Endosulfan

Title	Bioconcentration factor-based management of soil pesticide residues: Endosulfan uptake by carrot and potato plants
Author Name	Jeong-In Hwang, Andrew R Zimmerman & Jang-Eok Kim
Journal Name	Science of the Total Environment
Year	2018
Volume and Issue	Volume 627
Pages	Pages 514-522
Abstracts	*Endosulfan (ED*) losses in crop-grown soils fit a double-exponential model. • *Crop ED* uptake trends vary with plant compartment and starting soil ED levels. • *Bioconcentration factors (BCFs)* decrease with time and fit first order kinetic models. • *BCF* models could predict allowable soil ED residue levels for safe crop production. Uptake characteristics of *endosulfan* (ED), including α-, β-isomers and *sulfate-metabolites*, from the soils by carrot and potato plants were investigated to establish a method that may be used to calculate recommended permissible soil contaminant concentrations (C s, permissible) at time of planting so that maximum residue level (MRL) standards are not exceeded. The residues of ED were analyzed in soils treated with ED at concentrations of either 2 or 10 mg kg soil −1 and in the plants (carrots and potatoes) grown in such soils for 60-90 d. Presence of plants increased ED dissipation rates in soils in patterns that were best fit to a double-exponential decay model (R 2 of 0.84-0.99). The ED uptake extent varied with type of crop, ED isomer, plant growth duration, and plant compartments. However, ED concentrations in all edible parts of crops eventually exceeded their maximum residue limits. Total ED *bioconcentration* factor (BCF), the ratio of soil ED concentration at planting time to that in edible part of each crop at harvest day, was found to decrease with time due to decreasing soil ED concentration and increasing plant biomass in a pattern that followed a first order kinetic model. Using this model, the C s, permissible values, specific to the soils used in this study, were calculated to be 0.32 and 0.19 mg kg soil −1 for carrots and *potatoes* , respectively. The results and methods developed in this study may be utilized as a prediction tool to ensure crop safety from pesticide residues.
Keywords	Carrot; Crop Uptake; Endosulfan; Potato; Bioconcentration factor; Pesticides Management factor

Title	**Endosulfan Plant Uptake Suppression Effect on Char Amendment in Oriental Radish**
Author Name	Geun-Hyoung Choi, Deuk-Yeong Lee, Dong-CheolSeo, Leesun Kim, Sung-Jin Lim, Song-HeeRyu, Byung-Jun Park, Jeong-Han Kim&Jin Hyo Kim
Journal Name	Water, Air, & Soil Pollution
Year	2018
Volume and Issue	Volume 229, Issue 24
Abstracts	Persistent organic pollutants (POPs) immobilization in farm land is an important issue to solve the residue in crop, and char has been considered for the remediation. In here, three commercially available chars like powdered oak char (POC), granulated oak char (GOC), and rice husk char (RHC) including powdered activated carbon (PAC) were investigated for their potential to adsorb and immobilize *endosulfan* in the soil. The maximum adsorption capacities (mg g−1) of the applied chars as POC, GOC, and RHC were 714.8, 322.6, and 181.8, respectively, and the capacity of POC was similar with PAC (713.8). In addition, the pore volume (0.138 cm3 g−1) and the surface area (270.3 m2 g−1) of POC were over 3-fold higher than GOC and RHC. The *bioconcentration* factor (BCF) reducing effect of *α-, β-endosulfan*, and *endosulfansulfate* in oriental radish (*Raphanussativus var. sativus*) was investigated by amendment of three commercially available chars to the contaminated soils. The BCF of total *endosulfan* was 0.025 in the radish root. POC treatments effectively suppressed the *endosulfan* uptake (BCF 0.002). However, GOC and RHC showed little BCF reducing effect of *endosulfan* in radish.
Keywords	Bioconcentration factor; Endosulfan; Char; Soil amendment; Radish

Title	**Assessment and comparison of phytoremediation potential of selected plant species against endosulfan**
Author Name	V. Singh, A. Lehri&N. Singh
Journal Name	International Journal of Environmental Science and Technology
Year	2018
Pages	Pages 01-18
Abstracts	The present study is focused on assessment of *phytoremediation* potential of selected plant species by removal of *endosulfan* from contaminated soil via plant uptake. Eight plant species were selected for pot experiment under controlled condition. From the field monitoring study, *Vetiveriazizanioides* was found to be *accumulate* more *endosulfan* as compared to others. In this experiment, the *phytoremediation* potential of V. *zizanioides* is further tested. Apart from V. *zizanioides*, eight locally available plant species, namely *Phragmitiskarka*, *Jatrophacurcas, Brassica juncea,Vignaradiata, Solanumlycopersicum, Solanummelongena, Spinaciaoleracea and Withaniasomnifera,* were also tested against different concentrations of endosulfan (0–1500 µg g−1) the interval of at 500 µg g−1. Morphological parameters in terms of fresh weight, biomass, shoot length and root length were deliberate just after harvesting. The chlorophyll, *carotenoids* and lipid *peroxidation* were estimated in plant samples. Microbial biomass carbon (MBC), *dehydrogenase* activity (DHA), pH, electrical conductivity and *endosulfan* concentration were analyzed in soil before and after cropping. The result shows that there was a noteworthy difference at 95% confidence level in growth of experimental plants when compared with control. Enhanced MBC and DHA showed active degradation of *endosulfan* by microbes that proliferate due to secretion of root exudates of test plants. Among all the test plants, V. *zizanioides* accumulated the highest and B. *juncea* accumulated the lowest concentration of *endosulfan* in their tissues. No significant reduction in lipid *peroxidation* and chlorophyll content in V. *zizanioides* supports its suitability for *phytoremediation*.
Keywords	Accumulation; Endosulfan; Phytoremediation; Vetiveria zizanioide; Biomass

Title	**Distribution mode and environmental risk of POP pesticides such as endosulfan under the agricultural practice of straw incorporating**
Author Name	JieWang, LiLi, JianguoLiu&BowenTi
Journal Name	Environmental Pollution
Year	2017
Volume and Issue	220
Pages	1394-1399
Abstracts	The practice of incorporating post-harvest crop waste is widely used because it maintains soil fertility and avoids environmental pollution from straw burning. However, the practice of straw incorporation may also retain the pesticides that are applied to crop plants, which may pose a potential long term risk to local and regional environments if the applied pesticide is a Persistent, *Bioaccumulative*, and Toxic (PBT) substance or a Persistent Organic Pollutant (POP). Here we investigate the influence of the "receiving-retention-release" route on the distribution of a POP pesticide (*endosulfan)* and the associated environmental risk among different environmental compartments. Our study indicates that most endosulfan enters the atmosphere *(φatmosphere = 64.5–72.5%),* which is dominated by the indirect route of volatilization from crop plants *(φatmosphere, indirect = 54.7–70.3%)*. In contrast, soil releases are minor (ϕsoil = 10.8–20.5%), and are dominated by direct release during application (ϕsoil, direct = 8.0–18.0%). Under the practice of straw incorporation, the use of *endosulfan* posed an environmental risk to agricultural soil. In addition, the atmospheric deposition of *endosulfan* also posed an environmental risk to sediment. The study highlights the significance of the "receiving-retention-release" route by crop plants in determining the fate of POP pesticides associated with straw incorporation; hence complementing the current methodology for assessing the environmental risk of these compounds.
Keywords	Straw incorporation; "Receiving-retention-release" route; Endosulfan; Environmental risk assessment

Title	**Uptake and accumulation of endosulfan isomers and its metabolite endosulfan sulfate in naturally growing plants of contaminated area**
Author Name	Vandana Singh, Nandita Singh
Journal Name	Ecotoxicology and Environmental Safety
Year	2014
Volume and Issue	Volume 104
Pages	189–193
Abstracts	Endosulfan isomers (α+β) and its main metabolite endosulfan sulfate were analyzed in naturally growing vegetation of pesticide contaminated area in Ghaziabad, India. Seven species of dominating plants were collected at different locations within the contaminated area. Endosulfan residues from plant parts and soil were extracted and determined by a gas chromatograph equipped with 63Ni electron capture detector (GC-ECD). Endosulfan isomers and endosulfan sulfate were present in almost all soil and plant samples. The concentration of total endosulfan in plant and soil samples analyzed ranged from 14 to 343 ng g−1 and 13 to 938 ng g−1 respectively. Out of seven plant species studied, Vetiveria zizanioides (Khus Khus) and Sphenoclea zeylamica (Chikenspike) showed the highest and lowest accumulation respectively, with a significant difference at $p<0.01$ level. Vetiveria zizanioides and Digitaria longiflora (Crab grass) could accumulate considerable levels of endosulfan isomers (α+β) (343 and 163 ng g−1 respectively) and endosulfan sulfate (21 and 2 ng g−1, respectively).
Keywords	Endosulfan; Bioaccumulation, Organic pollutants, Persistence, Accumulation potential, Remediation

Title	**Bioremediation of endosulfan in laboratory-scale constructed wetlands: effect of bioaugmentation and biostimulation**
Author Name	Congcong Zhao & HuiJun Xie & Yang Mu & Xiaoli Xu & Jian Zhang & Cui Liu & Shuang Liang & Huu Hao Ngo & Wenshan Guo & Jingtao Xu & Qian Wang
Journal Name	Environmental Science Pollution Research
Year	2014
Volume and Issue	21
Pages	12827–12835
Abstracts	Abstract Bioremediation is widely used in organic pollutants. However, very little has been known on its application in constructed wetlands contaminated with *organochlorine* pesticide, *endosulfan* in particular. To evaluate the effect of bioremediation on *endosulfan* removal and clarify the fate, bioaugmentation and *biostimulation* were studied in laboratory-scale vertical-flow constructed wetlands. After 20 days' experiment, endosulfan isomers removal efficiencies were increased to 89.24–97.62 % through bioremediation. In bacteria *bioaugmentation* (E-in) and sucrose *biostimulation* (E-C), peak concentrations of *endosulfan* in sediment were reduced by 31.02–76.77 %, and plant absorption were 347.45–576.65 μg kg−1. By contrast, plant absorption in KH2PO4 *biostimulation* (E-P) was increased to 811.64 and 1,067.68 μg kg−1. Degradation process was probably promoted in E-in and E-C, while plant absorption was enhanced in EP. Consequently, E-in and E-C were effective for *endosulfan* removal in constructed wetlands, while adding KH2PO4 had potential to cause air pollution. Additionally, combined bioremediation was not recommended.
Keywords	Bioremediation, Constructedwetlands, Endosulfan, Sucrose , KH2PO4

Title	**Phytotoxicity Assay of Crop Plants to Lindane and Alphaendosulfan Contaminants in Alkaline Thai Soil**
Author Name	Waraporn chouychai and Hung lee
Journal Name	International journal of agriculture & biology
Year	2012
Volume and Issue	Volume 14, Issue 5
Pages	734–738
Abstracts	Four plants (corn, pumpkin, sunflower & water morning glory) were tested for their ability to germinate and grow in an alkaline Thai soil contaminated with 0.2–20 mg/kg dry soil of either lindane or alpha endosulfan, two organochlorine pesticides commonly found in agricultural soils in Thailand. Based on root length assessment, sunflower was the most tolerant to lindane contaminant, while corn was the most tolerant to alpha-endosulfan in the alkaline soil. Base on root dry weight assessment, corn was the most tolerant to both lindane and alpha-endosulfan. Corn was selected to further test its ability to tolerate a mixture of 0.2, 2.0, 20 mg/kg dry soil of lindane and alpha-endosulfan in the alkaline soil. The presence of both pesticides decreased root length of corn but did not affect its shoot and root dry weights. The results suggest that corn is suitable for use in the phytoremediation of alkaline soil contaminated with a mixture of lindane and alpha-endosulfan.
Keywords	Alkaline soil, Endosulfan, Lindane, Organochlorine, Phytotoxicity

Title	**Phytoremediatory effect and growth of two species of Ocimum in endosulfan polluted soil**
Author Name	M. Ramírez-Sandoval, G.N. Melchor-Partida, S. Muñiz-Hernández, M.I. Girón-Pérez, A.E. Rojas-García, I.M. Medina-Díaz, M.L. Robledo-Marenco, J.B. Velázquez-Fernández
Journal Name	Journal of Hazardous Materials
Year	2011
Volume and Issue	Volume 192, Issue 1
Pages	388–392
Abstracts	Endosulfan is a hazardous organochlorine pesticide banned or restricted in several countries. However, it has been found in the environment and in animal samples. To study a potential way to bioremediate soils contaminated with this pesticide, two plant species of the genus Ocimum were studied: Ocimum basilicum L. and Ocimum minimum L., since they are economically feasible and well adapted to the climatic conditions of the Nayarit zone (Mexican pacific coast). Young plants were transplanted into soil experimentally polluted with endosulfan. Growth of both species was not affected by endosulfan, the plants grew, flourished, and produced seeds; 30 days later, endosulfan concentration was lower in the soil with O. basilicum than in the soil without plants. On day 90, no differences in endosulfan concentrations were found between soil with or without O. minimum. At day 1, plants in the polluted soil showed lipoperoxidation, as measured by thiobarbituric acid-reactive species (TBARS). Interestingly, a higher TBARS value was observed at day 3 in transplanted plants as compared to non-transplanted plants. In conclusion, both species can endure endosulfan pollution (as high as 1 g kg−1) in soils. O. basilicum seems to be an adequate candidate for bioremediation of soils polluted with endosulfan.
Keywords	Ocimum, Endosulfan, Bioremediation