

DESCRIPTION

Title of Invention: WATER-SOLUBLE UNIT AMOUNT METALWORKING FLUID
COMPOSITION AND METHOD FOR PRODUCING DILUTED FLUID THEREOF

5

Technical Field

[0001]

The present invention relates to a method for producing
a unit amount article or a diluted fluid thereof that is used for
10 a simple and safe chemical input when an undiluted water-soluble
metalworking fluid composition (undiluted fluid) for use in
metalworking is placed into a water storage tank to prepare a
diluted fluid of the composition, or is added to a used water-
soluble metalworking fluid to replenish the water-soluble
15 metalworking fluid composition or adjust the concentrations of
components of the composition.

Background Art

[0002]

20 Water-soluble metalworking fluid is generally used in
metalworking processes. Metalworking fluid is not used as is, but
is used by placing a predetermined amount of an undiluted fluid
into a tank or a vessel, and diluting the fluid with water to
prepare a diluted fluid. In order to prevent various troubles due
25 to changes in component balance, component deterioration with
time, etc., the concentration of the used fluid is controlled by
periodically adding, for example, undiluted fluid and additives.

[0003]

In dilution and replenishment operations, it is not
30 only time-consuming for the operator to weigh the undiluted
metalworking fluid, additives, and the like each time, but there
are also problems, such as the risk of causing rough hands due to
direct contact with the undiluted metalworking fluid, additives,
and the like, and odor emitted from the undiluted metalworking
35 fluid even if the operator does not touch the fluid.

[0004]

As measures to solve these problems, industrial chemical manufacturers are, for example, devising formulations with less skin irritation, which are less likely to cause hand
5 irritation, and selecting starting materials with milder odors.

[0005]

In metalworking factories where metalworking fluids are used, measures such as the introduction of automatic dilution devices have been taken. The use of automatic dilution devices
10 has merits, such as eliminating the need for a worker to weigh undiluted metalworking fluid each time, and avoiding risks caused by direct contact; however, it also has a problem in that such automatic dilution devices are costly to install. Furthermore, even if such an automatic dilution device is installed, the
15 device is structured so as to pump up undiluted fluid; therefore, it cannot be applied when undiluted fluid has a high viscosity.

[0006]

On the other hand, in the field of household detergents, unit amount articles (unit packages) in which a
20 detergent is placed in a packaging container formed from a water-soluble resin film, such as polyvinyl alcohol (PVA), have been proposed and used from the viewpoint of saving time and effort in weighing, avoiding contact with chemical substances, and omitting the disposal of packaging materials (see, for example, Patent
25 Literature (PTL) 1 and Patent Literature (PTL) 2).

[0007]

However, the method of using a unit amount article has not been put into practical use in the field of industrial chemicals. This is, for example, for the following reasons.

30 (1) In a dilution operation, the object to which the chemical is added is fresh water, such as for laundry; however, in a replenishment operation, the object to which the chemical is added is not fresh water, but water containing various chemical components of metalworking fluid.

35 (2) As compared with household washing machines, the capacity of

tanks for industrial use is overwhelmingly large. However, despite this large capacity, the stirring power of these tanks is not as powerful as that of washing machines.

(3) With respect to household detergents, since there is not much difference in laundry capacity of washing machines used in households, it is sufficient if detergent manufacturers provide an article containing a specific unit amount of a detergent. However, in the field of industrial chemicals, tanks or vessels installed in metalworking plants vary in capacity.

Citation List

Patent Literature

[0008]

PTL 1: JPH03-059059A

PTL 2: JP2002-003897A

Summary of Invention

Technical Problem

[0009]

An object of the present invention is to provide a water-soluble unit amount metalworking fluid composition that can be put into practical use in the field of industrial chemicals, in particular in metalworking.

Solution to Problem

[0010]

The present invention provides the following water-soluble unit amount metalworking fluid compositions, and methods for producing diluted fluids of the water-soluble unit amount metalworking fluid compositions.

Item 1. A water-soluble unit amount metalworking fluid composition comprising

a water-soluble metalworking fluid composition and/or at least one water-soluble metalworking fluid component and

a water-soluble packaging container formed from a

water-soluble film material,
the water-soluble metalworking fluid composition and/or the
water-soluble metalworking fluid component being packed in the
water-soluble packaging container.

5 Item 2. The water-soluble unit amount metalworking fluid
composition according to Item 1, wherein the water-soluble
metalworking fluid composition and/or the water-soluble
metalworking fluid component that is packed has a water content
of less than 10 mass% and a pH of 7.5 to 12, and the film
10 material is a material durable to the water-soluble metalworking
fluid composition that satisfies these conditions.

Item 3.

The water-soluble unit amount metalworking fluid
composition according to Item 1 or 2, wherein the water-soluble
15 metalworking fluid composition is an emulsion-type metalworking
fluid composition.

Item 4.

The water-soluble unit amount metalworking fluid
composition according to any one of Items 1 to 3, wherein the
20 water-soluble film material comprises polyvinyl alcohol (PVA).
Item 5.

The water-soluble unit amount metalworking fluid
composition according to any one of Items 1 to 4, wherein the
water-soluble film material has a thickness of 40 μm to 70 μm .
25 Item 6.

The water-soluble unit amount metalworking fluid
composition according to any one of Items 1 to 5, which is in one
of the following forms (1) to (6):

(1) a form in which the water-soluble packaging container
30 comprises multiple separable compartments comprising at least one
compartment in which the water-soluble metalworking fluid
composition is packed and at least one compartment in which the
water-soluble metalworking fluid component is packed;

(2) a form in which the water-soluble packaging container
35 comprises one compartment or two or more separable compartments,

wherein the water-soluble metalworking fluid composition is packed in each compartment;

(3) a form in which the water-soluble packaging container comprises one compartment or two or more separable compartments, wherein the water-soluble metalworking fluid component is packed in each compartment;

(4) a form in which the water-soluble packaging container has a multi-layer structure comprising at least one layer in which the water-soluble metalworking fluid composition is packed and at least one layer in which the water-soluble metalworking fluid component is packed;

(5) a form in which the water-soluble packaging container has a multi-layer structure, wherein the water-soluble metalworking fluid composition is packed in each layer; and

(6) a form in which the water-soluble packaging container has a multi-layer structure, wherein the water-soluble metalworking fluid component is packed in each layer.

Item 7. The water-soluble unit amount metalworking fluid composition according to Item 6, wherein the amount of the water-soluble metalworking fluid composition or the water-soluble metalworking fluid component packed in each compartment or in each layer is 100 to 1000 g.

Item 8. A package comprising a box having a top face, a bottom face, and four lateral faces; the water-soluble unit amount metalworking fluid composition of any one of Items 1 to 7 that is housed in a stacked manner in the box; and

a protective sheet that is disposed between each water-soluble unit amount metalworking fluid composition, so that adjacent water-soluble unit amount metalworking fluid compositions do not come into contact with each other.

Item 9.

A method for producing a diluted water-soluble metalworking fluid composition, the method comprising preparing a unit amount article of the water-soluble unit amount

metalworking fluid composition of any one of Items 1 to 7, and placing the unit amount article into a water storage tank or adding the unit amount article to a used water-soluble metalworking fluid to prepare a diluted water-soluble metalworking fluid composition having a desired concentration. Item 10.

A method for adjusting the concentration of a water-soluble metalworking fluid composition, the method comprising: preparing a unit amount article of the water-soluble unit amount metalworking fluid composition of any one of Items 1 to 7; and adding the unit amount article to a used water-soluble metalworking fluid to adjust the water-soluble metalworking fluid composition to a desired concentration.

15 Advantageous Effects of Invention [0011]

In the field of industrial chemicals, in particular in metalworking, the water-soluble unit amount metalworking fluid composition of the present invention can be used not only in fresh water, but also in water containing chemical components of metalworking fluid; is easily soluble even with weak stirring; and is applicable to tanks having different capacities.

Brief Description of Drawings 25 [0012]

Fig. 1 shows one embodiment of the water-soluble packaging container having perforations. The water-soluble metalworking fluid composition is packed in each compartment.

Fig. 2 shows another embodiment of the water-soluble packaging container having perforations. Each compartment contains a different volume of the water-soluble metalworking fluid composition.

Fig. 3 shows another embodiment of the water-soluble packaging container having perforations. Main ingredients are packed in one compartment and additives, which are water-soluble

metalworking fluid components, are packed in the other compartment.

Fig. 4 shows one embodiment of the water-soluble packaging container having a multi-layer structure. The
5 dissolution time of the content packed in each layer is different.

Fig. 5 shows a package form of multiple water-soluble packaging containers. A protective sheet is inserted between the adjacent water-soluble packaging containers to prevent damage to
10 the water-soluble packaging containers during storage and transportation.

Description of Embodiments

[0013]

15 In the field of industrial chemicals, in particular in metalworking, one of the factors different from those in the field of household detergents is that metalworking fluid must be easily soluble not only in fresh water, but also in water containing chemical components of metalworking fluid.
20 Furthermore, dissolution of the water-soluble film takes more time because stirring is not performed as much as in washing machines; and since industrial products are large volume products, if the film thickness of the water-soluble film is increased in order to provide sufficient strength, the water-
25 soluble film takes more time to dissolve.

[0014]

The water-soluble unit amount metalworking fluid composition of the present invention quickly dissolves in fresh water and in water containing chemical components of metalworking
30 fluid, withstands impact during transportation, and has sufficient strength even during long-term storage. The water-soluble metalworking fluid composition packed in a water-soluble packaging container, and components for use to form the water-soluble metalworking fluid composition (referred to herein as
35 "water-soluble metalworking fluid components") packed in a water-

soluble packaging container are herein collectively referred to as the water-soluble unit amount metalworking fluid composition. [0015]

The water-soluble metalworking fluid composition
5 comprises main ingredients such as base oils, oiliness improvers, and surfactants; and additives selected from the group consisting of lubrication improvers, rust inhibitors, defoaming agents, extreme-pressure agents, coupling agents, anticorrosive agents, preservatives, antibacterial agents, chelating agents, oil
10 separators, coloring agents, fragrances, and the like, and is used after being diluted with water. Examples of base oils include mineral oils (e.g., spindle oils, light oils, kerosene, and machine oils) and synthetic oils (e.g., polyolefins, diesters, and hindered esters). Examples of oiliness improvers
15 include vegetable oils such as rapeseed oil, soybean oil, castor oil, and coconut oil; and animal oils such as lard. Examples of surfactants include anionic surfactants, cationic surfactants, nonionic surfactants, and amphoteric surfactants, with anionic surfactants, cationic surfactants, and nonionic surfactants being
20 preferred. Examples of rust inhibitors include organic carboxylic acids, organic amines, and the like; these may be used in a combination. Examples of extreme-pressure agents include sulfur compounds, phosphorus compounds, organometallic compounds, and the like. Examples of preservatives include phenolic
25 preservatives, formaldehyde donors, and the like. Examples of coupling agents include alcohols.
[0016]

Typical types of water-soluble metalworking fluid compositions include emulsion-type compositions that are
30 emulsified in water (Class A1 in JIS classification); soluble-type compositions that are dissolved in water (Class A2 in JIS classification); and solution-type compositions (Class A3 in JIS classification). The dilution ratio of the water-soluble metalworking fluid composition varies depending on the
35 application; however, it is usually from about 5 to 100 times,

and preferably from about 10 to 50 times.

[0017]

Emulsion-type compositions are diluted with water to form milky color emulsions, and generally comprise a base oil
5 and/or an oiliness improver, and a surfactant, which is an emulsifier. Examples of soluble-type compositions include compositions that have a surfactant content increased from that of the corresponding emulsion-type compositions. Soluble-type compositions generally contain a synthetic polymer as base oil,
10 and form translucent or transparent solutions. Solution-type compositions contain, as a main component, a water-soluble lubricant such as polyalkylene glycol.

Among these compositions, in view of quick dissolution in a solution containing a metalworking fluid, emulsion-type
15 metalworking fluid compositions are preferable as the water-soluble metalworking fluid composition to be packed in the water-soluble packaging container.

[0018]

In order to maintain the strength of the water-soluble
20 packaging container, the water-soluble metalworking fluid composition to be packed in the water-soluble packaging container preferably has a water content of less than 10 mass%. The undiluted water-soluble metalworking fluid composition packed in the water-soluble packaging container preferably has a pH of 7.5
25 to 12, and more preferably a pH of 7.5 to 10. When the water-soluble metalworking fluid composition is alkaline to weakly alkaline, the water-soluble film material from which the water-soluble packaging container is formed is preferably resistant to alkali.

30 [0019]

The water-soluble film material used to form the water-soluble packaging container is not particularly limited, as long as it is soluble in water. Examples include water-soluble film materials comprising one resin or two or more resins selected
35 from polyvinyl alcohol, hydroxyethyl cellulose,

polyvinylpyrrolidone, starch, glycerin, gelatin, and the like. Among these, water-soluble film materials comprising polyvinyl alcohol are preferable because the required mechanical strength and moisture resistance during handling can be controlled by
5 changing various conditions, such as the degree of polymerization of polyvinyl alcohol, the degree of saponification, and the blending of additives such as starch.

[0020]

Examples of commercially available products of
10 polyvinyl alcohol (PVA) include M8630 and M8900, both produced by MonoSol, LLC.

[0021]

The water-soluble film material preferably has a film thickness of about 40 to 70 μm , and more preferably from about 45
15 to 64 μm . When the film thickness is about 40 micrometers to about 70 micrometers, the water-soluble film material has sufficient film strength and practical film dissolution. With respect to commercially available products, for example, M8630 film produced by MonoSol, LLC and having a thickness of 2.0 mil
20 (51 μm) is the most preferable.

[0022]

Components used to form the water-soluble metalworking fluid composition (water-soluble metalworking fluid components), which are main ingredients and/or additives, can be packed in the
25 water-soluble packaging container. Examples of main ingredients include base oils, oiliness improvers, surfactants, and the like. Examples of additives include lubrication improvers, rust inhibitors, defoaming agents, extreme-pressure agents, coupling agents, anticorrosive agents, preservatives, antibacterial
30 agents, chelating agents, oil separators, coloring agents, fragrances, and the like. The water-soluble metalworking fluid component(s) to be packed in the water-soluble packaging container can be a single component, or mixed components. Examples of mixing components include a mixture of main
35 ingredients, a mixture of additives, and a mixture of one or more

main ingredients and one or more additives. Further, the water-soluble metalworking fluid component(s) can be diluted with water.

[0023]

5 In view of maintaining the strength of the water-soluble packaging container, the water-soluble metalworking fluid component to be packed in the water-soluble packaging container preferably has a water content of less than 10% by mass. The water-soluble metalworking fluid component packed in the water-soluble packaging container preferably has a pH of 7.5 to 12, and more preferably a pH of 7.5 to 10. When the water-soluble metalworking fluid component is alkaline to weakly alkaline, the water-soluble film material used to form the water-soluble packaging container is preferably resistant to alkali. Therefore, the water-soluble film material used to form the water-soluble packaging container in which the water-soluble metalworking fluid component is packed preferably comprises polyvinyl alcohol (PVA). The water-soluble film material preferably has a film thickness of about 40 to 70 μm , and more preferably about 45 to 64 μm .

20 [0024]

 When the water-soluble metalworking fluid composition is placed into a water storage tank to prepare a diluted fluid of the composition, or when the water-soluble metalworking fluid composition is added to a used water-soluble metalworking fluid to replenish the water-soluble metalworking fluid composition, if a unit amount article prepared by packing the water-soluble metalworking fluid composition, preferably an emulsion-type metalworking fluid composition, in a water-soluble packaging container formed from the water-soluble film material described above (hereinafter referred to as the article of the present invention) is used, the article easily dissolves even with weak stirring.

[0025]

 The water-soluble unit amount metalworking fluid composition can preferably be in one of the following forms (1)

to (6):

(1) a form in which the water-soluble packaging container comprises multiple separable compartments comprising at least one compartment in which the water-soluble metalworking fluid composition is packed and at least one compartment in which the water-soluble metalworking fluid component is packed;

(2) a form in which the water-soluble packaging container comprises one compartment or two or more separable compartments, wherein the water-soluble metalworking fluid composition is packed in each compartment;

(3) a form in which the water-soluble packaging container comprises one compartment or two or more separable compartments, wherein the water-soluble metalworking fluid component is packed in each compartment;

(4) a form in which the water-soluble packaging container has a multi-layer structure and is configured such that the water-soluble metalworking fluid composition is packed in at least one layer, and the water-soluble metalworking fluid component is packed in at least one layer;

(5) a form in which the water-soluble packaging container has a multi-layer structure, wherein the water-soluble metalworking fluid composition is packed in each layer; and

(6) a form in which the water-soluble packaging container has a multi-layer structure, wherein the water-soluble metalworking fluid component is packed in each layer.

[0026]

The amount of water-soluble metalworking fluid packed in each compartment or in each layer is not particularly limited; however, it can preferably be in the range of 100 to 1000 g (or 100 to 1000 ml). For example, the amount can be 100 g (or 100 ml) and/or 500 g (or 500 ml) and/or 1000 g (or 1000 ml). When the amount of the metalworking fluid to be fed into a water storage tank reaches several tens or several hundreds of kilograms, it is sufficient if drums or gallons of metalworking fluid are used and the amount of shortage is supplemented by the article of the

present invention. Accordingly, an article in which unit amounts corresponding to several kilograms or several hundred grams of the metalworking fluid are packed are necessary. If a unit amount article in which the metalworking fluid is packed in such
5 specific unit amounts is prepared, there is no hindrance to usual diluted metalworking fluid preparation and replenishment operations in tanks having different capacities. The amount of the water-soluble metalworking fluid component packed in each compartment or in each layer is also not particularly limited, as
10 described above; however, it can preferably be in the range of 100 to 1000 g (or 100 to 1000 ml). For example, the amount can be 100 g (or 100 ml) and/or 500 g (or 500 ml) and/or 1000 g (or 1000 ml).

[0027]

15 The water-soluble unit amount metalworking fluid composition can be, for example, in one of the following forms. As shown in Fig. 1, the water-soluble packaging container 2 used to contain the water-soluble unit amount metalworking fluid composition 1 of the present invention can be provided with
20 perforations 3, and can comprise multiple packed portions that can be individually cut out at the perforations 3. The water-soluble unit amount metalworking fluid composition 1 shown in Fig. 1 comprises a compartment 4 in which a principal amount (a large volume) of the water-soluble metalworking fluid composition
25 is packed, and compartments 5 in which a small volume of the water-soluble metalworking fluid composition composed of the same components as in compartment 4 is packed for minor adjustment. The water-soluble metalworking fluid composition is, for example, a composition comprising one or more main ingredients and one or
30 more additives capable of imparting functions, such as a lubrication improver, a rust inhibitor, an antibacterial agent, a defoaming agent, and an oil separator.

[0028]

As shown in Fig. 2, compartments 6, 7, 8, and 9 for
35 containing the water-soluble metalworking fluid composition

divided by perforations 3 may each have a different content volume (for example, 500 ml for compartment 6, 300 ml for compartment 7, 200 ml for compartment 8, and 100 ml for compartment 9), and may be configured so that the desired amount to be fed can be adjusted by combining the content volumes.

[0029]

Fig. 3 shows a water-soluble unit amount metalworking fluid composition 1 of the present invention comprising two independent compartments 10 and 11 that can be cut away from each other at the perforations. Main ingredients are packed in one compartment and additives, which are water-soluble metalworking fluid components, are packed in the other compartment.

[0030]

Fig. 4 shows a water-soluble unit amount metalworking fluid composition 1 having a multilayer structure, wherein 10 is an outer compartment, and 11 is an inner compartment. For example, when main ingredients are packed in the outer compartment 10 and additives are packed in the inner compartment 11, the main ingredients are first released, and the additives are then released. It is possible to create a time lag between the dissolution of main ingredients and that of the additives by, for example, increasing the thickness of the film material in the inner portion, and reducing the thickness of the film material in the outer portion.

[0031]

When the water-soluble unit amount metalworking fluid composition is formed into a package for storage and transportation, the water-soluble unit amount metalworking fluid composition can be housed in a stacked manner in a box that has a top face, a bottom face, and four side faces with a protective sheet being placed between each water-soluble unit amount metalworking fluid composition, so that adjacent water-soluble unit amount metalworking fluid compositions do not contact each other. For example, as shown in Fig. 5, when the water-soluble unit amount metalworking fluid composition 1 of the present

invention in the form of a sheet is stacked in a box 12 and packaged for storage and transportation, a protective sheet 13 for cushion is inserted between each water-soluble unit amount metalworking fluid composition 1; accordingly, adjacent water-soluble unit amount metalworking fluid compositions 1 do not come into direct contact with each other, thereby preventing damage to the water-soluble unit amount metalworking fluid compositions 1. Examples of the protective sheet 13 include an aluminum sheet.

[0032]

10 A water-soluble metalworking fluid having a desired concentration can be prepared by using the present invention. For example, according to a first use embodiment, the water-soluble unit amount metalworking fluid composition of the present invention is formed into a unit amount article that is set to have a predetermined concentration and contain a predetermined packed amount of the composition; and the unit amount article thus prepared is placed into a water storage tank or added to a used water-soluble metalworking fluid, thus producing a diluted water-soluble metalworking fluid composition having a desired concentration.

[0033]

 According to a second use embodiment, the water-soluble unit amount metalworking fluid composition of the present invention is formed into a unit amount article that is set to have a predetermined concentration and contain a predetermined packed amount of the composition, and the unit amount article thus prepared is added to a used water-soluble metalworking fluid to adjust the concentration of the water-soluble metalworking fluid. In the second use embodiment, the concentration of the entire water-soluble metalworking fluid composition can be adjusted, or the concentration of only one or more specific components of the fluid composition can be adjusted. In the second use embodiment, one or more components contained in the water-soluble unit amount metalworking fluid composition do not have to be contained in the used water-soluble metalworking oil

fluid. Accordingly, one or more components not originally contained in the used water-soluble metalworking fluid can be newly added to thereby enhance properties of the water-soluble metalworking fluid, or impart new properties.

5

Examples

[0034]

The present invention is described below in more detail, with reference to Examples.

10

[0035]

Example 1

Film Performance Test I: Film Dissolution in Diluted Metalworking Fluid

15

A film dissolution test was performed in the following manner using an emulsion-type water-soluble metalworking fluid "Finecut CFS-100PA" produced by Neos Co., Ltd., and using a water-soluble PVA film "M8630 3.0 mil (76 μ m)" produced by MonoSol, LLC. Table 1 shows the obtained results.

[0036]

20

Test Method

400 ml of a 20-fold diluted aqueous solution of Finecut CFS-100PA, prepared by dilution with tap water, was placed into a 1-liter beaker, and the fluid temperature was adjusted to 15°C. A PVA film piece obtained by cutting M8630 3.0 mil into a size of 5 cm x 10 cm was immersed in the diluted water-soluble metalworking fluid, and the time until the film had dissolved was confirmed (1 minute after the immersion, gentle stirring with a glass rod was started).

[0037]

30

Evaluation Method

A film dissolution test was performed under the same conditions as above except that tap water was used instead of the diluted metalworking fluid, and the dissolution time thus obtained was used as a reference. The film dissolution was evaluated according to the following criteria.

35

A: The film dissolved in the diluted metalworking fluid in a time equivalent to or shorter than the film dissolution time in tap water.

B: The dissolution of the film took a longer time than its
5 dissolution in tap water.

[0038]

Example 2

A film dissolution test was performed in the same manner as in Example 1, except that the water-soluble
10 metalworking fluid was changed to an emulsion-type Finecut CFS-95 produced by Neos Co., Ltd. Table 1 shows the obtained results.

[0039]

Comparative Examples 1 and 2

A film dissolution test was performed in the same
15 manner as in Example 1, except that the water-soluble metalworking fluid was changed to a soluble-type Finecut 2500 (Comparative Example 1) produced by Neos Com., Ltd., or to tap water (Comparative Example 2). Table 1 shows the obtained results.

20 [0040]

Table 1: Test Results of Film Dissolution in Diluted Metalworking Fluid

		Example 1	Example 2	Comp. Ex. 1	Comp. Ex. 2
Fluid in which the water-soluble film is dissolved (diluted fluid)		Finecut CFS-100PA	Finecut CFS-95	Finecut 2500	Tap water
Water-soluble film		PVA film M8639 3.0 mil	PVA film M8639 3.0 mil	PVA film M8639 3.0 mil	PVA film M8639 3.0 mil
Thickness of the film		76 μ m	76 μ m	76 μ m	76 μ m
Type of the metalworking fluid		Emulsion	Emulsion	Soluble	-
Properties of the metalworking fluid	pH (25°C, undiluted solution)	8.3	9.8	9.9	-
	Water amount	1 to 5	1 to 5	44 to 55	-
	Specific				

	gravity (15°C)	0.95	0.93	1.05	-
Dissolution time (min)		2.5 to 3	2.5 to 3	4.5 to 5	3
Evaluation		A	A	B	-

[0041]

Example 3 and Comparative Examples 3 and 4

Film Performance Test II: Dissolution and Strength of Package

Three MonoSol M8630 water-soluble PVA films that differ
5 in film thickness were subjected to the following test. The
correspondence between the film thickness and Example No. or
Comparative Example No. subjected to the test is as follows:
Comparative Example 3: 1.5 mil (38 µm)

Example 3: 2.0 mil (51 µm)

10 Comparative Example 4: 3.0 mil (76 µm)

[0042]

Preparation of Packages

Using the three water-soluble films, open bags 20 cm x
15 cm in size were produced, and 500 ml of Finecut CFS-100PA
15 (produced by Neos Com., Ltd.) undiluted emulsion-type water-
soluble metalworking fluid was placed into each bag. Each bag was
closed by heat-sealing to produce a fluid package formed from
each water-soluble film.

[0043]

20 Evaluation of Dissolution

Using the fluid packages obtained above, the
dissolution of each fluid package after being allowed to stand in
a constant temperature chamber at 38°C/80% RH for 14 days was
evaluated. For the storage in the constant temperature chamber,
25 the fluid package was double-packaged by being further wrapped
with a polyethylene-laminated aluminum film, and heat-sealed.
This simple aluminum package was removed before measurement of
the dissolution.

The evaluation was conducted in the following manner.
30 First, 2.5 liters of 20°C tap water was placed in a 3-liter
beaker. The fluid package maintained at 20°C was gently added
thereto, and the resulting mixture was slowly stirred (at 400

rpm) using a stirrer comprising a 30-mm-long magnetic stirrer piece. The time it took for complete dissolution of the film was determined by visual observation.

The evaluation was made according to the following
5 criteria. Table 2 shows the evaluation results.

A: The complete dissolution took 120 seconds or less.

B: The complete dissolution took more than 120 seconds.

[0044]

Bag Breaking Strength Test

10 After each aluminum-packaged sample was allowed to stand in a constant temperature chamber at 38°C/80% RH for 14 days, the simple aluminum package was removed to take out the fluid package. The fluid package was subjected to the following test. In accordance with JIS Z 0238: 1998, the fluid package was
15 dropped vertically and horizontally from a drop height of 30 cm to check for content leakage.

The evaluation was made according to the following criteria. Table 2 shows the evaluation results.

A: No leakage.

20 B: Leakage was observed.

[0045]

Evaluation

The water-soluble PVA films of three different film thicknesses were assessed from the above test results. Table 2
25 shows the evaluation results.

[0046]

Table 2: Evaluation Results of Dissolution and Strength of Packages Formed from M8630 Films Different in Film Thickness

	Comparative Example 3	Example 3	Comparative Example 4
Film thickness of water- soluble film	1.5 mil (38 µm)	2.0 mil (51 µm)	3.0 mil (76 µm)
Complete dissolution time: measured after 14 days (seconds)	32	49	124

Evaluation of film dissolution	A	A	B
Bag breaking strength: measured at the initial stage	A	A	A
Bag breaking strength: measured after 14 days	B	A	A
Evaluation	B	A	B

[0047]

Example 4

Film Performance Test III: Adhesion During Stacking of Packages
Test for Confirming Adhesion During Stacking

5 The fluid package produced using M8630 film with a film thickness of 2.0 mil (51 μ m) prepared above in Example 3 was stacked to five layers. After the packages were allowed to stand at room temperature for 28 days, the state of tight adhesion of the packages was checked. The presence of resistance at the time of peeling off and the occurrence of adhesion were confirmed. No
10 adhesion etc. were observed at the time of peeling off.

Description of the Reference Numerals

[0048]

- 15 1: Water-soluble unit amount metalworking fluid composition
- 2: Water-soluble container
- 3: Perforations
- 4: Compartment (large capacity)
- 5: Compartment (Small capacity)
- 20 6: Compartment (500 ml)
- 7: Compartment (300 ml)
- 8: Compartment (200 ml)
- 9: Compartment (100 ml)
- 10: Compartment (Main ingredient)
- 25 11: Compartment (Additive)
- 12: Box

13: Protective Sheet

CLAIMS

[Claim 1]

A water-soluble unit amount metalworking fluid
5 composition comprising
a water-soluble metalworking fluid composition and/or
at least one water-soluble metalworking fluid component and
a water-soluble packaging container formed from a
water-soluble film material,
10 the water-soluble metalworking fluid composition and/or the
water-soluble metalworking fluid component being packed in the
water-soluble packaging container.

[Claim 2]

15 The water-soluble unit amount metalworking fluid
composition according to claim 1, wherein the water-soluble
metalworking fluid composition and/or the water-soluble
metalworking fluid component that is packed has a water content
of less than 10 mass% and a pH of 7.5 to 12, and the film
20 material is a material durable to the water-soluble metalworking
fluid composition that satisfies these conditions.

[Claim 3]

The water-soluble unit amount metalworking fluid
25 composition according to claim 1 or 2, wherein the water-soluble
metalworking fluid composition is an emulsion-type metalworking
fluid composition.

[Claim 4]

30 The water-soluble unit amount metalworking fluid
composition according to any one of claims 1 to 3, wherein the
water-soluble film material comprises polyvinyl alcohol (PVA).

[Claim 5]

35 The water-soluble unit amount metalworking fluid

composition according to any one of claims 1 to 4, wherein the water-soluble film material has a thickness of 40 μm to 70 μm .

[Claim 6]

5 The water-soluble unit amount metalworking fluid composition according to any one of claims 1 to 5, which is in one of the following forms (1) to (6):

(1) a form in which the water-soluble packaging container comprises multiple separable compartments comprising at least one
10 compartment in which the water-soluble metalworking fluid composition is packed and at least one compartment in which the water-soluble metalworking fluid component is packed;

(2) a form in which the water-soluble packaging container comprises one compartment or two or more separable compartments,
15 wherein the water-soluble metalworking fluid composition is packed in each compartment;

(3) a form in which the water-soluble packaging container comprises one compartment or two or more separable compartments, wherein the water-soluble metalworking fluid component is packed
20 in each compartment;

(4) a form in which the water-soluble packaging container has a multi-layer structure comprising at least one layer in which the water-soluble metalworking fluid composition is packed and at least one layer in which the water-soluble metalworking fluid
25 component is packed;

(5) a form in which the water-soluble packaging container has a multi-layer structure, wherein the water-soluble metalworking fluid composition is packed in each layer; and

(6) a form in which the water-soluble packaging container has a
30 multi-layer structure, wherein the water-soluble metalworking fluid component is packed in each layer.

[Claim 7]

 The water-soluble unit amount metalworking fluid
35 composition according to claim 6, wherein the amount of the

water-soluble metalworking fluid composition or the water-soluble metalworking fluid component packed in each compartment or in each layer is 100 to 1000 g.

5 [Claim 8]

A package comprising
a box having a top face, a bottom face, and four lateral faces;
the water-soluble unit amount metalworking fluid composition of
any one of claims 1 to 7 that is housed in a stacked manner in
10 the box; and
a protective sheet that is disposed between each water-soluble
unit amount metalworking fluid composition, so that adjacent
water-soluble unit amount metalworking fluid compositions do not
come into contact with each other.

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[Claim 9]

A method for producing a diluted water-soluble
metalworking fluid composition, the method comprising
preparing a unit amount article of the water-soluble unit amount
20 metalworking fluid composition of any one of claims 1 to 7, and
placing the unit amount article into a water storage tank or
adding the unit amount article to a used water-soluble
metalworking fluid to prepare a diluted water-soluble
metalworking fluid composition having a desired concentration.

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[Claim 10]

A method for adjusting the concentration of a water-
soluble metalworking fluid composition, the method comprising:
preparing a unit amount article of the water-soluble unit amount
30 metalworking fluid composition of any one of claims 1 to 7; and
adding the unit amount article to a used water-soluble
metalworking fluid to adjust the water-soluble metalworking fluid
composition to a desired concentration.