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SOLUBLE CUTTING OIL

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The present invention is concerned with an improved lubricating and cooling composition. The invention more particularly is concerned with a non-foaming oil emulsion which is adapted for lubricating and cooling of various metallic surfaces under machining operations whereby the numerous chips formed in these operations readily separate from the cooling composition and are removed therefrom. In accordance with the present invention, improved soluble cutting oils are produced by utilizing, in conjunction with conventional cutting oils, an addition agent which is selected from the class of phenols and derivatives thereof.

It is well known in the metal fabricating, cutting, and related arts to employ various lubricating oil emulsions which function to lubricate and cool the metal cutting tools employed in turning, drilling, grinding, and similar operations. These emulsions in general usually comprise a mineral oil, an emulsifying agent and water. For example, it is known to use as cutting fluids aqueous emulsions of mineral oils with sulfonate and naphthenic soaps derived from petroleum as emulsifiers as well as aqueous emulsions of emulsifiable extreme pressure lubricants or sulfur oils such as a sulfurized fatty oil. These emulsions furthermore may also contain relatively small amounts of various coupling agents and other dispersing agents such as rosin soaps and alkalis which function to improve a particular characteristic of the composition. Although these emulsion compositions may be entirely satisfactory with respect to the lubricating and cooling characteristics, they are not entirely satisfactory due to the fact that the constituents employed in the same tend to retain the small metal chips which are evolved in the machining operation suspended in the cooling fluid. Thus, the metal chips are recirculated to the point of contact between the tool and the metal being fabricated, materially impairing at times the quality and character of the resulting work.

In order to overcome this inherent disadvantage of conventional lubricating and cooling compositions, many proposals have been made for the separation of the metal chips. For example, it has been proposed that the solution be filtered prior to recirculating the same to the point of contact between the tool and the metal being fabricated, but it is frequently impossible to employ a filter in the circulating system. We have, however, now discovered improved lubricating and cooling compositions which compositions contain an addition agent which facilitates the precipitation and removal of undesirable chips which would otherwise be retained in said composition and recirculated as described above. In accordance with our invention, we add to said conventional lubricating and cooling composition

an addition agent selected from a class of phenols and derivatives thereof.

Our addition agent is selected from a class of alkylated phenols characterized by having at least two alkyl groups attached directly to the phenolic ring. Compounds of this character are, for example, the various xylenols, and, we have discovered that the 3,5 xyleneol is to be preferred. Fractions of alkylated phenols from petroleum, shale oil, or coal tar boiling in the range of approximately 210° C–300° C. contain a high proportion of the xylenols and show this property.

These addition agents may be employed in any conventional soluble oil composition. For example, the base mineral oil of the soluble oil may vary considerably and may comprise an oil which boils in the lubricating oil boiling range, a spindle oil, a light oil or a similar type of oil. Distillate oils derived from paraffinic or naphthenic crudes and having Saybolt viscosities at 210° F. between 60 seconds and 200 seconds are generally suitable. Usually the oils have viscosities below about 500 seconds at 100° F. although under certain conditions more viscous oils may be employed. In general, the amount of base mineral oil employed in the soluble oil varies in concentrations of about 50% to 95%.

Any suitable emulsifying agent may be employed to render the base oil readily miscible or emulsifiable with water. Suitable emulsifying agents are sodium, potassium or onium base naphthenates or sulfonates; organic naphthenate soaps, such as di- and triethanolamine naphthenate may likewise be used. In general, it is preferred to employ a mixture of naphthenate or naphthenic sulfonate as, for example, one part naphthenate to four parts sulfonate. The usual concentration of the emulsifying agent in the mineral oil is about 5% to 40% by weight.

Various coupling agents adapted to disperse the soaps in the oil to form a clear stable pseudo solution are also added. These agents may be oil or water soluble but are preferably soluble in water and are soluble, at least to some extent, from about 1% to 5% or more, in the emulsifier containing mineral oils. Suitable dispersing agents of this character are, for example, polyhydric alcohols and polyhydric alcohol ethers, examples of which are glycol and glycol ethers, such as diethylene glycol and diethylene glycol monobutyl ether. Usually the amount of dispersing agents utilized is about 0.5% to 3% based upon the weight of base oil.

The emulsifiable oils may also contain rosins which, like the naphthenic acids, are neutralized with alkalis to form soaps. Such soaps have an alkaline reaction in water. Thus, it is not necessary to have an excess of alkali for this. Free inorganic alkalis are difficult to keep in solution or dispersion. Often free alkali is added,

however, to the emulsion already prepared to improve rust protection. The emulsifiable oil compositions may be mixed in any desirable concentration with water. In general, these oils are emulsified with from about 10 volumes to 200 volumes of water per volume of oil.

The amount of addition agent employed in a soluble oil composition to settle out the chips from its emulsion will vary somewhat depending upon the type of soluble oil, that is, on the particular base oil utilized, but does not appear to be affected appreciably by the quantity of water used in the emulsion. In general, we prefer to add from about 0.1% to 5%, preferably from about 0.5% to 2% of the addition agent in the soluble oil.

In order to further illustrate the present invention, the following examples are given which should not be construed as limiting the same in any manner whatsoever:

Soluble oils having the following compositions were employed in various grinding and machining operations and tested for chip settlement from 150/1 emulsions:

	Soluble oil #1	Soluble oil #2	Soluble oil #3	Soluble oil #4
	Per cent	Per cent	Per cent	Per cent
Mineral oil.....	85.1	84.2	92.80	82.0
Mahogany sulfonates.....	9.5	9.4	4.60	5.0
Sodium naphthenate.....	2.8	2.8	1.37	10.3
Water.....	1.7	1.7	0.83	1.2
Alcohol.....	0.9	0.9	0.44	1.0
Oleic acid.....		1.0		
Triethanolamine.....				0.5

Approximately 150 volumes of water and one volume of the soluble oil containing 1% of the selected additive were mixed in stoppered graduated cylinders to form a stable emulsion. A small quantity of washed and dried steel grindings were then added and shaken moderately to distribute the chips uniformly. The resulting suspension was then allowed to stand undisturbed until separation of the chips was substantially complete. The time required for this separation was measured. The results of these tests with the above soluble oils were as follows:

150/1 emulsion used	Time in seconds to settle without alkali	Steel grindings from emulsion with 0.4% soda ash in emulsion
Soluble oil #1 (1).....	17-20	60
Ditto+1% xylenols (mixture) (2).....	13	21-25
Ditto+1% xyleneol (3,5).....	10-12	13
Ditto+1% meta cresol.....	13	>60
Ditto+1% ortho cresol.....	11-15	51-58
Ditto+1% cresylic acid (3).....	13-14	>60
Ditto+1% petroleum phenols (4).....	12-13	>60
Soluble oil #2 (6).....	12-14	55-60
Ditto+1% alkylated phenols (6).....	14-17	12-15
Ditto+2% alkylated phenols.....	9-10	19-33
Soluble oil #3 (7).....	12-13	>60
Ditto+1% alkylated phenols.....	10-11	13-15
Soluble oil #4 (8).....	19-25	40-45
Ditto+1% alkylated phenols.....	15-17	17-19

Notes

- (1) Soluble oil #1 consists of approximately 15% sulfonate-naphthenate emulsifier (4/1 ratio) in 100 viscosity oil.
- (2) Xylenols consist of mixture of 2,4-2,5 and 2,6 dimethyl.
- (3) Cresylic acids are so-called C. P. coal tar cresols.
- (4) Petroleum, phenols recovered from heating oil—no distillation.
- (5) Soluble oil #2 consists of approximately 15% sulfonate-naphthenate emulsifier (4/1 ratio) and 1% oleic acid in 100 viscosity oil.
- (6) Alkylated phenols are 210°-300° C. distillation range from petroleum phenols and consist largely of xylenols.
- (7) Soluble oil #3 consists of approximately 7½% sulfonate-naphthenate emulsifier (4/1 ratio) in 100 viscosity oil.
- (8) Soluble oil #4 consists of approximately 18% naphthenate-sulfonate emulsifier (2/1 ratio) in 100 viscosity oil.

These data indicate the effectiveness of xylenols for promoting chip settlement from the 150/1 emulsions when employed in a 1% concentration in the soluble oil (equivalent to a 0.0067% concentration in the emulsion). It is interesting to find that the coal tar cresylic acids, which are said to contain appreciable quantities of the para isomer, have no settling effect. On the other hand, the mixed xylenols and the 210°-300° C. distillation fraction of petroleum phenols have a definite separating action on the chips.

We claim:

1. An improved alkaline-soluble oil composition comprising a base oil, an emulsifying agent of the oil-in-water type, and an addition agent selected from the class of phenols which are characterized by having at least two alkyl groups attached directly to the phenolic ring.

2. Composition as defined by claim 1 in which said addition agent comprises a xyleneol.

3. A composition according to claim 1 in which the addition agent is a distillate selected from the group consisting of petroleum, coal tar and shale oil distillates boiling between 210°-300° C.

4. Composition as defined by claim 1 in which said addition agent comprises from 0.1 to 5% of 3,5-xyleneol.

5. Improved alkaline-soluble oil composition which comprises a base oil having a Saybolt viscosity of 210° F. between about 60 seconds and 200 seconds, an emulsifying agent selected from the class of sodium, potassium and onium base naphthenates and sulfonates, a dispersing agent selected from the class of polyhydric alcohols and an addition agent selected from the class of phenols which are characterized by having two alkyl groups attached directly to the phenolic ring.

6. Composition as defined by claim 5 in which said addition agent comprises a xyleneol.

7. A composition in accordance with claim 5 in which the addition agent is a distillate selected from the group consisting of petroleum, coal tar and shale oil distillates boiling between 210°-300° C.

8. Composition as defined by claim 5 in which said addition agent comprises from 0.1 to 5% of 3,5-xyleneol.

9. An improved alkaline lubricating and cooling composition comprising a base oil, an emulsifying agent of the oil-in-water type, water, a small amount of alkali and an addition agent selected from the class of phenols which are characterized by having at least 2 alkyl groups attached directly to the phenolic ring.

10. A composition as defined by claim 9 in which said addition agent comprises a xyleneol.

11. A composition as defined by claim 9 in which the addition agent is a distillate selected from the group consisting of petroleum, coal tar and shale oil distillates boiling between 210°-300° C.

12. Composition as defined by claim 9 in which said addition agent consists of from 0.1 to 5% of 3,5-xyleneol.

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