(57) Abrégé/Abstract:
The present invention discloses a water-soluble granule formulation of 2,4-D salt, comprising components in the following weight percent: 5-80% 2,4-D salt (calculated as 2,4-D acid), and a water-soluble filler as the balance. The water-soluble granule formulation of 2,4-D salt has an outstanding control efficiency on annual or perennial Poaceae weeds and some broadleaf weeds in fields of soybean and other Fabaceae plants, for example, such weeds as amaranth, knotweed, lamb's- quarters, night shade, siberian cocklebur, barnyard grass, foxtail grass, digitaria sanguinalis, broomcorn millet and the like. The formulation is environment-friendly, and has the advantages of being free of organic solvents and dusts and being easy to measure in comparison to conventional emulsifiable formulation, wettable powder formulation and suspension formulation. The present invention also discloses the preparation method of the formulation. The production process is simple, economical and safe. The whole production process, without the use of dangerous chemicals, is easy to control and operate and has a high safety factor.
Abstract

The present invention discloses a water-soluble granule formulation of 2,4-D salt, comprising components in the following weight percent: 5-80% 2,4-D salt (calculated as 2,4-D acid), and a water-soluble filler as the balance. The water-soluble granule formulation of 2,4-D salt has an outstanding control efficiency on annual or perennial Poaceae weeds and some broadleaf weeds in fields of soybean and other Fabaceae plants, for example, such weeds as amaranth, knotweed, lamb's-quarters, night shade, siberian cocklebur, barnyard grass, foxtail grass, digitaria sanguinalis, broomcorn millet and the like. The formulation is environment-friendly, and has the advantages of being free of organic solvents and dusts and being easy to measure in comparison to conventional emulsifiable formulation, wettable powder formulation and suspension formulation. The present invention also discloses the preparation method of the formulation. The production process is simple, economical and safe. The whole production process, without the use of dangerous chemicals, is easy to control and operate and has a high safety factor.
WATER-SOLUBLE GRANULE FORMULATION OF 2,4-D SALT AND PREPARATION METHOD THEREOF

TECHNICAL FIELD

[0001] The present invention relates to a herbicide and a preparation method thereof and in particular to a water-soluble granule formulation of 2,4-D salt (i.e. water-soluble granule) and a preparation method thereof.

BACKGROUND ART

[0002] 2,4-D, a phenoxyalkanoic acids herbicide, is a selective systemic hormone herbicide. Pure 2,4-D exists as white crystals, which has low solubility in water but is easily soluble in organic solvents such as ethanol and benzene. The amine salts and sodium salts of 2,4-D, however, are quite easily soluble in water. 2,4-D is strongly systemic. At low concentration, 2,4-D can inhibit the growth and development of the plant and cause uncontrolled growth and eventually death. 2,4-D is mainly used for post-emergence foliar treatment and has various effects on the synthesis of nucleic acids and proteins, such that the growing points of the plant stop growing, young leaves are inextensible and normal photosynthesis is inhibited. When transported to the lower parts of the plants, 2,4-D can promote uncontrolled cell division. Root tips become swollen, losing the ability of absorption. Stems and stalks become distorted and aberrant. Sieve tubes are blocked and the phloem is damaged, such that the transport of organic substances is obstructed, leading to the death of the plant. 2,4-D herbicide has an outstanding control efficiency on annual or perennial Poaceae weeds and some broadleaf weeds in fields of soybean and other Fabaceae plants, for example, such weeds as amaranth, knotweed, lamb's-quarters, night shade, siberian cocklebur, barnyard grass, foxtail grass, digitaria sanguinalis, broomcorn millet and the like.

[0003] The main formulations of 2,4-D are emulsifiable formulation of its esters and aqueous formulation of its salts. Because the organic solvents in the emulsifiable formulation are flammable and would cause great pollution to the environment, the fraction of such formulation among herbicide formulations has been decreasing annually in recent years. Although aqueous formulation of 2,4-D salt is environment-friendly, the aqueous formulation with high concentration is very easy to crystallize at low temperatures, and the aqueous formulation with low concentration, while easy to crystallize, will lead to increased costs in packaging and transporting,
which limits the use of aqueous formulation of 2,4-D salt to some extent.

SUMMARY OF THE INVENTION

[0004] In order to overcome the disadvantages of the prior art, the present invention provides a water-soluble granule formulation of 2,4-D salt which is simple in components, friendly to the environment, and more convenient for application than other existing formulations.

[0005] The present invention further provides a preparation method of the water-soluble granule formulation whereby 2,4-D salt is readily made into water-soluble granules, with simple granulation and convenient operation.

[0006] The present invention is achieved by the following technical solution:

[0007] A water-soluble granule formulation of 2,4-D salt, comprising components in the following weight percent: 5-80% 2,4-D salt (calculated as 2,4-D acid), and a water-soluble filler which is used to make up to 100%.

[0008] In the above-mentioned water-soluble granule formulation of 2,4-D salt, the 2,4-D salt is selected from one or more of isopropylamine salt, ethylamine salt, monomethylamine salt, dimethylamine salt, sodium salt, potassium salt and ammonium salt.

[0009] In the above-mentioned water-soluble granule formulation of 2,4-D salt, only a water-soluble filler is needed to prepare water-soluble granules, without the need to add any surfactant and binder. The used water-soluble filler is a water-soluble inorganic salt which is selected from one or more of sulfate, nitrate, hydrochlorate, carbonate, bicarbonate, phosphate, dibasic phosphate, monobasic phosphate, borate and silicate.

[0010] In the above-mentioned water-soluble granule formulation of 2,4-D salt, the water-soluble inorganic salts used can be mixed in any ratio.

[0011] 2,4-D salt herbicide is made into water dispersible granule formulation in the present invention, which overcomes the disadvantages existing in the aqueous formulation and makes the application of the herbicide more convenient. The water dispersible granule formulation of the present invention is simpler in components, without the need to add excipient component such as surfactant, binder and the like. Nevertheless, 2,4-D salt is hard to granulate without adding surfactant or binder. Therefore, based on the composition of the water-soluble granule formulation, the present invention provides a method suitable for preparing the formulation which
allows easy granulation and convenient operation.

[0012] The preparation method of the present invention comprises: sufficiently and homogeneously mixing the 2,4-D salt and the water-soluble filler in a kneader, adding 1-10 wt% water based on the total amount of the 2,4-D salt and the water-soluble filler to perform kneading, granulating at 40-110°C after kneading, and drying at 20-90°C.

[0013] In the above-mentioned preparation method, granulation is performed without adding any binder and surfactant, so long as it is ensured that the mixture is granulated at 40-110°C.

[0014] In comparison with the prior art, the water-soluble granule formulation of 2,4-D salt of the present invention has the following advantages:

[0015] 1. The production process is simple, economical and safe. The whole production process, without the use of dangerous chemicals, is easy to control and operate and has a high safety factor.

[0016] 2. The water-soluble granule formulation is environment-friendly, and has the advantages of being free of organic solvents and dusts and being easy to measure in comparison to conventional emulsifiable formulation, wettable powder formulation and suspension formulation.

[0017] 3. The water-soluble granule formulation of 2,4-D salt obtained is convenient for using, which reduces the costs of packaging, storing and transporting and is suitable for large-scale popularization and application.

[0017a] Accordingly, in one aspect of the present invention there is provided a water-soluble granule formulation of 2,4-D salt, characterized by consisting of components in the following weight percent: 5-80% 2,4-D salt calculated as 2,4-D acid, and a water-soluble filler as the balance to 100%.

[0017b] According to another aspect of the present invention there is provided a preparation method of the water-soluble granule formulation of 2,4-D salt disclosed herein, characterized in that said water-soluble granule formulation of 2,4-D salt is prepared by homogeneously mixing the 2,4-D salt and the water-soluble filler according to ratio and performing granulation at 40-110°C.
DETAILED DESCRIPTION OF THE INVENTION

[0018] Hereinafter further description will be made by incorporating examples to illustrate the present invention, which by no means should be regarded as a limitation of the present invention.

[0019] Example 1

[0020] The content (by weight) of each component was: 65% 2,4-D dimethylamine salt (calculated as 2,4-D acid), and ammonium phosphate monobasic and sodium phosphate dibasic which were used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 5% water was added to perform kneading followed by granulating at 55°C, drying at 82°C. Thus a water-soluble granule formulation of 65% 2,4-D dimethylamine salt (calculated as 2,4-D acid) was obtained.

[0021] Example 2

[0022] The content (by weight) of each component was: 50% 2,4-D monomethylamine salt (calculated as 2,4-D acid), and water-soluble inorganic salt ammonium nitrate which was used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 1% water was added to perform kneading followed by granulating at 70°C, drying at 74°C. Thus a water-soluble granule formulation of 50% 2,4-D dimethylamine salt (calculated as 2,4-D acid) was obtained.

[0023] Example 3

[0024] The content (by weight) of each component was: 5% 2,4-D ethylamine salt (calculated as 2,4-D acid), and water-soluble inorganic salt ammonium chloride which was used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 7% water was added to perform kneading followed by granulating at 40°C, drying at 65°C. Thus a water-soluble granule formulation of 5% 2,4-D ethylamine salt (calculated as 2,4-D acid) was obtained.

[0025] Example 4

[0026] The content (by weight) of each component was: 20% 2,4-D potassium salt (calculated as 2,4-D acid), and water-soluble inorganic salt potassium phosphate which was used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 10% water was added to perform kneading followed by granulating at 100°C, drying at 20°C. Thus a water-soluble granule
formulation of 20% 2,4-D ethylamine potassium salt (calculated as 2,4-D acid) was obtained.

[0027] Example 5

[0028] The content (by weight) of each component was: 35% 2,4-D potassium salt (calculated as 2,4-D acid), and water-soluble inorganic salts sodium bicarbonate and sodium carbonate which were used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 3% water was added to perform kneading followed by granulating at 95°C, drying at 43°C. Thus a water-soluble granule formulation of 35% 2,4-D ethylamine salt (calculated as 2,4-D acid) was obtained.

[0029] Example 6

[0030] The content (by weight) of each component was: 80% 2,4-D isopropylamine salt, and water-soluble inorganic salts anhydrous sodium sulfate and dibasic sodium phosphate which were used to make up to 100%. The components were sufficiently and homogeneously mixed in a kneader. Then 4% water was added to perform kneading followed by granulating at 85°C, drying at 90°C. Thus a water-soluble granule formulation of 80% 2,4-D isopropylamine salt was obtained.

[0031] Industrial applicability

[0032] The prepared water-soluble granule formulation of the present invention is free of organic solvents and dusts, and is friendly to the environment. The water-soluble granule formulation has a remarkable effect when it is used to remove annual and perennial Poaceae weeds and some broadleaf weeds in fields of soybean and other Fabaceae plants, such weeds as amaranth, knotweed, lamb's-quarters, night shade, siberian cocklebur, barnyard grass, foxtail grass, digitaria sanguinalis and the like, which is more convenient for application compared with other existing formulations and has industrial applicability.
Claims

1. A water-soluble granule formulation of 2,4-D salt, characterized by consisting of components in the following weight percent: 5-80% 2,4-D salt calculated as 2,4-D acid, and a water-soluble filler as the balance to 100%.

2. The water-soluble granule formulation of 2,4-D salt according to claim 1, characterized by consisting of components in the following weight percent: 50-80% 2,4-D salt calculated as 2,4-D acid, and a water-soluble filler as the balance to 100%.

3. The water-soluble granule formulation of 2,4-D salt according to claim 1, characterized by consisting of components in the following weight percent: 65-80% 2,4-D salt calculated as 2,4-D acid, and a water-soluble filler as the balance to 100%.

4. The water-soluble granule formulation of 2,4-D salt according to claim 1, characterized by consisting of components in the following weight percent: 80% 2,4-D salt calculated as 2,4-D acid, and a water-soluble filler as the balance to 100%.

5. The water-soluble granule formulation of 2,4-D salt according to claim 1, characterized in that said 2,4-D salt is selected from one or more of isopropylamine salt, ethylamine salt, monomethylamine salt, dimethylamine salt, sodium salt, potassium salt and ammonium salt.

6. The water-soluble granule formulation of 2,4-D salt according to claim 5, characterized in that said 2,4-D salt is dimethylamine salt.
7. The water-soluble granule formulation of 2,4-D salt according to claim 1, characterized in that said water-soluble filler is a water-soluble inorganic salt.

8. The water-soluble granule formulation of 2,4-D salt according to claim 7, characterized in that said water-soluble inorganic salt is selected from one or more of sulfate, nitrate, hydrochlorate, carbonate, bicarbonate, phosphate, dibasic phosphate, monobasic phosphate, borate and silicate.

9. The water-soluble granule formulation of 2,4-D salt according to claim 8, characterized in that said water-soluble inorganic salt is a mixture of water-soluble inorganic salts.

10. The water-soluble granule formulation of 2,4-D salt according to claim 1, consisting of 65 weight % 2,4-D dimethylamine salt calculated as 2,4-D acid, and ammonium phosphate monobasic and sodium phosphate dibasic which are used to make up to 100 weight %, and the formulation is prepared by a method wherein the components are sufficiently and homogeneously mixed in a kneader, then 5 weight % water is added to perform kneading followed by granulating at 55°C, drying at 82°C, thus a water-soluble granule formulation of 65 weight % 2,4-D dimethylamine salt calculated as 2,4-D acid is obtained.

11. The water-soluble granule formulation of 2,4-D salt according to claim 1, consisting of 80 weight % 2,4-D isopropylamine salt calculated as 2,4-D acid, and water-soluble inorganic salts anhydrous sodium sulfate and dibasic sodium phosphate which are used to make up to 100 weight %, and the formulation is prepared by a method wherein the components are sufficiently and homogeneously mixed in a kneader, then 4 weight % water is added to perform kneading followed by granulating at 85°C, drying at 90°C, thus a water-soluble granule formulation of 80 weight % 2,4-D isopropylamine salt calculated as 2,4-D acid is obtained.
12. A preparation method of the water-soluble granule formulation of 2,4-D salt as claimed in claim 1, characterized in that said water-soluble granule formulation of 2,4-D salt is prepared by homogeneously mixing the 2,4-D salt and the water-soluble filler according to ratio and performing granulation at 40-110°C.

13. The preparation method according to claim 12, characterized in that said preparation method comprises the following steps: sufficiently mixing the 2,4-D salt and the water-soluble filler in a kneader, adding 1-10 weight % water to perform kneading, granulating at 40-110°C after kneading, and drying at 20-90°C to obtain the water-soluble granule formulation of 2,4-D salt.