcontent.cgi?article=7732&context=etd

PILOT-SCALE ELECTROCHEMICAL TREATMENT OF A 1,4-DIOXANE SOURCE ZONE

Blotevogel, J., C. Pijls, B. Scheffer, J.-P. de Waele, A. Lee, R. van Poecke, N. van Belzen, and W. Staals.
Groundwater Monitoring and Remediation 39(1):36-42(2019)

Six pilot-scale reactors were designed and tested for the treatment of groundwater contaminated with 1,4-dioxane at concentrations >1000 mg/L. Anode surface area-normalized degradation rates increased with increasing potential applied, while the process was more energy-efficient per mass unit removed at low potentials. Toward the end of the 8.5-month pilot test, decreasing currents and degradation rates indicated progressing passivation of the electrodes, likely due to cathodic carbonate precipitation and/or poisoning by the uniquely high organic carbon load of this source zone groundwater. *This article is* ***Open Access*** *at* https://onlinelibrary.wiley.com/doi/full/10.1111/gwmr.12307.

FIRST USE OF PETROFIX™ - A RADICAL ADVANCE IN LIQUID ACTIVATED CARBON

Dean, W.G.
Florida Remediation Conference 2018, 5-6 December. Abstract only, 2018

PetroFix is designed to treat groundwater in higher concentration target treatment zones where free product is not observed. The Reef Deli site in Panama City discharged ~1,000 gal of gasoline in March 2007. Petroleum contamination migrated beneath the adjacent road and onto the downgradient property. Since February 2016, BTEX plus naphthalene concentrations have varied from 1,310 µg/L to 14,300 µg/L. TRPH concentrations varied from 4,300 µg/L to 11,000 µg/L during that time. A total of 1,700 lbs of PetroFix and electron acceptors was injected into 13 DPT injection points around the off-site well in March 2018. A 60-day post-injection sample was collected in May 2018. All contaminants were below both lab detection limits and Florida groundwater cleanup target levels. A 90-day post-injection sample showed all contaminants remained below lab detection limits and GCTLs. Full-scale site remediation is being designed based on the test results

MICROBIAL COMMUNITY CHANGES IN A CHLORINATED SOLVENTS POLLUTED AQUIFER OVER THE FIELD SCALE TREATMENT WITH POLY-3-HYDROXYBUTYRATE AS AMENDMENT

Matturro, B., L. Pierro, E. Frascadore, M.P. Papini, and S. Rossetti.
Frontiers in Microbiology 9:1664(2018)

This study investigated organohalide-respiring bacteria (OHRB) and supporting microbial populations operating in a pilot-scale plant employing poly-3-hydroxybutyrate (PHB) for the in situ bioremediation of groundwater contaminated by chlorinated solvents. Bioremediation was performed in ground treatment units where groundwater extracted from the wells flowed through before re-infiltration to the low permeability zones of the aquifer. Coupling biological treatment with groundwater recirculation reduced contamination level and remediation time by efficiently stimulating the growth of autochthonous OHRB and enhancing mobilization of pollutants. Quantitative PCR showed that the PHB reactor may efficiently act as an external incubator to growing *Dehalococcoides mccartyi*, which is known to be capable of fully converting chlorinated ethenes to innocuous end products. The slow-release source of electron donors for the bioremediation process allowed the establishment of a stable population of *D. mccartyi* mainly carrying *bvcA* and *vcrA* genes, which are implicated in the metabolic conversion of vinyl chloride to ethene. Next-generation sequencing performed to analyze the phylogenetic diversity of the groundwater microbiome before and after bioremediation treatment allowed identification of the microorganisms working closely with the organohalide-respiring bacteria. *This article is* ***Open Access*** *at* https://www.frontiersin.org/articles/10.3389/fmicb.2018.01664/full.

THE IN SITU REMEDIATION OF PFAS-IMPACTED GROUNDWATER USING INJECTABLE ACTIVATED CARBON

McGregor, R.
RemTech 2018, 10-12 October, Banff, Alberta, Canada. 27 slides, 2018

This study involved the application of colloidal activated carbon at a site in Canada. PFOA and PFOS were detected in groundwater at concentrations up to 3,300 ng/L and 1,500 ng/L, respectively, before remediation. Colloidal activated carbon was applied using direct-push technology, resulting in the removal of the PFOA and PFOS to concentrations at and below the analytical detection limit (> 20 ng/L) over a 21-month period. Analysis showed that all PFASs analyzed were below their method detection limits. Examination of post-injection cores indicated that the colloidal activated carbon was successfully distributed within the target zone and was measured up to 5 m away from the injection point.
Slides: https://www.esaa.org/wp-content/uploads/2018/10/18-McGregor.pdf
Longer abstract: https://www.esaa.org/wp-content/uploads/2016/05/Abstracts-RT2018-36.pdf

Research

EVALUATION OF CENTRAL PLATEAU REMEDIATION ALTERNATIVES: INTERIM STATUS REPORT

Bagwell, C., A.R. Lawter, K.J. Cantrell, and C.F. Brown.
PNNL-28055, 34 pp, 2018

Several comingled groundwater contaminant plumes exist in the Hanford Central Plateau and are currently targeted by ongoing remedy efforts (i.e., pump-and-treat). However, across much of the Central Plateau, the deep vadose zone is also expected to serve as a long-term source of contaminant flux to the groundwater. Contaminant transport in the groundwater and vadose zone often occurs at vastly different time scales. Remedial action is needed in the near term to address existing groundwater contamination, but for some waste sites, long-term vadose zone source control may be needed. This report documents lab studies initiated in FY18 to evaluate gas-phase remediation approaches for the deep vadose zone and co-contaminant impacts on biological attenuation processes.
https://www.osti.gov/servlets/purl/1489412

SUCCESSFUL AEROBIC BIOREMEDIATION OF GROUNDWATER CONTAMINATED WITH HIGHER CHLORINATED PHENOLS BY INDIGENOUS DEGRADER BACTERIA

Mikkonen A., K. Ylaranta, M. Tiirola, L.A.L Dutra, P. Salmi, M. Romantschuk, S. Copley, et al.
Water Research 138:118-128(2018)

Results from a 4-year full-scale in situ biostimulation of a chlorophenol-contaminated aquifer by circulation and re-infiltration of aerated groundwater at a sawmill site showed a decrease of pentachlorophenol from 400 µg/L to

IMPROVED ISOLATION OF CADMIUM FROM PADDY SOIL BY NOVEL TECHNOLOGY BASED ON PORE WATER DRAINAGE WITH GRAPHITE-CONTAINED ELECTRO-KINETIC GEOSYNTHETICS

Tang, X., Q. Li, Z. Wang, Y. Hu, Y. Hu, and M. Scholzy.
Environmental Science and Pollution Research 25:14244-14253(2018)

Two mutually independent field plot experiments A and B were conducted to test electrokinetic geosynthetics ability to isolate Cd in paddy soil. After saturation using ferric chloride ($FeCl_3$) and calcium chloride ($CaCl_2$), assessment of soil water drainage capacity, soil Cd removal performance, energy consumption, and residual soil iron and chloride was performed. Cd was dissolved in the soil matrix and resulted in a 100% increase of diethylenetriaminepentaacetic acid (DTPA)-extracted phyto-available Cd. The total soil Cd content reductions were 15.20% and 26.58% for groups A and B, respectively, and electric field applications resulted in a 74.87% increase of soil total Cd removal. Drainage by gravity contributed to > 90% of the overall soil dewatering capacity. Compared to conventional electrokinetic technology, fast soil water drainage resulted in negligible hydrogen ion and hydroxide ion accumulation at nearby electrode zones. External addition of $FeCl_3$ and $CaCl_2$ led to 4.33-7.59% and 139-172% acceptable augments in total Fe and Cl content compared to original untreated soils. *This article is* ***Open Access*** *at* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5978830/pdf/11356_2018_Article_1664.pdf

ENHANCEMENT OF GASWORKS GROUNDWATER REMEDIATION BY COUPLING A BIO-ELECTROCHEMICAL AND ACTIVATED CARBON SYSTEM

Panagiotis, K., R. Doherty, C.A. Mendonca, R. Costeira, C.C.R. Allen, U.S. Ofterdinger, et. al.
Environmental Science and Pollution Research [Publication online 9 Feb 2019 prior to print]

The study shows the electrical response, bacterial community, and remediation of hydrocarbon-contaminated groundwater from a gasworks site using a graphite-chambered bio-electrochemical system (BES) that utilized granular activated carbon (GAC) as both sorption agent and high surface area anode. The BES chambers were effectively colonized by the bacterial communities from the contaminated groundwater. Principal coordinate analysis of UniFrac Observed Taxonomic Units showed distinct grouping of microbial types associated with the presence of GAC and grouping of microbial types associated with electroactivity. Bacterial community analysis showed that beta-proteobacteria (particularly the PAH-degrading *Pseudomonadaceae*) dominated all the samples. *Rhodocyclaceae*- and *Comamonadaceae*-related OTU were observed to increase in BES cells. The GAC BES (99% removal) outperformed the control graphite GAC chamber, as well as a graphite BES and a control chamber both filled with glass beads. *This article is* ***Open Access*** *at* https://link.springer.com/content/pdf/10.1007%2Fs11356-019-04297-w.pdf

A STUDY OF CADMIUM REMEDIATION AND MECHANISMS: IMPROVEMENTS IN THE STABILITY OF WALNUT SHELL-DERIVED BIOCHAR

Qiu, Z., J. Chen, J. Tang, and Q. Zhang.
Science of the Total Environment 636:80-84(2018)

Biochar prepared using walnut shell was incubated in $Cd(NO_3)_2$ and kaolin for 15 days. Different chemical forms of Cd in kaolin and biochar were determined, and the stability of biochar was evaluated by R_{50} using TGA analysis. Walnut shell-derived biochar was able to reduce Cd mobility. After incubation, the $R_{50,\ biochar}$ value increased from 61.31% to 69.57%-72.24%. Mechanisms that initiated improvements in biochar stability were investigated by XPS, XRD, and SEM-EDS analysis. Enhanced biochar stability is likely due to physical isolation and the formation of precipitates and complexes formed on the surface or interior of the biochar.

AN OVERVIEW OF FIELD-SCALE STUDIES ON REMEDIATION OF SOIL CONTAMINATED WITH HEAVY METALS AND METALLOIDS: TECHNICAL PROGRESS OVER THE LAST DECADE

Yanyan, G., D. Zhao, and Q. Wang.
Water Research 147:440-460(2018)

This paper provides an overview on the field applications of various soil metals remediation technologies performed over the last decade. Under the general categories of physical, chemical, and biological approaches, 10 remediation techniques were critically reviewed. Technical feasibility and economic effectiveness were evaluated, and pros and cons were appraised. The environmental impacts of the remediation practices and long-term stability of the contaminants were discussed and key knowledge gaps and practical challenges identified.

A CRITICAL REVIEW OF FERRATE(VI)-BASED REMEDIATION OF SOIL AND GROUNDWATER

Rai, P.K, J. Lee, S.K. Kailasa, E.E. Kwon, Y.F. Tsang, Y.S. Ok, and K.-H. Kim.
Environmental Research 160:420-448(2018)

Comprehensive information is provided on recent progress in the use of ferrate ($Fe^{VI}O_4^{2-}$) as a green material for use in sustainable treatment processes, especially for soil and water remediation. Diverse synthesis recipes for ferrates

were reviewed for their associated physicochemical properties as oxidants, coagulants, and disinfectants for the elimination of a diverse range of chemical and biological species from water/wastewater samples. The review includes a summary of the eco-sustainable performance of ferrate(VI) in water remediation.

NOVEL, ACTIVATED CARBON-BASED MATERIAL FOR IN-SITU REMEDIATION OF CONTAMINATED SEDIMENTS

Abel, S. and J. Akkanen. Environmental Science & Technology [Published online 28 Feb 2019 prior to print]

The high buoyancy of activated carbon (AC) particles makes their application difficult in the field. A novel sorbent material was developed, consisting of powdered AC (PAC) embedded into a stable, granular clay matrix, significantly reducing buoyancy. These AC-clay granules (ACC-G) were tested for remediation potential (PCB bioaccumulation reduction) and adverse effects on the benthic invertebrates *Chironomus riparius* and *Lumbriculus variegatus*. The novel ACC-G material was compared to GAC of the same particle size, the clay matrix, and PAC. The findings show that ACC-G has a significantly higher remediation potential than GAC, allowing for reductions in PCB bioaccumulation of up to 89%. Adverse bioaccumulation effects could not be totally eliminated with ACC-G, but they were less severe than with PAC, likely due to the increased particle size. *This article is* ***Open Access*** *at* https://pubs.acs.org/doi/pdf/10.1021/acs.est.8b06471.

A REVIEW OF STATE-OF-THE-ART MICROFLUIDIC TECHNOLOGIES FOR ENVIRONMENTAL APPLICATIONS: DETECTION AND REMEDIATION

Yew, M., Y. Ren, K.S. Koh, C. Sun, and C. Snape.
Global Challenges 3(1):1800060(2019)

This paper reviews state-of-the-art microfluidic technologies for environmental applications, such as on-site environmental monitoring and detection. Microdevices are extensively used in collecting environmental samples as a means to facilitate detection and quantification of targeted components with minimal quantities of samples. Microfluidic-inspired approaches for separation and treatment of contaminated water and air, such as the removal of heavy metals and waterborne pathogens from wastewater and carbon capture, are also investigated. *This article is* ***Open Access*** *at* https://onlinelibrary.wiley.com/doi/full/10.1002/gch2.201800060.

ABIOTIC AND BIOAUGMENTED GRANULAR ACTIVATED CARBON FOR THE TREATMENT OF 1,4-DIOXANE-CONTAMINATED WATER

Myers, M.A., N.W. Johnson, E.Z. Marin, P. Pornwongthong, Y. Liu, P.B. Gedalanga, S. Mahendra.
Environmental Pollution 240:916-924(2018)

Adsorption has not historically been considered an effective means of removing 1,4-dioxane due to the contaminant's low Koc and Kow values. This paper reports that the Norit 1240 granular activated carbon (GAC) is an adsorbent with high affinity for 1,4-dioxane as well as having physical dimensions conducive to attached bacterial growth. In abiotic batch reactor studies, 1,4-dioxane adsorption was reversible to a large extent. By bioaugmenting GAC with 1,4-dioxane-degrading microbes (*Pseudonocardia dioxanivorans* CB1190 and *Mycobacterium austroafricanum* JOB5), the adsorption reversibility was minimized while achieving greater 1,4-dioxane removal when compared with abiotic GAC (95-98% reduction of initial 1,4-dioxane as compared to an 85-89% reduction of initial 1,4-dioxane, respectively). Bacterial attachment and viability was visualized using fluorescence microscopy and confirmed by amplification of taxonomic genes by qPCR and an ATP assay. Filtered samples of industrial wastewater and contaminated groundwater were also tested in the bioaugmented GAC reactors. Both CB1190 and JOB5 augmentations demonstrated 1,4-dioxane removal greater than that of the abiotic adsorbent controls.

"GREEN" SYNTHESIS OF METALS AND THEIR OXIDE NANOPARTICLES: APPLICATIONS FOR ENVIRONMENTAL REMEDIATION

Singh, J., T. Dutta, K.-H. Kim, M. Rawat, P. Samddar, and P. Kumar.
Journal of Nanobiotechnology 16:84(2018)

"Green" synthesis is regarded as an important tool to reduce the destructive effects associated with traditional methods of synthesis for nanoparticles commonly utilized in laboratory and industry. This review summarizes the fundamental processes and mechanisms of green synthesis approaches, especially for metal and metal oxide [e.g., gold (Au), silver (Ag), copper oxide (CuO), and zinc oxide (ZnO)] nanoparticles using natural extracts. The role of biological components is explored, including essential phytochemicals (e.g., flavonoids, alkaloids, terpenoids, amides, and aldehydes) as reducing agents and solvent systems. The stability/toxicity of nanoparticles and associated surface engineering techniques for achieving biocompatibility are also discussed. Applications of synthesized products to environmental remediation are considered in terms of antimicrobial activity, catalytic activity, removal of pollutants dyes, and heavy metal ion sensing.
https://jnanobiotechnology.biomedcentral.com/articles/10.1186/s12951-018-0408-4

General News

TECHNOLOGY GUIDE: BIOREMEDIATION

Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE), Australia. 44 pp, 2018

The purpose of this guide is to provide information on bioremediation as a treatment technology for the remediation of contaminated sites to assist with selection of remediation options. The document contains information to inform remediation planning and aid compilation of a remediation action plan. While soil, groundwater, and vapor are all able to be bioremediated, this document predominantly provides guidance on the application of bioremediation as a remediation technology to treat contaminated soil. This guide is primarily intended to be utilized by remediation practitioners and those reviewing practitioner's work; however, it can be utilized by other stakeholders within the contaminated sites industry, including site owners, proponents of works, and the community. *See this guide and others that CRC CARE is developing as part of a National Remediation Framework to provide practical guidance to practitioners and regulators in Australia. The files are posted near the bottom of* https://www.crccare.com/knowledge-sharing/national-remediation-framework.

SCIENTIFIC EVIDENCE AND RECOMMENDATIONS FOR MANAGING PFAS CONTAMINATION IN MICHIGAN

Michigan PFAS Science Advisory Panel, 90 pp, 2018

In November 2017, after finding per- and polyfluoroalkyl substances (PFASs) in several locations in Michigan, the Michigan PFAS Action Response Team (MPART) was established by Executive Directive. The purpose of MPART is to ensure a comprehensive, cohesive, and timely response to the continued mitigation of PFASs across Michigan. Since its inception, MPART has worked to address 34 sites of PFAS groundwater and surface water contamination across the state. This report provides a general understanding of human health risks associated with PFASs in the environment and evidence-based recommendations to Michigan. While this document discusses environmental pathways for PFAS contamination, its scope is directed toward human health as a first priority.
https://www.michigan.gov/documents/pfasresponse/Science_Advisory_Board_Report_641294_7.pdf

NANOTECHNOLOGY: A NEW PERSPECTIVE FOR MANAGEMENT OF ENVIRONMENT

Banwaskar, M.R. and S.N. Dachawar.
International Journal of Research and Analytical Reviews 6(1):i78-i82(2019)

Nanotechnology is being explored to provide new solutions for detoxification of the environment. It can also prevent the formation of dangerous pollutants. This paper discusses the use of nanotechnology for sustainable management of environment and also throws light on how nanotechnology can support precision farming and energy generation. *This article is* ***Open Access*** *at* http://ijrar.com/upload_issue/ijrar_issue_20542927.pdf

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