Patents

Water-based graphene oxide nano pesticide and preparation method and application thereof

Abstract

The invention belongs to the field of nanotechnology, and particularly relates to a water-based graphene oxide nano pesticide for preventing and controlling fungal diseases of crops, and a preparation method and application thereof. The bactericide in the water-based graphene oxide nano pesticide is adhered to the surface of graphene oxide through pi-pi conjugation effect, hydrogen bonding effect and electrostatic adsorption effect, fungal cells are damaged through the graphene oxide, and then the medicine is accurately released, so that efficient utilization of the medicine is realized, and the graphene oxide and the pesticide show an excellent synergistic mechanism. When the water-based graphene oxide nano pesticide prepared by the emulsification-freeze drying method is applied to prevention and control of plant fungal diseases, the drift problem of the nano pesticide is relieved. And the water-soluble nano pesticide has good water solubility and anti-drift performance, and is a novel water-based nano pesticide.

Classifications

A01N25/08 Biocides, pest repellants or attractants, or plant growth regulators, characterised by their forms, or by their non-active ingredients or by their methods of application, e.g. seed treatment or sequential application; Substances for reducing the noxious effect of the active ingredients to organisms other than pests containing solids as carriers or diluents

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CN111149798A
China

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Other languages: Chinese

Inventor: 贾金亮, 胡鹏通, 徐汉虹, 朱丽, 郑烽

Current Assignee : South China Agricultural University

Worldwide applications

2020 CN

Application CN202010023060.0A events

2020-01-09	Application filed by South China Agricultural University
2020-01-09	Priority to CN202010023060.0A
2020-05-15	Publication of CN111149798A
Status	Pending

Info: Patent citations (7), Non-patent citations (2), Legal events, Similar documents, Priority and Related Applications

External links: Espacenet, Global Dossier, Discuss

Claims (8)

Hide Dependent

1. A preparation method of a water-based graphene oxide nano pesticide is characterized by comprising the following steps:

(1) dissolving graphene oxide in water, and violently stirring to form a graphene oxide aqueous dispersion; dissolving the bactericide in dimethyl sulfoxide, N-N dimethylformamide or methanol to form an organic phase bactericide solution;

the concentration of the graphene oxide aqueous dispersion is 0.5-1 g/L;

the concentration of the bactericide solution is 1.25: 1-3.75: 1;

(2) dropwise adding the bactericide solution into the graphene oxide aqueous dispersion under vigorous stirring, and vigorously stirring for 24-48 hours from the dropwise adding to obtain a mixed solution, removing free pesticide molecules by dialysis or reaction liquid cleaning, removing supernatant by high-speed centrifugation, and freeze-drying to obtain a product, namely the solid water-based graphene oxide nano pesticide;

the mass ratio of the bactericide to the graphene oxide in the mixed solution is 2: 1-2: 3;

(3) dispersing the solid water-based graphene oxide nano pesticide into an aqueous solution according to the proportion of 1: 100-1000, adding 1% of Tween 80, and oscillating to obtain an emulsion, namely the water-based graphene oxide nano pesticide.

2. The preparation method of the water-based graphene oxide nano pesticide as claimed in claim 1, characterized in that: the bactericide is carbendazim or epoxiconazole.

3. The preparation method of the water-based graphene oxide nano pesticide as claimed in claim 2, characterized in that: the rotating speed of the high-speed centrifugation is 10000 rpm.

4. The preparation method of the water-based graphene oxide nano pesticide as claimed in claim 3, characterized in that: the dialysis time period is 6 h.

5. The preparation method of the water-based graphene oxide nano pesticide as claimed in claim 4, wherein the preparation method comprises the following steps: the number of washing with the reaction solution was 3.

6. A water-based graphene oxide nano pesticide is characterized in that: the preparation method of any one of claims 1 to 5.

7. The application of the water-based graphene oxide nano pesticide as claimed in claim 6, is characterized in that: the water-based graphene oxide nano pesticide is used for preventing and controlling fungal diseases of crops.

8. The application of the water-based graphene oxide nano pesticide as claimed in claim 7, wherein the water-based graphene oxide nano pesticide is characterized in that: the fungal diseases of the crops comprise rice blast, banded sclerotial blight, powdery mildew, damping off, anthracnose or leaf spot.

Description

Water-based graphene oxide nano pesticide and preparation method and application thereof

Technical Field

The invention belongs to the field of nanotechnology, and particularly relates to a water-based graphene oxide nano pesticide for preventing and controlling fungal

diseases of crops, and a preparation method and application thereof.

Background

The traditional pesticide has the problems of poor dispersibility, poor stability, low biological activity, low degradation rate and the like due to the fact that drug-loaded particles of the traditional pesticide are large, the utilization rate of target crops is less than 30%, and the dosage of harmful organisms is less than 0.1%. The data show that the pesticide can be sprayed in the field, and the loss of the pesticide caused by dropping, dust drift, rain wash and the like can reach more than 70%. The use of a large amount of pesticides causes serious environmental pollution and overproof pesticide residues, and seriously threatens the physical and psychological health of human beings. The nanotechnology can effectively relieve pesticide residue pollution and improve the effective utilization rate of the pesticide. In addition, the nano drug delivery system has the advantages of improving the dispersibility, stability and utilization rate of the pesticide, prolonging the lasting period, reducing the residual quantity and the like.

Graphene is a two-dimensional nanomaterial composed of a single layer of carbon atoms first discovered by british scientists Novoselov and gemm et al in 2004. Graphene oxide is a derivative belonging to graphene, and has a surface rich in oxygen-containing functional groups, so that the graphene oxide shows good water solubility and stability. Meanwhile, the graphene oxide also has the capacity of loading the medicine with the structure similar to a benzene ring through pi-pi accumulation, hydrophobic effect and hydrogen bond effect, so that the graphene oxide is widely applied to the field of biological medicine. The edge blade of the graphene oxide nano-material two-dimensional slice is called as a nano-knife and can cut cell membranes of bacterial cells. Normal metabolism of the bacterial cells can be affected by an oxidative stress mechanism, thereby causing cell death. In addition, when a large amount of graphene oxide nano-sheets are adsorbed on the surfaces of bacterial cells, the bacteria can be completely wrapped, so that the bacteria are physically isolated from the surrounding environment, and the microorganisms slowly die. The sterilization mechanism shows that the two-dimensional graphene oxide can be used as a drug carrier to play an antibacterial synergistic effect.

The invention patent application with application number of 201310550703.7 discloses a preparation method of thiophanate methyl nano pesticide, which reduces the dosage and improves the pesticide effect. However, the existing patents on nano pesticides are mainly studied on the synergy of nano pesticides, and the drift problem of nano pesticides cannot be solved.

Disclosure of Invention

In order to overcome the defects of the traditional pesticide and solve the environmental and social problems caused by the traditional pesticide, the invention mainly aims to provide a preparation method of a water-based graphene oxide nano pesticide for preventing and controlling fungal diseases of crops.

The invention also aims to provide the water-based graphene oxide nano pesticide prepared by the preparation method. The nano pesticide has good water solubility and anti-drift performance, can obviously improve the sterilization capability of the pesticide, and realizes the reduction and the synergism of the pesticide.

The invention further aims to provide application of the water-based graphene oxide nano pesticide.

In order to achieve the purpose, the technical scheme adopted by the invention is as follows:

a preparation method of a water-based graphene oxide nano pesticide comprises the following steps:

(1) dissolving graphene oxide in water, and violently stirring to form a graphene oxide aqueous dispersion; dissolving the bactericide in dimethyl sulfoxide, N-N dimethylformamide or methanol to form an organic phase bactericide solution;

the concentration of the graphene oxide aqueous dispersion is 0.5-1 g/L;

the concentration of the bactericide solution is 1.25: 1-3.75: 1;

(2) dropwise adding the bactericide solution into the graphene oxide aqueous dispersion under vigorous stirring, and vigorously stirring for 24-48 hours from the dropwise adding to obtain a mixed solution, removing free pesticide molecules by dialysis or reaction liquid cleaning, removing supernatant by high-speed centrifugation, and freeze-drying to obtain a product, namely the solid water-based graphene oxide nano pesticide;

the mass ratio of the bactericide to the graphene oxide in the mixed solution is 2: 1-2: 3;

(3) dispersing the solid water-based graphene oxide nano pesticide into an aqueous solution according to the proportion of 1: 100-1000, adding 1% of Tween 80, and oscillating to obtain an emulsion, namely the water-based graphene oxide nano pesticide.

Preferably, the bactericide is carbendazim or epoxiconazole and is suitable for preventing and treating fungal diseases.

Preferably, the dialysis time period is 6 h.

Preferably, the number of washing with the reaction solution is 3.

Preferably, the rotation speed of the high-speed centrifugation is 10000 rpm.

The invention further provides the water-based graphene oxide nano pesticide prepared by the preparation method.

The invention further provides application of the water-based graphene oxide nano pesticide in the prevention and control of fungal diseases of crops, wherein the fungal diseases of the crops comprise rice blast, banded sclerotial blight, powdery mildew, damping off, anthracnose or leaf spot.

Compared with the prior art, the invention has the following advantages and beneficial effects:

the bactericide in the water-based graphene oxide nano pesticide (GO-Carbendazim) prepared by the invention is adhered to the surface of graphene oxide through pi-pi conjugation effect, hydrogen bonding effect and electrostatic adsorption effect, and the graphene oxide damages fungal cells, so that the medicine is accurately released, the efficient utilization of the medicine is realized, and the graphene oxide and the pesticide show an excellent synergistic mechanism. When the water-based graphene oxide nano pesticide prepared by the emulsification-freeze drying method is applied to prevention and control of fungal diseases of plants, the hydrophobic surface of the two-dimensional sheet structure of the graphene oxide is easy to attach to plant leaves, so that the carried nano pesticide is easy to attach to the surface of the plants, and the drift problem of the nano pesticide is relieved.

Detailed Description

The present invention will be described in further detail with reference to examples, but the embodiments of the present invention are not limited thereto. For process parameters not specifically noted, reference may be made to conventional techniques.

Example 1

The embodiment provides a water-based graphene oxide-carbendazim nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 40mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 10mg of carbendazim raw drug is weighed and dissolved in 8mL of N-N dimethylformamide to prepare a carbendazim solution. Slowly dropwise adding the carbendazim solution into the graphene oxide water dispersion liquid under the condition of vigorous stirring, vigorously stirring for 48 hours, dialyzing for 6 hours to remove free carbendazim, centrifuging for 10 minutes at 10000rpm, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide

into an aqueous solution according to the proportion of 1:100, adding 1% of tween 80, and oscillating to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 2

The embodiment provides a water-based graphene oxide-carbendazim nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 40mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 30mg of carbendazim raw drug is weighed and dissolved in 8mL of N-N dimethylformamide to prepare a carbendazim solution. Slowly dropwise adding the carbendazim solution into the graphene oxide water dispersion liquid under the condition of vigorous stirring, vigorously stirring for 48 hours, dialyzing for 6 hours to remove free carbendazim, centrifuging for 10 minutes at 10000rpm, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide into an aqueous solution according to the proportion of 1:1000, adding 1% of Tween 80, and oscillating to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 3

The embodiment provides a water-based graphene oxide-carbendazim nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 40mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 20mg of carbendazim raw medicine is weighed and dissolved in 8mL of N-N dimethylformamide to prepare a carbendazim solution. Slowly dropwise adding the carbendazim solution into the graphene oxide water dispersion liquid under the condition of vigorous stirring, vigorously stirring for 48 hours, dialyzing for 6 hours to remove free carbendazim molecules, centrifuging for 10 minutes at 10000rpm, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide into an aqueous solution according to the proportion of 1:500, adding 1% of tween 80, and oscillating to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 4

The embodiment provides a water-based graphene oxide-carbendazim nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 40mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 20mg of carbendazim raw medicine is weighed and dissolved in 8mL of N-N dimethylformamide to prepare a carbendazim solution. Slowly dropwise adding the carbendazim solution into the graphene oxide aqueous dispersion under vigorous stirring, vigorously stirring for 48 hours, centrifuging, and adding DMF: washing the reaction solution with water at a ratio of 1:5 for 3 times, removing free carbendazim molecules, centrifuging at 10000rpm for 10min, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide in an aqueous solution at a ratio of 1:600, adding 1% of tween 80, and shaking to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 5

The embodiment provides a water-based graphene oxide-carbendazim nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 20mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 20mg of carbendazim raw medicine is weighed and dissolved in 8mL of N-N dimethylformamide to prepare a carbendazim solution. Slowly dropwise adding the carbendazim solution into the graphene oxide aqueous dispersion under vigorous stirring, vigorously stirring for 48 hours, centrifuging, and adding DMF: washing the reaction solution with water at a ratio of 1:5 for 3 times, removing free carbendazim molecules, centrifuging at 10000rpm for 10min, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide in an aqueous solution at a ratio of 1:1000, adding 1% of tween 80, and shaking to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 6

The embodiment provides a water-based graphene oxide-epoxiconazole nano pesticide and a preparation method thereof.

Weighing 20mg of graphene oxide powder, placing the graphene oxide powder in 40mL of deionized water, and violently stirring to form a graphene oxide dispersion liquid. 30mg of epoxiconazole raw drug is weighed and dissolved in 8mL of methanol to prepare epoxiconazole solution. Slowly dropwise adding the epoxiconazole solution into the graphene oxide aqueous dispersion under the condition of vigorous stirring, vigorously stirring for 48 hours, centrifuging, and adding methanol: washing the reaction solution with water at a ratio of 1:5 for 3 times, removing free epoxiconazole molecules, centrifuging at 10000rpm for 10min, removing supernatant, freeze-drying, dispersing the solid water-based graphene oxide nano pesticide in an aqueous solution at a ratio of 1:1000, adding 1% of tween 80, and shaking to obtain emulsion, namely the water-based graphene oxide nano pesticide.

Example 7

The embodiment provides application of the water-based graphene oxide-carbendazim nano pesticide obtained in the embodiment 4 in the aspect of inhibiting rice blast fungi.

Specifically, the effect of the nano pesticide on inhibiting rice blast fungi is measured by a plate method. 50mL PDA culture media containing carbendazim and graphene oxide-carbendazim (GO-carbendazim) with concentration gradients of 0.2, 0.4, 0.6, 0.8 and 1 mu g/mL are prepared respectively. Under aseptic condition, opening the pre-dissolved sterilization culture medium beside an alcohol burner according to test treatment, adding the pre-prepared sterilization liquid medicine, and shaking up fully. Then pouring the mixture into more than 3 culture dishes with the diameter of 9cm in equal amount to prepare the drug-containing plates with corresponding concentrations.

The test requires a blank with no agent treatment, not less than 3 replicates per treatment.

And (3) cutting the cultured rice blast fungus pathogenic fungi from the edges of bacterial colonies by using a sterilization puncher with the diameter of 5mm under the aseptic condition, inoculating the fungus cakes to the center of the poured drug-containing flat plate by using an inoculating ring, enabling the hypha surface to face upwards, covering a dish cover, sealing by using a sealing film, and placing the dish cover in an incubator with proper temperature and humidity for culturing.

After 9 days of incubation, the colony diameter was measured in millimeters (mm) with a ruler. The diameter of each colony was measured perpendicularly by the cross method once and averaged. And (5) investigating the growth condition of the hyphae of the rice blast fungi according to the growth condition of the fungi in the blank control culture dish.

The experimental results show that: under the same drug concentration, the graphene oxide-carbendazim nano pesticide has a more obvious inhibition effect on rice blast fungi.

Table 1 shows the inhibition effect of water-based graphene oxide-carbendazim nano pesticide on rice blast fungus

Example 8

The embodiment provides application of the water-based graphene oxide-carbendazim nano pesticide obtained in the embodiment 4 in the aspect of inhibiting rice sheath blight.

Specifically, the effect of the nano pesticide on inhibiting rice sheath blight is measured by a plate method. 50mL PDA culture media containing carbendazim and graphene oxide-carbendazim (GO-carbendazim) with the concentration gradients of 0.1, 0.2, 0.3, 0.4 and 0.5 mu g/L are prepared respectively. Under aseptic condition, opening the pre-dissolved sterilization culture medium beside an alcohol burner according to test treatment, adding the pre-prepared sterilization liquid medicine, and shaking up fully. Then pouring the mixture into more than 3 culture dishes with the diameter of 9cm in equal amount to prepare the drug-containing plates with corresponding concentrations.

The test requires a blank with no agent treatment, not less than 3 replicates per treatment.

Cutting the cultured rhizoctonia solani pathogenic fungi from the edge of a bacterial colony by using a sterilization puncher with the diameter of 5mm under the aseptic condition, inoculating the bacterial cake to the center of a poured drug-containing flat plate by using an inoculating ring, enabling the hypha surface to face upwards, covering a dish cover, sealing by using a sealing film, and placing the dish cover in an incubator at a proper temperature and humidity for culturing.

After 2-3 days of incubation, the colony diameter was measured in millimeters (mm) with a caliper. The diameter of each colony was measured perpendicularly by the cross method once and averaged. And (4) investigating the growth condition of rhizoctonia solani hyphae according to the growth condition of the bacteria in the blank control culture dish.

The experimental results show that: under the condition of equal dosage, the water-based nano pesticide has better effect on rhizoctonia solani, and the nano pesticide with the concentration of 0.4 mu g/mL can completely inhibit the growth of the rhizoctonia solani.

Table 2 shows the effect of water-based graphene oxide-carbendazim nano pesticide on inhibiting rhizoctonia solani

Example 9

The embodiment provides application of the water-based graphene oxide-epoxiconazole nano pesticide obtained in the embodiment 5 in the aspect of inhibiting rice blast fungi.

Specifically, the effect of the nano pesticide on inhibiting rice blast fungi is measured by a plate method. 50mL of fluorine-containing epoxiconazole and graphene oxide-epoxiconazole (GO-epoxiconazole) PDA culture medium with concentration gradients of 0.1, 0.2, 0.3, 0.4 and 0.5 mu g/mL are prepared respectively. Under aseptic condition, opening the pre-dissolved sterilization culture medium beside an alcohol burner according to test treatment, adding the pre-prepared sterilization liquid medicine, and shaking up fully. Then pouring the mixture into more than 3 culture dishes with the diameter of 9cm in equal amount to prepare the drug-containing plates with corresponding concentrations.

The test requires a blank with no agent treatment, not less than 3 replicates per treatment.

And (3) cutting the cultured rice blast fungus pathogenic fungi from the edges of bacterial colonies by using a sterilization puncher with the diameter of 5mm under the aseptic condition, inoculating the fungus cakes to the center of the poured drug-containing flat plate by using an inoculating ring, enabling the hypha surface to face upwards, covering a dish cover, sealing by using a sealing film, and placing the dish cover in an incubator with proper temperature and humidity for culturing.

After 9 days of incubation, the colony diameter was measured in millimeters (mm) with a caliper. The diameter of each colony was measured perpendicularly by the cross method once and averaged. And (5) investigating the growth condition of the hyphae of the rice blast fungi according to the growth condition of the fungi in the blank control culture dish.

Table 3 shows the inhibition effect of water-based graphene oxide-epoxiconazole nano pesticide on rice blast fungus

The experimental results show that: compared with the original epoxiconazole, the water-based nano pesticide has more obvious inhibition effect on rice blast fungi under the same drug concentration.

The above embodiments are preferred embodiments of the present invention, but the present invention is not limited to the above embodiments, and any other changes, modifications, substitutions, combinations, and simplifications which do not depart from the spirit and principle of the present invention should be construed as equivalents thereof, and all such changes, modifications, substitutions, combinations, and simplifications are intended to be included in the scope of the present invention.

Patent Citations (7)

Publication number	Priority date	Publication date	Assignee	Title
CN103548823A *	2013-11-09	2014-02-05	福建农林大学	Method for preparing thiophanate-methyl nano-pesticide
CN106719627A *	2016-11-25	2017-05-31	广西田园生化股份有限公司	The pesticidal preparations and its preparation method of a kind of sustained-release pesticides composition and its composition
CN107970454A *	2017-11-23	2018-05-01	江苏大学	A kind of preparation method and application of graphene oxide-lipid nanometer composite material
CN108684706A *	2018-05-23	2018-10-23	南通强生石墨烯科技有限公司	A kind of graphene pesticide compound and preparation method thereof
CN108782603A *	2018-06-01	2018-11-13	林荣铨	A kind of composition and fungicide of prevention Alfalfa damping-off
CN109497048A *	2018-12-29	2019-03-22	杭州敦和科技有限公司	A kind of trunk injection liquor of containing graphene nano material
CN109704321A *	2018-12-29	2019-05-03	宁波高新区敦和科技有限公司	A kind of nano graphene oxide and its preparation and application
Family To Family Citations				

* Cited by examiner, † Cited by third party

Non-Patent Citations (2)

Title
孙长娇 等: "纳米材料与技术在农业上的应用研究进展",《中国农业科技导报》 *

Title
胡鹏通等: "氧化石墨烯- 多菌灵纳米农药的制备及其抗稻瘟活性", 《中国化学会第一届农业化学学术讨论会论文集》 *

* Cited by examiner, † Cited by third party

Similar Documents

Publication	Publication Date	Title
Yu et al.	2008	Physiological and biochemical response of seaweed Gracilaria lemaneiformis to concentration changes of N and P
Morales et al.	1998	Effect of dimethyl-β-cyclodextrins on resveratrol metabolism in Gamay grapevine cell cultures before and after inoculation with shape Xylophilus ampelinus
Chang et al.	2008	Efficient disinfection of Escherichia coli in water by silver loaded alumina
Xin et al.	2011	Utilization of horticultural waste for laccase production by Trametes versicolor under solid-state fermentation
CN104099272B	2016-05-04	Preparation and the application of one strain phenolic acid class Allelochemical degradation bacterium and microbial inoculum thereof
Cotton et al.	2009	The role of alginate in P. aeruginosa PAO1 biofilm structural resistance to gentamicin and ciprofloxacin
CN1772881A	2006-05-17	Fluorescent pseudomonads and its fermenting culture process and application
Jones et al.	1959	Aggregates of Bacteria in Sea Water as Determined By Treatment With Surface Active Agents 1
CN111778032B	2021-07-09	Soil conditioner, preparation method and application
CN101948782A	2011-01-19	Rhodopseudomonas spheroides strain and liquid inoculant thereof as well as preparation method and application thereof
Zohar-Perez et al.	2002	Preservation of chitinolytic Pantoae agglomerans in a viable form by cellular dried alginate-based carriers
CN111149798A	2020-05-15	Water-based graphene oxide nano pesticide and preparation method and application thereof
CN102160553A	2011-08-24	Bacillus amyloliquefaciens preparation for controlling viral diseases of plants and application thereof
CN111662837A	2020-09-15	Bacillus atrophaeus and application thereof
CN113016799B	2021-10-26	Low-temperature-resistant disinfectant and preparation method thereof
TW200838570A	2008-10-01	Chromatographic media and chromatographic equipment storage solutions and use thereof
CN112358997A	2021-02-12	Bacterial strain with biocontrol function on tobacco brown spot, fermentation method of bacterial strain and tobacco brown spot prevention and control compound agent
CN110241049B	2020-11-24	Pseudoalteromonas with algae dissolving capacity and application thereof to Karenia mikimotoi red tide
CN1358838A	2002-07-17	Preservation method for live bacterial preparation
CN109618997B	2021-05-11	Ecological purification method for oyster cultivation
CN109896703B	2021-10-26	Light-enzyme composite catalytic function microorganism water purifying agent for culturing anaerobic sewage
CN102424804A	2012-04-25	Citrobacter sp. for removing H2S gas from gas, and use thereof
Nikolaev et al.	2010	Antimicrobic features of phenolic lipids
CN110521723B	2021-12-03	Sulfonylation chitosan microcapsule preparation for efficiently preventing and controlling diseases such as vegetable gray mold and the like
CN111019870B	2021-09-10	Pseudomonas, microbial agent and application thereof

Priority And Related Applications

Priority Applications (1)

Application	Priority date	Filing date	Title
CN202010023060.0A	2020-01-09	2020-01-09	Water-based graphene oxide nano pesticide and preparation method and application thereof

Applications Claiming Priority (1)

Application	Filing date	Title
CN202010023060.0A	2020-01-09	Water-based graphene oxide nano pesticide and preparation method and application thereof

Legal Events

Date	Code	Title	Description
2020-05-15	PB01	Publication	
2020-05-15	PB01	Publication	
2020-06-09	SE01	Entry into force of request for substantive examination	
2020-06-09	SE01	Entry into force of request for substantive examination	

Concepts

machine-extracted

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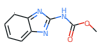
Name	Image	Sections	Count	Query match
carbon		title,claims,abstract,description	108	0.000
graphene		title,claims,abstract,description	108	0.000
pesticide		title,claims,abstract,description	86	0.000
water		title,claims,abstract,description	74	0.000
preparation method		title,claims,abstract,description	22	0.000
anti-bacterial		claims,abstract,description	15	0.000
bactericide agent		claims,abstract,description	14	0.000
fungal		claims,abstract,description	12	0.000
disease		claims,abstract,description	10	0.000
freeze drying		claims,abstract,description	10	0.000
controlling effect		claims,abstract,description	4	0.000
carbendazim		claims,description	37	0.000
Carbendazim		claims,description	24	0.000
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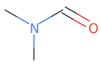
solution		claims,description	23	0.000
N,N-dimethylformamide		claims,description	18	0.000
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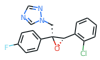
solid		claims,description	10	0.000
(2R,3S)-epoxiconazole		claims,description	8	0.000
aqueous solution		claims,description	8	0.000
emulsion		claims,description	8	0.000

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methanol		claims,description	8	0.000
polyoxyethylene sorbitan monooleate		claims,description	8	0.000
polysorbate 80		claims,description	8	0.000
supernatant		claims,description	8	0.000
chemical reaction		claims,description	5	0.000
washing		claims,description	5	0.000
dialysis		claims,description	4	0.000
high-speed centrifugation		claims,description	4	0.000
mixed solution		claims,description	4	0.000
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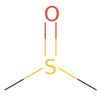
Colletotrichum trifolii		claims,description	2	0.000
Erysiphales		claims,description	2	0.000
Pythium aphanidermatum		claims,description	2	0.000
chemical reaction liquid		claims,description	2	0.000
cleaning		claims,description	2	0.000
dimethylsulphoxide		claims,description	2	0.000
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product		claims,description	2	0.000
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effects		abstract,description	18	0.000
hydrogen		abstract,description	3	0.000
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