CLAIM(S)

1. A water-soluble metalworking oil agent provided by blending the following components A, B, C and D:

(A) at least one of a condensed fatty acid obtained by dehydration-condensing a ricinoleic acid, and a condensed fatty acid obtained by dehydration-condensing a monovalent carboxylic acid with an alcoholic hydroxyl group of a condensed fatty acid obtained by dehydration-condensing a ricinoleic acid;

(B) an ester compound provided by a dehydration condensate of a monovalent or multivalent alcohol and a monovalent carboxylic acid;

(C) an amine compound; and

(D) water, wherein

a blend ratio of the component A is 10 mass% or more of a total amount of the oil agent, and

a blend ratio of the component B is 5 mass% or more of the total amount of the oil agent.

2. The water-soluble metalworking oil agent according to claim 1, wherein the metalworking oil agent is used for cutting and grinding.

3. The water-soluble metalworking oil agent according to claim 2, wherein the metalworking oil agent is used for end milling.

4. The water-soluble metalworking oil agent according to any one of claims 1 to 3, wherein the metalworking oil agent is used for metalworking of a difficult-to-machine material.

5. The water-soluble metalworking oil agent according to claim 4, wherein the difficult-to-machine material is one of titanium, a titanium alloy, a nickel alloy, a magnesium alloy, a niobium alloy, a tantalum alloy, a molybdenum alloy, a tungsten alloy, a stainless steel and a high-manganese steel.

6. A method of using the water-soluble metalworking oil agent according to any one of claims 1 to 5, comprising diluting the water-soluble metalworking oil agent with

water in use so that the water-soluble metalworking oil agent is used at a concentration of 3 vol% or more.

CLAIMS

[Claim 1]

A water-soluble metalworking oil agent provided by blending the following components A, B, C and D:

(A) at least one of a condensed fatty acid obtained by dehydration-condensing a ricinoleic acid, and a condensed fatty acid obtained by dehydration-condensing a monovalent carboxylic acid with an alcoholic hydroxyl group of a condensed fatty acid obtained by dehydration-condensing a ricinoleic acid;

(B) an ester compound provided by a dehydration condensate of a monovalent or multivalent alcohol and a monovalent carboxylic acid;

(C) an amine compound; and

(D) water, wherein

a blend ratio of the component A is 10 mass% or more of a total amount of the oil agent,

a blend ratio of the component B is 5 mass% or more of the total amount of the oil agent

the metalworking oil agent is used for metalworking of a difficult-to-machine material, and

the difficult-to-machine material is one of titanium and a titanium alloy.

[Claim 2]

The water-soluble metalworking oil agent according to claim 1, wherein

the metalworking oil agent is used for cutting or grinding.

[Claim 3]

The water-soluble metalworking oil agent according to claim 2, wherein

the metalworking oil agent is used for end milling.

[Claim 4]

A method of using the water-soluble metalworking oil agent according to any one of claims 1 to 3, comprising:

diluting the water-soluble metalworking oil agent with water in use so that the water-soluble metalworking oil agent is used at a concentration of 3 vol% or more.