

Organophosphate

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| Title | Toxicity, monitoring and biodegradation of organophosphate pesticides: A review |
| Author Name | Gurpreet Kaur Sidhua, Simranjeet Singha , Vijay Kumarb, Daljeet Singh Dhanjala , Shivika Dattac§ , and Joginder Singh |
| Journal Name | Critical Reviews in Environmental Science and Technology |
| Year | 2019 |
| Volume and Issue | --- |
| Pages | --- |
| Abstracts | <p>Organophosphates are one of the major constituent of herbicides, pesticides, insecticides and nerve gas. Azinophosmethyl, chlorpyrifos, diazinon, fonofos and disulfoton are wellknown organophosphate pesticides (OPs) having extensive applications in agriculture, horticulture, pest control, plastic making, flame retardants and for several household applications. OPs are the ester forms of phosphoric acid, usually considered as safe for agriculture use due to their relatively fast degradation rates. Acute or chronic exposure to OPs can produce varying levels of toxicity in humans, animals, plants, and insects. These are known to inhibit acetylcholinesterase activity, not only in insects but also in aquatic and terrestrial organisms leading to respiratory, reproductive, nervous, hepatic and renal abnormalities. OPs disrupt the growth promoting mechanism by inhibiting various enzymes, transcuticular diffusion and permeability which is essential for the growth of plants. Regular use of OPs subside the microbial community and reduces soil fertility. Due to environmental concerns associated with the accumulation of OPs in food products and water supplies, there is an urgent need to develop rapid, reliable and economical method amenable to onsite applications. Here, we review different classes of organophosphate pesticides, their environmental issues, analytical techniques for estimation, and eco-friendly biodegradation approaches for its efficient bioremediation.</p> |
| Keywords | Accumulation; biodegradation; organophosphates; soil microorganisms; toxicity |

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| Title | Uptake and translocation of organophosphate flame retardants (OPFRs) by hydroponically grown wheat (<i>Triticum aestivum</i> L.) |
| Author Name | Qingzhi Wang, Hongxia Zhao, Ling Xu & YanWang |
| Journal Name | Ecotoxicology and Environmental Safety |
| Year | 2019 |
| Volume and Issue | 174 |
| Pages | Pages 683-689 |
| Abstracts | <p>The increasing load of organophosphate flame retardants (OPFRs) has generated wide concerns about their potential residues in aquatic environments. The uptake and translocation of fourteen OPFRs by wheat (<i>Triticum aestivum</i> L.) were studied under hydroponic conditions. The results revealed that OPFRs were removed from hydroponic solution by wheat, and the removal processes followed first-order kinetics. After 10 days, the removal efficiencies were in a range of $57.9 \pm 3.8\%$–$63.8 \pm 5.6\%$. The potential for translocation of these OPFRs from the roots to foliage was also assessed. OPFRs with relatively higher hydrophobicity were more likely taken up by roots, and OPFRs with lower hydrophobicity were more prone to be translocated. Root concentration factors (RCFs), transpiration stream concentration factors (TSCFs), and foliage/root concentration factors (FRCFs) were calculated. Furthermore, significant correlations were found between RCF, FRCF or TSCF values of OPFRs and log K_{ow} ($p < 0.05$), and translocation of OPFRs depended on their physicochemical properties. The findings of this study develop better understanding of accumulation and translocation of OPFRs in plants, which is valuable for environmental and human health assessments of such kind of contaminants.</p> |
| Keywords | Organophosphate esters; Root uptake; Removal efficiency; Phytoremediation |

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| Title | Occurrence, distribution and human exposure to 20 organophosphate esters in air, soil, pine needles, river water, and dust samples collected around an airport in New York state, United States |
| Author Name | Wenhui Li, YuWang & Kurunthachalam Kannan |
| Journal Name | Environment International |
| Year | 2019 |
| Volume and Issue | 131 |
| Pages | ---- |
| Abstracts | <p>Organophosphate esters (OPEs) are used in aircraft lubricating oil and hydraulic fluids, and, thus, airplane emissions are thought to be an important source of these chemicals in the environment. In this study, concentrations of 20 OPEs, comprising seven alkyl-OPEs, three chlorinated (Cl)-OPEs, seven aryl-OPEs, and three oligomeric-OPEs, were determined in outdoor air, soil, pine needles, river water, and outdoor dust samples collected around an airport in Albany, New York, in 2018. Elevated ΣOPE concentrations were found in outdoor air, soil, pine needles, outdoor dust, and river water in the ranges of 1320–20,700 pg/m³ (median: 3880), 1.16–73.1 (14.3) ng/g dry weight (dw), 23.2–534 (102) ng/g (dw), 153–2140 (824) ng/g (dw), and 174–24,600 (1250) ng/L, respectively. The total OPE concentrations in air, soil, water, and outdoor dust samples in the study area were dominated by Cl-OPEs, whereas those in pine needles were dominated by aryl-OPEs. The spatial distribution of OPEs in air, soil, and pine needles showed a gradual decreasing trend with increasing distance from the airport. A significant correlation was observed between ΣOPE concentrations in air and soil, and the fugacity ratio showed the flux of OPEs from air to soil. The spatial distribution of OPEs between air and pine needles was similar and highly correlated, suggesting that pine needles are suitable indicators of atmospheric OPE concentrations. In addition to urban activities, aircraft hydraulic/lubricant oils are a major source of OPEs in the vicinity of the airport. The average daily intake of OPEs via air inhalation and outdoor dust ingestion in the vicinity of the airport was up to 1.53 ng/kg bw/day for children and 0.73 ng/kg bw/day for adults.</p> |
| Keywords | Organophosphorus flame retardants; Atmosphere; Airport; Flux; Partitioning; Pine needle |

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| Title | Concentration and spatial distribution of organophosphate esters in the soil-sediment profile of Kathmandu Valley, Nepal: Implication for risk assessment |
| Author Name | Ishwar Chandra Yadav, Ningombam Linthoingambi Devi, Jun Li, Gan Zhang & Adrian Covacic |
| Journal Name | Science of The Total Environment |
| Year | 2018 |
| Volume and Issue | 613-614 |
| Pages | Pages 502-512 |
| Abstracts | <p>Despite the fact that soil and sediments, which act as a sink or potential source of organic pollutants, have been polluted with organophosphate esters (OPEs) around the globe, extremely constrained data is accessible on environmental concentration and fate of OPEs in solid matrices in whole of the South Asia particularly if there should be an occurrence in Nepal. In this study, surface soil (N = 19) and sediments samples (N = 20) were analyzed for eight different OPE in Kathmandu Valley during October 2014. The concentration of Σ 8OPE measured in sediments samples was 12 times higher than soil and ranged 983–7460 ng/g dw (median 2210 ng/g dw) and 65–27,500 ng/g dw (186 ng/g dw), respectively. TMPP was most abundant in soil followed by TCIPP, TEHP and EHDPHP and ranged 17–25,300 ng/g dw (41.3 ng/g dw), 11.2–911 ng/g dw (31.7 ng/g dw), 8.52–858 ng/g dw (26.1 ng/g dw) and 10.2–114 ng/g dw (25.6 ng/g dw), respectively. TEHP was most prevalent in sediments followed by TMPP and EHDPHP and were in the range of 657–3020 ng/g dw (median 1140 ng/g dw), 267–2630 ng/g dw (median 815 g/g dw), 34–418 ng/g (median 131 ng/g dw), respectively. The sources of the high level of OPEs in soil was related to the end point use of consumer materials, traffic emission, and close proximity to commercial and industrial areas; while domestic sewage discharges and effluents from carpet industry were identified as the possible entry of OPE in sediments. Total organic carbon (TOC) and black carbon (BC) content in soil were moderately and positively correlated with Σ 8OPE indicating more or less influence of soil organic carbon. The health risk assessment suggested dermal absorption of OPEs via soil is the primary pathway of human exposure to the general population. The significantly high-risk quotient (RQ) estimated for Σ 8OPEs especially TMPP and TPHP suggested significant potential adverse risk for aquatic organisms.</p> |
| Keywords | Nepal; Carpet effluent; Domestic sewage; Consumer materials; Bagmati River |

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| Title | Organophosphate pesticide in agricultural soils from the Yangtze River Delta of China: concentration, distribution, and risk assessment |
| Author Name | Lili Pan, Jianteng Sun, Zhiheng Li, Yu Zhan, Shen Xu & Lizhong Zhu |
| Journal Name | Environmental Science and Pollution Research |
| Year | 2018 |
| Volume and Issue | 25, 1 |
| Pages | 4–11 |
| Abstracts | <p>Organophosphorus pesticides (OPPs) are used worldwide and pose great risks to human health. However, information on their presence in agricultural soils at regional scale and the associated risks is limited. In this study, an extensive investigation on agricultural soils was conducted throughout the Yangtze River Delta (YRD) of China to reveal the status of OPP pollution. The total concentrations of the nine OPPs ranged from <math><3.0</math> to 521 ng g⁻¹ dry weight, with a mean of 64.7 ng g⁻¹ dry weight and a detection rate of 93 %. Dimethoate was found to be the primary compound, followed by methyl parathion and parathion. The highest concentrations of OPPs were found in Jiangsu province due to the intensive agricultural activities. The pollution of OPPs is also highly associated with the land use types. The lower concentrations of OPPs found in vegetable fields could be attributed to their easy photodegradation and hydrolysis in aerobic soils. There was no significant difference in microbial communities among the sample sites, indicating that OPPs in agricultural soils of the YRD region cause negligible effects on microbiota. The risks of OPPs in the soils to human health were further evaluated. The hazard indexes in all the soil samples were below 1, suggesting absence of non-cancer risks. This study provides valuable information for a better understanding of the pollution status of OPPs in agricultural soils and a scientific basis for soil quality assessments.</p> |
| Keywords | Organophosphorus pesticide; Farmlands; Soil pollution; Microbial communities; Human health risks |

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| Title | Effects of Organophosphate Herbicides on Biological Organisms in Soil Medium-A Mini Review |
| Author Name | Suleiman Usman, Abbakar Musa Kundiri, and Maximillien Nzamouhe |
| Journal Name | Journal of Ecology and Toxicology |
| Year | 2017 |
| Volume and Issue | 1,1 |
| Pages | Pages 102 |
| Abstracts | <p>Herbicides are toxic agrochemicals, which have being used to fight against the existence of weeds in the agricultural farms and gardens. To some extent, these herbicides are rampantly used by farmers without considering the long or short term effects in soil medium. The aim of this paper was to provide a synopsis review of the effects of some organophosphate herbicides to soil biological community. It is evident that most of these herbicides may cause the reduction of sensitive populations of certain groups of biota in soil medium. This paper reported that the effect of organophosphate herbicides on soil biota is considerable. For example, Paraquat and round-up treated soils has been noted to cause decrease in heterotrophic aerobic bacterial count (HAB) and fungal population. It is believe that in cases where these herbicides are used to treat soils, they are considered harmful to nematode, earthworms and other biological organisms. They suppress the biodiversity of soil microbes, hinder the decomposition of soil organic matter and altered plant biomass. They also obstruct the biological activities of soil biota, photosynthetic, biosynthetic reaction, cell growth/divisions and molecular composition of soil biota. Understanding these effects is vital for variety of agricultural purposes including ensuring healthy soil and crop yield conditions, water sanitation, environmental quality and human health developments.</p> |
| Keywords | Herbicide; Soil; Biota |

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| Title | The occurrence and removal of organophosphate ester flame retardants /plasticizers in a municipal wastewater treatment plant in the Pearl River Delta, China |
| Author Name | Xiangying Zeng, Zhiyang Liu, Lixiong He, Shuxia Cao, Han Song, Zhiqiang Yu, Guoying Sheng & Jiamo Fu |
| Journal Name | Journal of Environmental Science and Health, Part A |
| Year | 2015 |
| Volume and Issue | 50 |
| Pages | 1291–1297 |
| Abstracts | The occurrence, distribution and main removal pathway of seven widely used organophosphate esters (OPs) in a municipal wastewater treatment plant (WWTP) located in the Pearl River Delta were investigated. Their daily discharge load into the Pearl River via effluent was also estimated. All the target analytes were detected in wastewater, suspended particle and dewatered sludge, with trin-butyl phosphate (TBP) and tris(2-butoxyethyl) phosphate (TBEP) as the main components. The total concentrations of TBP and TBEP were 21271.8 ng L ⁻¹ and 4349.4 ng L ⁻¹ , 3105.1 ng L ⁻¹ and 494.5 ng L ⁻¹ in influent wastewater and final effluent, respectively. These results indicated that non-chlorinated OPs were removed efficiently in the WWTP, while chlorinated OPs passed through the WWTP unchanged due to their resistance to current wastewater treatment technology. Approximate 91.4 g of non-chlorinated OPs and 23.4 g of chlorinated OPs per day were discharged into the Pearl River via effluent, 2.4 g of non-chlorinated OPs and 0.6 g of chlorinated OPs entered the environment following sludge disposal. |
| Keywords | Organophosphate ester; sludge; wastewater; removal |

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| Title | Removal of organophosphate esters from municipal secondary effluent by ozone and UV/H ₂ O ₂ treatments |
| Author Name | Xiangjuan Yuan , Silvia Lacorte , Joyce Cristale, Renato F. Dantas, Carme Sans, Santiago Esplugas, Zhimin Qiang |
| Journal Name | Separation and Purification Technology |
| Year | 2015 |
| Volume and Issue | 156,3 |
| Pages | 1028–1034 |
| Abstracts | <p>Organophosphate esters (OPEs) have emerged as a new class of contaminants due to their massive use as flame retardants and plasticizers. These contaminants are toxic to aquatic organisms and some of them are not biodegradable in wastewater treatment plants. This study investigated the degradation kinetics of eight typical OPEs during ozone and UV/H₂O₂ treatments in Milli-Q water, humic acid (HA) solution, and municipal secondary effluent. The studied OPEs included three chlorinated: tris(2-chloroethyl) phosphate (TCEP), tris(chloropropyl) phosphate (TCPP) and tris(dichloropropyl) phosphate (TDCP); two aromatic: triphenyl phosphate (TPhP) and tricresyl phosphate (TCrP); and three aliphatic: tri-n-butyl phosphate (TnBP), tris(2-butoxyethyl) phosphate (TBEP), and tris(2-ethylhexyl) phosphate (TEHP). Results indicate that the degradation of target OPEs conformed to the pseudo-first-order kinetics and UV/H₂O₂ was more effective than ozone for their elimination by comparing the overall removal efficiencies and energy consumptions. Two aromatic and two aliphatic OPEs (i.e., TPhP, TCrP, TnBP and TBEP) were effectively degraded by ozone and UV/H₂O₂ in the test water matrices, while all chlorinated and one aliphatic OPEs (i.e., TCEP, TCPP, TDCP and TEHP) were found to be recalcitrant to oxidation. Moreover, the presence of HA significantly enhanced the degradation of reactive OPEs in ozone treatment.</p> |
| Keywords | Organophosphate esters (OPEs); Municipal secondary effluent; Advanced treatment; Ozone; UV/H ₂ O ₂ |

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| Title | Plant growth promoting rhizobacteria: an effective tool to remediate residual organophosphate pesticide methyl parathion, widely used in indian agriculture |
| Author Name | Yadav Pratibha and Sundari S.Krishna |
| Journal Name | Journal of Environmental Research And Development |
| Year | 2015 |
| Volume and Issue | 9,4 |
| Pages | 1138-1149 |
| Abstracts | <p>Organophosphate pesticides (OPP) are applied globally and are considered to be relatively safer alternatives to the first generation pesticides dominated by organochlorines. OPP are also more amenable to degradation. However, bioaccumulation of highly toxic organophosphates (Ops) has been observed which may be due to sorption of OPs to soil particles, making it unavailable for microbial metabolism. As a result several acute and chronic toxicity effects (Neurological effects) were reported in connection with OPP. The primary route of entry of these chemicals to food chain is through food crops grown in chemically overburdened agricultural soils. Hence it's important to address this problem by constructing a bioremediation method for in-situ remediation of OPP in agricultural soils without causing any harm to plants. Our study focuses on remediation of OPP methyl parathion using rhizobacteria (namely RB1, RB2, RB3 and RB4) that also have properties of plant growth promotion. Primary screening was done to check the limits of tolerance in test isolates to a range of OPP (100 - 600ppm). Isolate RB1 showed best tolerance to OPP with a 11% growth increment at 500ppm of OPP. Isolates to utilize OPP as principle carbon and/ or nitrogen source, in vitro experiments were conducted by sequential exclusion of carbon and nitrogen salts in the medium and provision of OPP in their place. Amongst the four isolates studied, RB1 was found to be best utiliser of methyl parathion as both carbon and nitrogen source followed by RB4, whereas RB3 showed best response towards utilization of methyl parathion as nitrogen source. Further enzyme assays were conducted to test the presence of enzymes responsible for OPP degradation i.e., esterase and OPhydrolase (OPH). Isolates RB1 and RB4 showed maximum enzyme activity even at a OPP concentration of 300ppm. Additionally biochemical tests were performed to identify such properties that would increase OPP bioavailability and thus promote degradation of OPP. These assays comprised of: emulsification assay, assay for biofilm formation and biosurfactant assay to which isolates RB1, RB2 and RB3 gave strong positive results. Subsequently, in vitro plant bio assay was performed to check ability of these isolates for promoting growth of Mung bean (<i>Vigna radiata</i>) when challenged with increasing concentrations of OPP (100 – 500ppm) in the medium. Upon inoculation with test isolates, positive growth increment was observed in radical length and an increase in percentage germination, leaf count, seed vigour and total biomass in seedlings. Thus from our study it is evident that rhizobacteria can be effectively used both for remediation of OPP and promote plant growth.</p> |
| Keywords | Pesticide remediation; Esterase; OP hydrolase; Rhizobacteria; Biofilm |

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| Title | Evaluation of Alternatives to Carbamate and Organophosphate Insecticides Against Thrips and Tomato Spotted Wilt Virus in Peanut Production |
| Author Name | K. Marasigan, M. Toews, R. Kemerait Jr, M. R. Abney, A. Culbreath, R. Srinivasan |
| Journal Name | Journal of Economic Entomology |
| Year | 2015 |
| Volume and Issue | Volume 3 |
| Pages | 113-124 |
| Abstracts | <p>Thrips are important pests of peanut. They cause severe feeding injuries on peanut foliage in the early season. They also transmit Tomato spotted wilt virus (TSWV), which causes spotted wilt disease. At-plant insecticides and cultivars that exhibit field resistance to TSWV are often used to manage thrips and spotted wilt disease. Historically, peanut growers used the broad-spectrum insecticides aldicarb (IRAC class 1A; Temik) and phorate (IRAC class 1B; Thimet) for managing thrips and thereby reducing TSWV transmission. Aldicarb has not been produced since 2011 and its usage in peanut will be legally phased out in 2018; therefore, identification of alternative chemistries is critical for thrips and spotted wilt management. Here, eight alternative insecticides, with known thrips activity, were evaluated in field trials conducted from 2011 through 2013. In addition, different application methods of alternatives were also evaluated. Imidacloprid (Admire Pro), thiamethoxam (Actara), spinetoram (Radiant), and cyantraniliprole (Exirel) were as effective as aldicarb and phorate in suppressing thrips, but none of the insecticides significantly suppressed spotted wilt incidence. Nevertheless, greenhouse assays demonstrated that the same alternative insecticides were effective in suppressing thrips feeding and reducing TSWV transmission. Spotted wilt incidence in the greenhouse was more severe (~80%) than in the field (5–25%). In general, field resistance to TSWV in cultivars only marginally influenced spotted wilt incidence. Results suggest that effective management of thrips using alternative insecticides and subsequent feeding reduction could improve yields under low to moderate virus pressure.</p> |
| Keywords | tobacco thrips; spotted wilt; vector and disease management |

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| Title | Ecotoxicity of two organophosphate pesticides chlorpyrifos and dichlorvos on non-targeting cyanobacteria <i>Microcystis wesenbergii</i> |
| Author Name | Kai-Feng Sun, Xiang-Rong Xu, Shun-Shan Duan, You-Shao Wang, Hao Cheng, Zai-Wang Zhang, Guang-Jie Zhou, Yi-Guo Hong |
| Journal Name | Ecotoxicology |
| Year | 2015 |
| Volume and Issue | 24 |
| Pages | 1498-1507 |
| Abstracts | <p>Organophosphate pesticides (OPs), as a replacement for the organochlorine pesticides, are generally considered non-toxic to plants and algae. Chlorpyrifos and dichlorvos are two OPs used for pest control all over the world. In this study, the dose–response of cyanobacteria <i>Microcystis wesenbergii</i> on OPs exposure and the stimulating effect of OPs with and without phosphorus source were investigated. The results showed that high concentrations of chlorpyrifos and dichlorvos caused significant decrease of chlorophyll a content. The median inhibitory concentrations (EC50) of chlorpyrifos and dichlorvos at 96 h were 15.40 and 261.16l mol L⁻¹, respectively. Growth of <i>M. wesenbergii</i> under low concentration of OPs (ranged from 1/10,000 to 1/20 EC50), was increased by 35.85 % (chlorpyrifos) and 41.83 % (dichlorvos) at 120 h, respectively. Correspondingly, the highest enhancement on the maximum quantum yield (Fv/Fm) was 4.20 % (24 h) and 9.70 % (48 h), respectively. Chlorophyll fluorescence kinetics, known as O–J–I–P transients, showed significant enhancements in the O–J, J–I, and I–P transients under low concentrations of dichlorvos at 144 h, while enhancements of chlorophyll fluorescence kinetics induced by low concentrations of chlorpyrifos were only observed in the J–I transient at 144 h. Significant decreases of chlorophyll content, Fv/Fm and O–J–I–P transients with OPs as sole phosphorus source were found when they were compared with inorganic phosphate treatments. The results demonstrated an evidently hormetic dose–response of <i>M. wesenbergii</i> to both chlorpyrifos and dichlorvos, where high dose (far beyond environmental concentrations) exposure caused growth inhibition and low dose exposure induced enhancement on physiological processes. The stimulating effect of two OPs on growth of <i>M. wesenbergii</i> was negligible under phosphate limitation.</p> |
| Keywords | Chlorophyll fluorescence; Hormesis; Chlorpyrifos; Dichlorvos; <i>M. wesenbergii</i> |