Catalog of graphene patents for fertilizers and phytosanitary products

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Patents reviewed 60

Introduction

Due to the large number of graphene oxide patents related to crops, fertilizers and phytosanitary products, the following catalog has been prepared in order to facilitate its review, analysis and access. @ *Given the magnitude of the work, the entry will be updated every day until all the patents discovered are completed and those that are not relevant are discarded* @

Foods explicitly named in patents

- Although the use of bactericides, biocides, fertilizers and phytosanitary products could affect any horticultural product (since many patents are for general use), in order to facilitate reading and review, the crops and fruits expressly mentioned in the patents are outlined, or either for being the object of the invention or for being part of the experimentation and tests carried out.
- Citrus, fruit trees, pear, apple, grapes, blueberries, plantain, banana, cucumber, tomato, cabbage, Chinese cabbage, potato, corn, wheat, rapeseed, legumes, peas...

data count

- **Patents by nationality.** Chinese (58). United States (2).
- **Patents according to their typology.** Fertilizer (26). Bactericide (11). Biocide (22). Pesticide (5). Pesticide(10). Insecticide (2). Soil conditioning (7). Growth regulator (2). Disinfectant (1). Compost (2).

Catalogue

1. **CN104119149A.**陈灿. (2014). [China]. Coated slow-release compound fertilizer containing oxidized graphene. https://patents.google.com/patent/CN104119149A/en
    - *Slow release fertilizer. Composed of graphene oxide, diatomaceous earth, gibberellins, potassium dihydrogen phosphate, silkworm excrement, sawdust, diphosphorus pentoxide, sodium polyaspartate, calcium magnesium phosphate, peat soil, ferrous sulfate, potassium fulvate, manure from decomposed cattle, withered persimmon leaves, sodium molybdate, wheat straw powder, fructooligosaccharides, water-based polyurethane emulsion, epoxysilane crosslinker, and auxiliary agents. The fertilizer has been designed to adapt to any type of soil and improve the efficiency of soil conditioners.*
2. **CN104686571A** . 王秀平; 温晓蕾; 齐慧霞; 赵春明. (2017). [China]. Phenyl-containing bactericide and graphene oxide-based composite bactericide and application of phenyl-containing bactericide and graphene oxide-based composite bactericide. https://patents.google.com/patent/CN104686571A/en
    - *Bactericide. Combination of graphene oxide, phenyl, thiophanate methyl, tpn, phenaminosulf, pcnb, triadimefon, carbendazim or benomyl or probenazole. Treatment to control downy mildew, gray mold and blight of vegetables, leaf blight and helminthosporium maydis of calluses and zoned leaf spot of fruit trees.*
3. **CN104839199A.**王秀平; 温晓蕾; 齐慧霞; 赵春明. (2015). [China]. Complex insecticide based on neurotoxicity pesticide and graphene oxide. https://patents.google.com/patent/CN104839199A/en
    - Insecticide-Biocide. Type of complex insecticide, based on neurotoxicity pesticide (organophosphates and chrysanthemum ester) and graphene oxide. pest control

4. **CN104289197A** . 赵兵. (2016). [China]. Amination-enhanced modified straw based composite material and preparation method thereof. https://patents.google.com/patent/CN104289197A/en
    - *Macromolecular fertilizer. Graphene oxide composite with amination-enhanced modified straw, alginate in deionized water. Calcium ion crosslinking and lyophilization are then applied to the material. Its application is aimed at improving the values of adsorption, porosity, desorption and reuse of nutrients in crops.*
5. **CN105585380A.**陈庆; 孙丽枝. (2016). [China]. Compound fertilizer synergist modified by oxidized graphene and preparation method of compound fertilizer synergist. https://patents.google.com/patent/CN105585380A/en
    - *Fertilizer. Composed of graphene oxide, agricultural and forestry residues, cyclodextrin and auxiliary agents (ammonium persulfate, potassium peroxydisulfate, sodium hydrogen sulfite includes sodium carboxymethylcellulose, guar gum, gum arabic, propylene glycol alginate, esterifying starch...). The patent stands out for developing the synergistic effect between nitrogen, phosphorus and potassium fertilizer.*
6. **CN106083225A.**多立安; 赵树兰; 卢云峰. (2016). [China]. The method using carbon nanomaterial regulation and control consumer garbage compost Pd release power. https://patents.google.com/patent/CN106083225A/en
    - *Compost. Composed of graphene oxide, organic waste, river sand, hydroxylating multiwalled carbon nanotubes, carboxylic-based multiwalled carbon nanotubes, phosphorus, calcium, magnesium, nickel, manganese, iron, zinc. The resulting compost is resistant to soil leaching, improving its fertility.*
7. **CN106105853A.**多立安; 赵树兰; 卢云峰. (2016). [China]. Use the method that carbon nanomaterial improves composting substrate Festuca Arundinacea initial stage ground biomass. https://patents.google.com/patent/CN106105853A/en
    - *Compost. Composed of graphene oxide, organic waste, nitrogen, ash, carboxylic acid COOH, phosphorus, magnesium, nickel, manganese, copper, zinc, chromium, calcium. Oriented to improve the production of the Festuca Arundinacea that serves as food for livestock.*
8. **CN106577644A.**张青; 卢瑞; 姚监; 邓爱珠. (2017). [China]. Medical fertilizer containing graphene nano material and preparation method of medical fertilizer. https://patents.google.com/patent/CN106577644A/en
    - *Fertilizer-Biocide-Pesticide. Composition of graphene oxide with polyethylene glycol, fertilizer, antibiotic insecticide, organophosphate insecticides, nicotinic insecticide, amide insecticides, methoxy acrylic bactericide, triazole bactericide agent, acetamide group herbicides, dinitroaniline herbicide, triazine herbicide and diphenyl ether, among others. The product is characterized by its versatility, characterized as a medical fertilizer, pesticide, insecticide, pesticide, etc.*
9. **CN106747954A.**张青; 卢瑞; 田裕; 宝刘; 玉生. (2017). [China]. A kind of foliar fertilizer of graphene-containing nanomaterial = A kind of foliar fertilizer of graphene-containing nano material. https://patents.google.com/patent/CN106747954A/en
    - *Slow release fertilizer-pesticide. Combination of graphene oxide, phosphate, potassium, calcium, magnesium, zinc, amino acids, among others. Foliar or irrigation administration.*
10. **CN106831183A.**李春生; 陆光远; 谢辉. (2017). [China]. Selenium-rich auxin, foliar fertilizer and preparation method thereof, selenium-rich rapeseed cultivation method. https://patents.google.com/patent/CN106831183A/en
    - *foliar fertilizer. Composition of graphene oxide, selenium-rich auxin, epiphysins, borax, sodium selenates, oxidation stone, black alkene. Applied especially to rapeseed crops.*
11. **CN107581193A.**吴重言; 李忠; 吴成伟; 徐晓勇; 熊燕玲; 邵旭升; 吴静; 陆静; 吴言富; 徐其文. (2018). [China]. A kind of Pesticidal combination containing paichongding and pymetrozine based on carrier. https://patents.google.com/patent/CN107581193A/en
    - *Pesticide-Insecticide. Composition of graphene oxide, paichongding, pymetrozine, sodium hydrate, hydroxymethylcellulose, lignosulfonates, cyanoacrylate and epoxychloropropane. The drug has an insecticidal effect and its application is aimed at sucking pests, aphids, in rice, corn, wheat, vegetable and fruit tree plantations.*

12. **CN107585764A.**刘亚男; 何东宁; 石伟琦; 王琚钢; 马海洋; 李普旺; 冼皑敏. (2020). [China]. Porous oxidation graphene and preparation method thereof and porous oxidation graphene coated slow-release chemical fertilizer and preparation method thereof . https://patents.google.com/patent/CN107585764A/en
    - *Slow release fertilizer. Combination of graphene oxide, potassium permanganate, hydrogen peroxide, hydrochloric acid and chemical fertilizer of the farmer's choice. Ability to sequester carbon from the soil.*
13. **CN107593736A.**束震; 李露蕾; 陶玉贵; 曾卫国; 傅叶强; 卞阿锋; 崔亚放; 王运秋; 束冰. (2018). A kind of hypocrellin photoactivation biological pesticide and preparation method thereof. https://patents.google.com/patent/CN107593736A/en
    - *Pesticide-Pesticide. Photoactivated pesticide, composed of graphene oxide, hypocrellin, non-ionic surfactant (TX-100, OP10, NP-10), buffer (potassium dihydrogen phosphate and disodium hydrogen phosphate), reducing agent (vitamin C acid) and water. The poison acts by contact with the insect.*
14. **CN107711861A.**吴重言; 李忠; 吴成伟; 徐晓勇; 熊燕玲; 邵旭升; 吴静; 陆静; 吴言富; 徐其文. (2018). [China]. A kind of go out controls the attractant and preparation method of whole nest Soil termites. https://patents.google.com/patent/CN107711861A/en
    - *Biocide-Pesticide. Contains graphene oxide, paichongding, benzophenone, potassium sorbate, chitosan and hydroxymethylcellulose. Aimed at eliminating termite nests in 48 hours.*
15. **CN107980541A.**姜鑫; 郭道 (2018). [China]. One kind of plantation selenium-rich soil and its preparation method and application. https://patents.google.com/patent/CN107980541A/en
    - *Fertilizer-Soil conditioner. Combination of graphene oxide, selenium mineral powder, organic fertilizer, protein raw material and straw. Increased nutrient absorption capacity of crops.*
16. **CN108207995A.** Shayan; Sha Xiaolin. (2018). [China]. The copper-based pesticide compound of the degradable graphene oxide-selenizing of slow-release and preparation. https://patents.google.com/patent/CN108207995A/en
    - *Pesticide-pesticide. Graphene oxide selenizing copper composition, chlorine pyrazothion, alternative styrene-maleic anhydride copolymer sodium salt PSMA. Degradable graphene oxide slow release pesticide.*
17. **CN108378025A.**吴雁; 吴学民; 佟雨佳; 邵磊厚. (2018). [China]. A kind of farm chemical carrier and the preparation method and application thereof. https://patents.google.com/patent/CN108378025A/en
    - *Vector for macromolecular fertilizers. Composed of graphene oxide, polydopamine and dopamine hydrochloride, to which the fertilizer or phytosanitary product that is desired to be released in the crop is added. It is characterized by simplicity of preparation and mild reaction conditions.*
18. **CN108402077A.** Lin Rongquan. (2018). [China]. A kind of bactericidal composition of prevention and control soft rot of Chinese cabbage. https://patents.google.com/patent/CN108402077A/en
    - *Bactericide-Biocide. Composition of graphene oxide, Jervine, Zhongshengmycin and auxiliary agents. Substantially increase germicidal efficiency, have a good control effect on Chinese cabbage soft rot.*
19. **CN108541715A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention pear scab. https://patents.google.com/patent/CN108541715A/en
    - *Fungicide-Biocide. Composition of graphene oxide with prochloraz and brassinosteroids. Fungicide for the prevention of pear scab.*
20. **CN108617681A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention banana freckle. https://patents.google.com/patent/CN108617681A/en
    - *Bactericide-Biocide. Composed of graphene oxide, prochloraz and brassinosteroids. In the indicated proportions, it can help prevent banana freckle. Crops can also develop immunity to scab and immunity to fruit diseases.*
21. **CN108617682A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention of scab of cucumber. https://patents.google.com/patent/CN108617682A/en

- *Bactericide-Biocide. Composed of graphene oxide, prochloraz and brassinosteroids. Prevention and treatment of cucumber scab. Reduce, slow down or prevent the disease with the slow release of prochloraz.*

22. **CN108633904A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention of citrus scab. https://patents.google.com/patent/CN108633904A/en
    - *Bactericide-Biocide. Composed of graphene oxide, prochloraz and brassinosteroids. Used for the prevention of citrus scab and fungicide.*
23. **CN108633909A.** Lin Rongquan. (2018). [China]. Application of graphene oxide in the prevention and control of Phytophthora plants = Application of the graphene oxide in terms of preventing plant phytophthora germ. https://patents.google.com/patent/CN108633909A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus Streptomyces Microflavus. Prevention of root rot of crops by phytophthora.*
24. **CN108633910A.**林荣铨. (2021). [China]. The sterilized pharmaceutics of graphene oxide and Antagonistic Fungi streptomycete compounding. https://patents.google.com/patent/CN108633910A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus Streptomyces Griseoflavus. Preventive treatment of phytophthora crop root rot and prevention of other plant diseases to improve crop yields.*
25. **CN108633911A.**林荣铨. (2018). [China]. A type of disinfectant for agricultural use containing graphene oxide = A kind of disinfectant use in agriculture containing graphene oxide. https://patents.google.com/patent/CN108633911A/en
    - *Disinfectant-Biocide. Composed of graphene oxide, bupirimate, fentin acetate and disinfectant (phosphate, lignin sulfonate, benzenesulfonates, alkylsulfonate, calcium salt, naphthalenesulfonic acid-formaldehyde condensation product sodium salt, alkylphenol polyoxyethylene ether, aliphatic acid), emulsifier (fat) , polyoxyethylene ether alcohol, magnesium aluminum silicate, sodium carboxymethylcellulose, gum arabic or xanthans, butyl glycidyl ether, phenyl glycidyl ether, cresyl glycidyl ether, polyethylene glycol, sodium silicoaluminate, tricalcium phosphate, sodium hydroxide, ammonium hydroxide, acid acetic acid, hydrochloric acid, citric acid or phosphoric acid, iatomeas, bentonite, attapulgite, starch or precipitated calcium carbonate, among other components. Application for the prevention and treatment of powdery mildew.*
26. **CN108719318A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention and control of tomato soft rot. https://patents.google.com/patent/CN108719318A/en
    - *Bactericide-Biocide. Graphene oxide composition with Jervine, Zhongshengmycin, wetting agent, thickener and defoamer. The patent focuses on the treatment and prevention of soft rot caused by Erwinia carotovora, which also affects potato rot.*
27. **CN108739851A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention and control of konjak soft rot. https://patents.google.com/patent/CN108739851A/en
    - *Bactericide. Composition of graphene oxide, Jervine, Zhongshengmycin and auxiliary agents (ethylene glycol, propylene glycol, triol, polyethylene glycol, xanthans, hydroxymethylcellulose, hydroxyethylcellulose, methyl, cellulose, magnesium aluminum silicate, polyvinyl alcohol, urea, ammonium sulfate, aluminum, citric acid , sodium bicarbonate, talcum powder, kaolinite, diatomite, bentonite). The compound helps build crop immunity to Konjak soft rot, caused by Erwinia carotovora.*
28. **CN108770852A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention of scab of apple. https://patents.google.com/patent/CN108770852A/en
    - *Bactericide-Biocide. Composition of graphene oxide with prochlorazes and brassinosteroids. The proportions of the compound are effective for the treatment and prevention of apple scab, a pathogen that slows down the growth of production and can lead to rotting of the crop.*
29. **CN108782610A.**林荣铨. (2018). [China]. Graphene oxide and Antagonistic Fungi compound the application in terms of preventing plant phytophthora root rot. https://patents.google.com/patent/CN108782610A/en

    - *Biocide. Combination of graphene oxide with antagonist fungus Fungi penicillium purpurogenum. Treatment against the phytophthora germ, which causes root rot in crops.*
30. **CN108812693A.**林荣铨. (2018). [China]. Application of the graphene oxide in terms of improving plant phytophthora germ Antagonistic Fungi preventive effect. https://patents.google.com/patent/CN108812693A/en
    - *Biocide. Combination of graphene oxide and antagonist fungus streptomycetes. Treatment against the plant phytophthora germ, which causes root rot in crops.*
31. **CN108812699A.**林荣铨. (2018). [China]. A kind of plant phytophthora root rot antibacterial agent of graphene oxide and Antagonistic Fungi compounding. https://patents.google.com/patent/CN108812699A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus bacillus amyloliquefaciens. Treatment against the phytophthora germ, which causes root rot in crops.*
32. **CN108925577A.**林荣铨. (2018). [China]. A kind of plant phytophthora root rot antibacterial agent containing graphene oxide. https://patents.google.com/patent/CN108925577A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus Fungi atrophy bacillus. Treatment against the phytophthora germ, which causes root rot in crops.*
33. **CN108935508A.**林荣铨. (2018). [China]. A kind of bactericidal composition of prevention and control of bacterial soft rot of potato. https://patents.google.com/patent/CN108935508A/en
    - *Bactericide-Biocide. Composition of graphene oxide with jervine, zhongshengmycin, dispersing, wetting and disintegrating agents. Prevention of potato rot.*
34. **CN108991005A.**林荣铨. (2018). [China]. Application of the graphene oxide in the prevention and treatment of crop phytophthora root rot. https://patents.google.com/patent/CN108991005A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus Fungi Pseudomonas. Treatment against the phytophthora germ, which causes root rot in crops.*
35. **CN108991006A.**林荣铨. (2018). [China]. A kind of graphene oxide compounding drip irrigation preventing and treating plant phytophthora root rot. https://patents.google.com/patent/CN108991006A/en
    - *Biocide. Combination of graphene oxide with antagonist fungus Fungi Lyceum bacillus. Treatment against the phytophthora germ, which causes root rot in crops.*
36. **CN109077065A.**周玉军; 罗玉松. (2018). A kind of basic zirconium phosphate bacteriostatic agent. https://patents.google.com/patent/CN109077065A/en
    - *Bactericide-Pesticide. Composition of graphene oxide, chitosan, basic zirconium phosphate, sodium benzoate, titanium dioxide TiO2 and antibacterial additives (silver particles). Applied on the fruit to maintain its properties.*
37. **CN109486494A.**不公告发明人. (2021). [China]. A kind of soil-repairing agent and preparation method thereof. https://patents.google.com/patent/CN109486494A/en
    - *Soil conditioner. Composition based on graphene oxide, ferrous fumarate, activated sludge, starch, activated coconut carbon and bamboo leaf powder. Used for the remediation of worn soils.*
38. **CN109809926A.**宋宁宁; 李绍静; 宗海英; 刘君. (2019). [China]. A kind of Ca/Fe/GO/ biomass carbon, the dedicated slow-release charcoal fertilizer of corn and its application its application. https://patents.google.com/patent/CN109809926A/en
    - *Fertilizer-Soil conditioner. Composed of graphene oxide, biomass material, ground slag is mixed with calcium chloride, iron chloride. A carbonized material is obtained, oriented to the remediation of the soil of corn crops.*
39. **CN109956797A.**林荣铨. (2019). [China]. A kind of graphene oxide liquid fertilizer and preparation method thereof improving fruit quality. https://patents.google.com/patent/CN109956797A/en
    - *Manure-Fertilizer. Liquid fertilizer based on graphene oxide, active liquid substrate, amino acids, dipotassium hydrogen phosphate, auxin, calcium gluconate and boric acid. The aim is to improve the growth and yield of fruits, especially in the case of black grapes.*

40. **CN109824459A.**王凯荣; 宋宁宁; 柳新伟; 刘君. (2019). [China]. A kind of corn fertilizer special for organic and its method of preparation and application = A kind of corn fertilizer special for organic and its preparation method and application. https://patents.google.com/patent/CN109824459A/en
    - *Fertilizer. Composed of graphene oxide, modified peanut charcoal, bacteria residue, enteromorpha algae, fish bone powder, wood vinegar, glucose, saccharomycete compost fermenting agent, and cellulase. Increases soil fertility and production. The fertilizer effect can be enhanced with manure.*
41. **CN109956809A.**林荣铨. (2019). [China]. A kind of graphene oxide liquid fertilizer of flower and fruit protecting and preparing method thereof. https://patents.google.com/patent/CN109956809A/en
    - *Fertilizer. Composition of graphene oxide, amino acids, potassium dihydrogen phosphate, gibberellin, brassin, calcium gluconate, boric acid, amino nitrogen and organic matter. Application to flowers and fruits of the black summer grape.*
42. **CN109956811A.**林荣铨. (2019). [China]. A kind of graphene oxide liquid fertilizer and preparation method thereof. https://patents.google.com/patent/CN109956811A/en
    - *Fertilizer. Composition of graphene oxide, methionine, tyrosinase, phenylalanine, aspartic acid, potassium dihydrogen phosphate, diethyl aminoethyl hexanoate, medium microelement (Ca, B, Mg, Zn, Fe, Mn), nitrogen, liquid fertilizer, amino nitrogen and organic matter. Tested on the development of the rhizome of the black summer grape. It improves the development of its roots, even in soils contaminated by heavy metals, improving the quality of the soil.*
43. **CN109956812A.**林荣铨. (2019). [China]. A kind of graphene oxide liquid fertilizer and preparation method thereof promoting flower bud development. https://patents.google.com/patent/CN109956812A/en
    - *Fertilizer. Composition of graphene oxide, amino acid, potassium dihydrogen phosphate, gibberellin, medium microelement, amino nitrogen, nitrogen and organic matter. In the form of liquid fertilizer, it develops the flower buds of black grapes more effectively in summer.*
44. **CN109988043A.**宋宁宁; 秦鹏; 王芳丽. (2019). A kind of biological organic fertilizer and its preparation and application method = A kind of biological organic fertilizer and its preparation method and application. https://patents.google.com/patent/CN109988043A/en
    - *Fertilizer. Composition of graphene oxide, charcoal that is cooked with banana wood, biogas waste, bagasse, oyster shell powder, enzyme preparation, honey, compost fermentation agent EM, cellulase. Applied in corn planting to increase soil fertility and retain nutrients.*
45. **CN109988044A.**宋宁宁; 王凯荣; 宗海英; 王芳丽; 刘君. (2019). [China]. A kind of modified corn core charcoal base slow-release compound fertilizer and its preparation method and application. https://patents.google.com/patent/CN109988044A/en
    - *Fertilizer. Composition of graphene oxide, modified charcoal, chemical fertilizer, bentonites and Aspergillus niger H201 strain. Improved soil physical properties and plant nutrients. It increases the resistance of maize and its tolerance to drought and premature senescence.*
46. **CN110204381A.**李贺; 尉靖; 郭海滨; 魏雅冬; 王可答. (2019). [China]. A kind of method that modified auricuralia auricular bran prepares a biological complex organic fertilizer. https://patents.google.com/patent/CN110204381A/en
    - *Complex organic fertilizer. A fertilizer-compost based on mushroom bran of the Auricuralia auricula variety in powder with graphene oxide, with Elymus nutan powder, is made. According to the authors, it improves plant growth, production efficiency, fertility, soil texture, and disease resistance.*
47. **CN110248914A.**杜桑洛西; 舍尔温卡比里; 迈克尔麦克劳克林; 黛安娜德兰; 伊凡安德科维奇. (2019). [China]. Graphene for fertilizer application = Graphene for fertilizer application. https://patents.google.com/patent/CN110248914A/en
    - *Fertilizer. Composition of graphene oxide and microfertilizing materials such as copper, potassium, zinc, chromium, nickel, boron, cobalt, iron... and main nutrients such as*

calcium, magnesium, manganese, sulfur. The fertilizer is characterized by portability and resistance to leaching and runoff.

48. **CN110385106A.**李琳. (2019). [China]. A kind of preparation method of biology carbonaceous compound adsorbent. https://patents.google.com/patent/CN110385106A/en
    - *Fertilizer. Composition of graphene oxide with sodium hydrate, citric acid, iron chloride ethylene glycol, ammonium hydroxide, polyvinylpyrrolidone, superfine powdered silica gel and surfactant, lecithin. Graphene oxide-based biomass carbon granules are shaped to improve the yield of depleted farmland.*
49. **CN111454728A.**王婷婷. (2020). [China]. Soil hardening improver capable of improving consistency of soil structure loosening degree. https://patents.google.com/patent/CN111454728A/en
    - *Soil conditioner. The soil is prepared according to the following methodology: 1) irradiate the prepared proton titanium dioxide with ultraviolet light to obtain pretreated proton titanium dioxide; 2) carry out a modification pretreatment on graphene oxide to obtain pretreated graphene oxide; 3) modifying the epoxy resin using chitosan to obtain a chitosan-modified epoxy resin precursor; 4) use polyethylene glycol as a pore foaming agent to obtain a porous polymer powder; 5) and uniformly mixing the raw materials obtained, drying and grinding to obtain the required soil conditioner.*
50. **CN111470915A.**刘亚男; 何东宁; 徐明岗; 李普旺; 王艳丽; 谭德新; 刘思汝; 陈菁; 龚伟. (2020). [China]. Long-acting water-soluble iron fertilizer and preparation method thereof. https://patents.google.com/patent/CN111470915A/en
    - *Fertilizer. Composition of graphene oxide, water-soluble iron fertilizer (ferrous salt). It has the particularity that the fertilizer is not easily removed by rainwater, even under the corrosion of acid soil, which makes it a very resistant compound.*
51. **CN111149798A.**贾金亮; 胡鹏通; 徐汉虹; 朱丽; 郑烽. (2020). [China]. Water-based graphene oxide nano pesticide and preparation method and application thereof. https://patents.google.com/patent/CN111149798A/en
    - *Biocide-pesticide-pesticide. Combination of graphene oxide, dimethyl sulfoxide, NN dimethylformamide, carbendazim and epoxiconazole. Treatment against fungal diseases.*
52. **CN111789130A.**唐先干; 徐昌旭; 李祖章; 刘增兵; 孙刚; 张文学; 袁福生. (2021). [China]. Plant growth regulator and application method and use thereof = Plant growth regulator and application and use method thereof. https://patents.google.com/patent/CN111789130A/en
    - *Fertilizer-growth regulator. Composed of graphene oxide, nano silicon dioxide, salicylic acid and violaxanthin. Applied to peas (peas) and derivatives, legumes.*
53. **CN111903706A.**高园园; 张旭; 邓杰帆; 肖蓉晖. (2020). [China]. Method for promoting wheat seed germination by graphene oxide soil passivator = Method for promoting wheat seed germination by graphene oxide soil passivator. https://patents.google.com/patent/CN111903706A/en
    - *Growth regulator. Aqueous solution of graphene oxide and hydrogen peroxide for seeds. Method to favor the germination of wheat seeds in soils contaminated with heavy metals.*
54. **CN111908972A.**谷袖黄. (2020). [China]. Slow-release fertilizer and preparation method thereof = Slow-release fertilizer and preparation method thereof. https://patents.google.com/patent/CN111908972A/en
    - *Fertilizer. Composition of graphene oxide, active humic acid, porous carboxymethyl starch, potassium dihydrogen phosphate, ammonium nitrate, porous carboxymethyl starch to potassium dihydrogen phosphate to ammonium nitrate.*
55. **CN112272987A.**陈卫荣; 黄守俊; 郭伟. (2021). [China]. Soil improvement method for blueberry planting = Soil improvement method for blueberry planting. https://patents.google.com/patent/CN112272987A/en
    - *Fertilizer-Soil conditioner. The patent describes a soil preparation process that includes a mixture of compost substrate, humic acid, graphene oxide and water. The process is completed with the addition of chitosan dissolved in pyrolino and chitosan dissolved in acetic acid.*
56. **CN112293419A.**李雪松; 程鹏; 刘富康. (2021). [China]. Graphene oxide-containing pesticide composition. https://patents.google.com/patent/CN112293419A/en

- *Biocide-Pesticide-Pesticide. Graphene oxide blend, with chlorfenapyr, indoxacarb, emamectin benzoate, methoxyfenozide, chlorantraniliprole, sodium alkyl sulfate, polyoxyethylene ether, ethylene glycol, propylene glycol, sodium benzoate, magnesium aluminum silicate, organic silicon, deionized water. Applied for pest control in crops.*

57. **CN112772670A.**周宁琳; 王玉丽; 沈健; 李东辉; 楚晓红; 孙宝宏; 冯文立; 石绍泽; 徐旺; 宋秋娴. (2021). [China]. Preparation method of quaternary composite nano controlled release system. https://patents.google.com/patent/CN112772670A/en
    - *Pesticide. Composed of aqueous solution of graphene oxide, dopamine monomer, acetamiprid dissolved in ethanol, fluorescent graphene quantum dots and addition of quaternary compound pesticides. It is characterized by the trace of the pesticide being easily traceable, being fluorescent, this makes it easier not to repeat the fumigation in the areas already applied, or to reoffend in those in which it was not properly distributed.*
58. **CN112980447A.**梅志华; 赵申; 陈阳; 汪寒寒. (2021). [China]. Method and device for preparing reduction curing agent for Cr (VI) contaminated soil. https://patents.google.com/patent/CN112980447A/en
    - *Soil conditioner. Graphene oxide compound with ferric sulfate. Remediation of Cr(VI) contaminants «Hexavalent Chromium» in farmland. Hexavalent chromium is a toxic, genotoxic, and carcinogenic material that can be easily inhaled and cause respiratory illness. According to the approach of the patent, once the soil has been treated with the compound, it can be reused for cultivation.*
59. **US2018009722A1.** Gordon Chiu. (2018). [U.S]. Graphene based growing medium and method. https://patents.google.com/patent/US20180009722A1/en
    - *Soil conditioner. Composition of graphene oxide, graphene and earth. Applied to increase crop yields, due to the greater retention of water, nutrients and fertilizers. This patent demonstrates that graphene oxide and graphene have been mixed with the earth directly.*
60. **WO2015066691A1.** Bin Gao Ming Zhang Yuncong Li. (2015). [U.S]. Slow-release fertilizer compositions with graphene oxide films and methods of making slow-release fertilizer compositions. https://patents.google.com/patent/WO2015066691A1/en
    - *Slow release fertilizer. Composed of graphene oxide layers overlaid with fertilizer and nutrient particles, namely; nitrogen, phosphorous, potassium, calcium, magnesium, sulfur, boron, chlorine, copper, iron, manganese, molybdenum, zinc, nickel. Other compounds with which graphene oxide is combined are aluminum sulfate, amino acid salt, ammonium chloride, ammonium molybdate, ammonium nitrate, ammonium phosphate, ammonium phosphate-sulfate, ammonium sulfate, borax, boric acid, calcium ammonium nitrate, calcium silicate, calcium chloride, calcium cyanamide, calcium nitrate, copper acetate, copper nitrate, copper oxalate, copper oxide, copper sulfate, diammonium phosphate, iron-ethylenediamine- N, N'- bis, iron-ethylenediaminetetraacetic acid, elemental sulfur, ferric sulfate, ferrous ammonium phosphate,ferrous ammonium sulfate, ferrous sulfate, gypsum, humic acid, iron ammonium polyphosphate, iron chelates, iron sulfate, lime, magnesium sulfate, manganese chloride, manganese oxide, manganese sulfate, monoammonium phosphate, monopotassium phosphate , polyhalite, potassium bromide, potassium chloride (MOP), potassium nitrate, among others. The fertilizer is released more slowly as it is contained in overlapping layers of graphene oxide.The fertilizer is released more slowly as it is contained in overlapping layers of graphene oxide.The fertilizer is released more slowly as it is contained in overlapping layers of graphene oxide.*

Pending review

https://worldwide.espacenet.com/patent/search/family/063691236/publication/CN108617681A?q=nftxt%20%3D%20%22graphene%20oxide%22%20AND%20nftxt%20%3D%20%22crop% 22

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