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(54) **PROCESS FOR METALWORKING FLUID FROM HEAVY ALKYLATE**

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(57) **ABSTRACT**

The present invention relates to composition of metalworking fluid based on heavy alkyl benzenes having 20 to 22 alkyl carbon atoms and process for the preparation thereof. The heavy alkyl benzene based, less toxic, soluble metalworking fluid composition comprises heavy alkyl benzene, emulsifier, lubricity booster, antioxidant, fungicide, extreme pressure additive, antirust, co-surfactant, coupling agent and alkali component. The process comprises tailoring the heavy alkyl benzene, removing of insoluble matter from the heavy alkylate, addition of emulsifier, additives, coupling agent and co-surfactant, homogenizing the mixture at 20-120° C., followed by conditioning of the soluble metal working fluid concentrate which can be used as emulsion in water.

PROCESS FOR METALWORKING FLUID FROM HEAVY ALKYLATE

PRIORITY

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 10/810,387 filed Mar. 26, 2004, the entire disclosure of which is hereby incorporated by reference.

FIELD OF INVENTION

[0002] The present invention relates to a process for metalworking fluids from heavy alkylate. More particularly this invention relates to composition of soluble metalworking fluid and process for its preparation based on less-toxic heavy alkyl benzenes having 20 to 22 alkyl carbon atoms to replace mineral oil. This soluble metalworking fluid composition comprises heavy alkylate, emulsifier lubricity booster, antioxidant, fungicide, extreme pressure additive, antirust, co-surfactant, coupling agent and alkali component. The process comprises tailoring the heavy alkylate, removing of insoluble matter from the heavy alkylate, addition of emulsifier, additives, coupling agent and co-surfactant, homogenizing the mixture at 20-120° C., followed by conditioning of the soluble metal working fluid concentrate which can be used as emulsion in water in 20:80 ratio.

BACKGROUND AND PRIOR ART

[0003] The speed of machining could be greatly increased if the cutting surface is kept cool and lubricated. Water can be regarded as the first cutting fluid because of its high specific and latent heats to give it unique potential cooling power and also it is available everywhere at low cost. However, due to poor wetting efficiency, water alone can't cool the metal surface with its full ability. Another serious disadvantage is the formation of rust on iron and steel surfaces. Modern development has led to the introduction of advanced water-oil emulsion incorporating special chemicals, which considerably improve its wettability, lubrication, high cooling power, rust inhibiting and detergency properties. These concentrates and their emulsions in water are known as 'Soluble Oil' or "soluble metalworking fluid". They are ideal for general machining process where Cooling, Lubrication, Cleaning and extreme pressure characteristics are essential requirements.

[0004] Traditionally, the mineral oils and petroleum sulfonates have been the basic source of metalworking fluid formulations. The petroleum based lubricating oils and sulfonates are hydrocarbons of varying composition consisting of naphthenes, paraffins and aromatics. The sulfonates formed by sulfonation of aromatic components in these lubricating oil streams act as oil/water emulsifiers. Various additives, which are primarily chemicals of defined composition or structure, are added also to improve the physico-chemical properties and performance of soluble metalworking fluids. Petroleum based soluble oils; generally suffer from many disadvantages such as higher toxicity to the environment, poor biodegradability and ever-changing characteristics with changes in crude oil composition. The other types of lubricants known as synthetic lubricants are designed for use in extreme conditions of temperature, pressure, radiation or chemical environment and have excellent lubricity and thermal stability. The synthetic lubricants are relatively costly as compared to petroleum based lubricants. Polyglycols, polybutenes, dibasic acid esters, fluoropolymers, polyol esters, phosphate esters, silicones, poly-alpha olefins etc. are commonly used synthetic lubricants for various applications. Some of the synthetics are also toxic to environment and are not readily biodegradable. Similar disadvantages are found with Petroleum sulfonates which are by-products of sulfonation of lubricating oils also suffer from inconsistent emulsification and compatibility characteristics due to ever-changing composition of the lubricating oils.

[0005] Keeping in the view the environmental concerns and improved performance, consistency in structural and performance characteristics, there is a need to develop alternative lubricant and emulsifier component for metalworking fluids, which are less toxic and low cost which show equivalent or improved performance to mineral oil or synthetic lubricant based metalworking fluids.

[0006] The use of Heavy alkyl benzene as a lubricant is very limited. Recently, the Heavy Alkyl Benzene alkaline earth metal sulfonates are in use as detergent-dispersant-anti rust additive in various types of lubricants but not for metalworking fluids.

[0007] Reference may be made to M/S Petresa, Madrid, Spain, (www.petresa.es) wherein they are marketing heavy alkylate under the brand name of 'PETRENE' to be use as thermal fluid, transformer oil, refrigerating oil, sulfonation feedstock and lubricating greases but not for metalworking fluids but not teaches the soluble metalworking fluids.

[0008] Reference may be made to M/s Chevron, U.S.A. Inc., (San Ramon, Calif.) has U.S. Pat. No. 6,187,981 "Process for producing aryl alkanes and arylalkanes sulfonates, compositions produced there from, and uses thereof". Wherein this invention is a process for producing aryl-alkanes. This invention also provides process that to produce modified alkyl benzene sulfonates, which can be used as detergents but not teaches the soluble metalworking fluids.

[0009] Chevron, U.S.A. Inc., (San Ramon, Calif.) has U.S. Pat. No. 6,392,109 "Synthesis of alkyl benzenes and synlubes from Fischer-Tropsch products" which is for an integrated process for producing alkyl benzenes, sulfonated alkyl benzenes and/or alkylcyclohexanes from syngas and used as detergents and/or dispersants but not teaches the soluble metalworking fluids.

[0010] There are sufficient guiding literatures in this field. Although there is very less background available for utilization of heavy alkyl benzene (by-product) but for soluble cutting oil there are sufficient literature, but not teaches the soluble metalworking fluids from heavy alkylate, such as:

[0011] U.S. Pat. No. 6,858,569—Yokota, 22 Feb. 2005

[0012] U.S. Pat. No. 4,589,990—Zehler, 20 Dec. 1986

[0013] U.S. Pat. No. 5,171,903—Koyama, 15 Dec. 1992

[0014] U.S. Pat. No. 5,877,130—Kohara, 2 Mar. 1999

[0015] U.S. Pat. No. 6,245,723—Sigg, 12 Jun. 2001

[0016] U.S. Pat. No. 6,605,575—Yamota, 12 Aug. 2003

[0017] U.S. Pat. No. 6,383,991—Hashimoto, 7 May 2002

[0018] U.S. Pat. No. 6,242,391—Fukutani, 5 Jun. 2001

[0019] In view of the growing concern about the environment, there is a need for less-toxic lubricant component for metalworking soluble oil based on Heavy alkyl benzene, which is a new application of the heavy alkylate. It will not only reduce the toxicity of soluble oil but also will be more cost effective than mineral oil because of improved and consistent performance because both the mineral oil component and the sulfonates made from these alkylates can be tailored

to obtain a high performance product of consistent quality. It is an additional benefit to the alkylate industry.

OBJECTS OF THE INVENTION

[0020] The main object of the present invention is to provide a process for metalworking fluids from heavy alkylate.

[0021] Another object of the present invention is to provide heavy alkylate based less toxic lubricant component metalworking fluids.

[0022] Still another objects of the present invention is to provide a new application to the heavy alkylate (a by-product or waste product).

[0023] Yet another object of the present invention is to provide new composition of metalworking fluid for the benefit of metalworking and alkylate manufacturing industries.

SUMMARY OF INVENTION

[0024] Accordingly the present invention provides a process for metalworking fluids from heavy alkylate concentrate composition comprising; (a) heavy alkyl benzenes having C20 to C22 alkyl carbon atoms on benzene ring, to replace mineral oil, in the concentration range of 40 to 85 weight percent of the metal working fluid concentrate, (b) at least one sulfonate or oleate emulsifier in the range of 10 to 40 weight percent of the metalworking fluid concentrate, (c) a synergetic combination of additives, (c1) at least one vegetable oil lubricity booster component in the concentration range of 2-10 percent of metal working fluid concentrate, (c2) an alkyl phenol or aromatic amine antioxidant component is in the concentration range of 50-500 mg/kg, (c3) a phenol fungicide component in the concentration range of 50-500 mg/kg, (c4) an organic sulphide or phosphosulfurized metal salt extreme pressure additive component in the concentration range of 50-500 mg/kg in the metal working fluid concentrate, (c5) a triazole or sulfonate antirust component in the concentration range of 50-500 mg/kg in the metal working fluid concentrate, (c6) an alcohol co-surfactant component in the range of 1-10 weight percent of metal working fluid concentrate, (c7) a sulfonate coupling agent in the range of 0.5 to 10 weight percent of metal working fluid concentrate, (c8) alkali or alkaline earth metal salt component in the range of 8-10 weight percent of metal working fluid concentrate, (d) a process comprises the steps of; tailoring the heavy alkylate, removing of insoluble matter from the heavy alkylate followed by addition of emulsifier and vegetable oil to obtain the mixture; homogenising the resultant mixture at a temperature in the range of 30 to 100 degree Celsius; for about one hour with stirring; adding the antioxidant, fungicide, extreme pressure additives, anti trust component, co-surfactant, coupling agent, alkali, followed by addition of water to make up the quantity about 1 kg, homogenizing the mixture for about 30 minutes, the pH of the solution should be adjusted to 7-9 by addition of sodium carbonate and cooling the resultant metal working fluid at room temperature, wherein the composition is suitable for use as soluble metalworking fluid as admixture or emulsion with water in concentration range from 20 to 80 weight percent.

[0025] In an embodiment of present invention the heavy Alkylate is a non-toxic lube oil component having heavy alkyl benzene of C20-C22 alkyl carbon atom, a heavy fraction by-product separated from detergent class alkyl benzene during manufacture. Heavy alkyl benzene mainly consists of mixture of substituted benzenes. Benzene is substituted with alkyl chain. Alkyl chains are straight-chain paraffin or branch-chain paraffin, average of C20-C22 alkyl carbon atom, at single or two places of benzene ring. No poly-aromatics or olefin compounds are present in the heavy alkylates.

[0026] In yet another embodiment the emulsifier is selected preferably from the group consisting of heavy alkylate sodium sulfonates, sodium carboxylate, sodium oleate, triethanolamine oleate, diethanolamine oleate or dodecyl toluene sodium sulfonate or mixtures thereof.

[0027] In yet another embodiment the lubricity booster is a vegetable oil selected preferably from the group consisting of karanja oil, neem oil, rice-bran oil, castor oil or mixtures thereof.

[0028] In yet another embodiment the antioxidant component is selected preferably from the group consisting of an alkyl phenol, aromatic amine, substituted tetrazole selected from 2,6-ditertiary butyl phenol, 2,6-ditertiary p-cresol, diphenylamine, Tertiary butyl phenol amino tetrazole and 2,6-dioctyl phenylene diamine or mixtures thereof.

[0029] In yet another embodiment the fungicide component is a phenol or phenolic acid selected preferably from the group consisting of o-cresol, phenol, m-cresol and cresylic acid or mixtures thereof.

[0030] In yet another embodiment the extreme pressure additive component is an organic sulphide or phosphosulfurized metal salt selected preferably from the group consisting of dibenzyl disulphide, sulfurized vegetable oil, phosphosulfurized decyl oleate molybdate and phosphothio pentadecyl phenol molybdate or mixtures thereof.

[0031] In yet another embodiment the anti-rust component is a triazole or sulfonate selected preferably from the group consisting of IH-benzotriazole, ditertiary butylated 1H-Benzotriazole, calcium petroleum sulfonate and calcium heavy alkylate sulfonate or mixtures thereof.

[0032] In yet another embodiment the co-surfactant component is a alcohol selected preferably from the group consisting of isopropanol, n-butanol, iso-butanol, iso-amyl alcohol, 2-ethyl-1-hexanol, mono & poly glycol such as diethylene glycol and tri ethylene glycol or mixtures thereof.

[0033] In yet another embodiment the coupling agent component is sulfonates (molecular weight less than 350) selected preferably from the group consisting of ligno sulfonate, petroleum sulfonate, sodium dodecyl benzene sulfonate and sodium lauryl sulphate or mixtures thereof.

[0034] In yet another embodiment the alkali component is an alkali and alkaline earth metal salt selected preferably from the group consisting of sodium carbonate, sodium hydrogen carbonate, calcium carbonate and calcium oxide or mixtures thereof.

[0035] In yet another embodiment the composition is suitable for use as soluble metal working fluid as emulsion or admixture with water in concentration range from 20 to 80 weight percent and useful for metal cutting, drilling, lathing, grinding or machining.

[0036] In yet another embodiment the process comprises the steps of; (a) tailoring the commercially available heavy alkylate, commercial heavy alkylates was fractionated by vacuum distillation, which should be done at 1 bar or 760 mm Hg vacuum and about 210° C., first 5 to 50 percent by weight cut and last 5 percent by weight cut should be left and middle cut of 55 to 90 percent by weight should be taken for formulation, (b) removing of insoluble or oxidized matter from the heavy alkylate followed by addition of emulsifier and vegetable oil to obtain the solution; (c) homogenising the result-

ant mixture at a temperature in the range of 30 to 100° C. for about one hour with stirring of force equivalent to 1300 RPM for 2 litre material; (d) adding the antioxidant, fungicide, extreme pressure additives, anti trust component, co-surfactant, coupling agent, alkali, (f) the pH of the solution was adjusted to 7-9 by addition of sodium carbonate, (e) followed by addition of water to make up the quantity about 1 kg, and homogenising the mixture for about 30 minutes and cooling the resultant metal working fluid at room temperature.

[0037] In yet another embodiment the concentration of heavy alkyl benzene component is in the range of 40 to 85 weight percent of the metalworking fluid concentrate.

[0038] In yet another embodiment the concentration of emulsifier component is in the range of 10 to 40 weight percent of the metalworking fluid concentrate.

[0039] In yet another embodiment the concentration of vegetable oil component for lubricity boost is in the range of 2 to 10 weight percent of the metalworking fluid concentrate.

[0040] In yet another embodiment the concentration of antioxidant component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

[0041] In yet another embodiment the concentration of fungicide component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

[0042] In yet another embodiment the concentration of extreme pressure additive component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

[0043] In yet another embodiment the concentration of anti-rust component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

[0044] In yet another embodiment the concentration of co-surfactant component is in the range of 1 to 10 weight percent of the metalworking fluid concentrate.

[0045] In yet another embodiment the concentration of coupling agent component is in the range of 0.5 to 10 weight percent of the metalworking fluid concentrate.

[0046] In yet another embodiment the concentration of alkali component is in the range of 0.5 to 8 weight percent of the metalworking fluid concentrate.

DETAILED DESCRIPTION

[0047] The speed and quality of machining could be greatly increased if the cutting surface is kept cool and lubricated. Modern development has led to the introduction of advanced water-oil emulsion incorporating special chemicals, which considerably improve its wettability, lubrication, high cooling power, rust inhibiting and detergency properties. These concentrates and their emulsions in water are known as 'Soluble Oil' or "soluble metalworking fluid" or "soluble cutting oil" or "metalworking fluid". It is a water based lubricants or functional fluid. They are ideal for general machining process where Cooling, Lubrication, Cleaning and extreme pressure characteristics are essential requirements. It is useful for metal cutting, drilling, lathing, grinding or machining.

[0048] There are three main components of this metalworking fluid; oil, emulsifier, and additives. The soluble metalworking fluids marketed in form of concentrates, which is converted in to milk like stable emulsion by mixing it with water before use. The performances of metalworking fluid depend upon the nature of emulsion. Soft metal (Aluminium, copper, etc) needs corrosion free diluted emulsion and hard metal (steel, iron, etc) needs thick-emulsion for better machining. Small colloidal particles of oil in water are the key for better performance. The main object of the present invention is to provide heavy alkylate based less toxic new composition of metalworking fluids particularly soluble cutting oil. This development will also provide a new application to the by-product heavy alkylate and increased the value of this by-product i.e. heavy alkyl benzene. The components of metalworking fluid/soluble cutting oil are as follows:

[0049] HEAVY ALKYL BENZENE: Heavy alkyl benzene (HAB) or heavy alkylate is produced as by-products during the preparation of linear alkyl benzene sulfonates for detergent industry. The alkylation reaction of C10-C14 olefin with benzene results in side reactions to give dialkyl benzenes and alkylated condensed ring derivatives. These products are generally in the range of 5 to 15 percent of the total alkylates depending upon the reaction conditions and purity of reactants employed. Heavy alkyl benzene mainly consists of substituted benzenes as determined by HPLC, UV, IR and RI analysis given in Table-1. The typical properties such as density, kinetic viscosity, viscosity index, refractive index, pour point, molecular weight and distillation characteristics were given in Table-2. No poly-aromatics or olefin compounds are present in the heavy alkylates. These heavy alkylates have been acquired from the Indian market.

TABLE 1

Typical Relative Content of Alkyl Benzenes and Alkyl Napthalenes

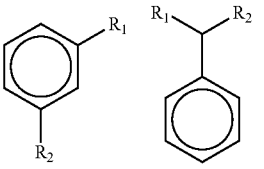
	HAB-I		HAB-II	
Components	IR	UV 254	IR	UV 254
Alkyl Benzenes % by wt.	84 ± 2	84 ± 2	93 ± 2	90 ± 2
Alkyl Napthalenes % by wt.	15 ± 2	16 ± 2	7 ± 2	10 ± 2

TABLE 2

Typical Characteristics of Heavy Alkyl Benzenes

Characteristics	HAB-I	HAB-II
Density at 15° C.	0.8839	0.8813
K. Viscosity Cst at 40° C.	28.95	26.93
K. Viscosity Cst at 100° C.	4.50	4.31
Viscosity Index	37	32
Pour Point ° C.	(−)27	(−)25
Molecular wt.	365 ± 5	361 ± 5
Distillation range ° C. (ASTM D1160)	225-440	226-515
Refractive index at 20° C.	1.4946	1.4916

[0050] The heavy alkylate have average structure of 20 to 22 carbon atoms as side alkyl chain attached to benzene ring. Structure of heavy alkyl benzene, based on analysis, is as follows:



[0051] Where the position of substitution is not fixed, R+R1=carbon atom 20, 21, or 22. It is the average. The total

carbon number of heavy alkyl benzene was calculated as A+R=6+20, 6+21 and 6+22 i.e. 26, 27 and 28.

[0052] This HAB is available as waste product or by-product at very low cost. One example of cost of HAB is $ 40 per 100 litres, which is very less in comparison to detergent grade LAB thus it is a loss to manufacturer. Converting it to metalworking fluid, which has a market rate around $ 240 per 100 litres will compensate for the loss of manufacture due to unwanted product HAB. So, conversion or utilization of HAB for metalworking fluid is a value addition to HAB. HAB has one more benefit over mineral oil that it is a less toxic product. As per information provided by M/S Gulf Farabi Petrochemical Co. Ltd, Jubail Industrial City—31961, Kingdom of Saudi Arabia, MDSD of HAB, CAS#: 84961-70-6, EINECS No.: 284-660-7, classified HAB as less toxic. As per wikipedia online: European Council Regulation (EC) 1488/94 led to it being extensively evaluated. The report concludes that there are no concerns for the environment or human health. There is no need for further testing or risk reduction measures beyond those currently practiced. LAB was therefore de-classified and was removed from Annex 1 in the 28th ATP (Directive 2001/59). Petroleum lube oil is categorized as toxic product due to presence of condensed ring. HAB component gives lubricity property to the soluble cutting oil/metalworking fluid. To replace the petroleum lube or mineral lube with heavy alkyl benzene is a beneficial step.

[0053] HAB is a non toxic product. As per OSHA-USA, HAB is not listed in hazardous chemical while mineral oil and its mist are in hazardous product list. The toxicity of mineral oil or mineral oil based cutting oil can affect the lungs of experimental animals, and certain mineral oils are carcinogenic. Petroleum oil is essentially innocuous when it comes in contact with rabbit corneas. Mineral oil mists derived from highly refined oils appear to have a low acute and sub-acute toxicity in experimental animals. The oral LD(50) is 100 mg/kg (rodent). The dermal LD(50) is 150 mg/kg (rodent). Exposure to mineral oil mists can cause eye, skin, and upper respiratory tract irritation as well as central nervous system effects in humans. In addition, certain mineral oils are carcinogenic in humans. In comparison to mineral product, HAB oral LD (50) is 15 g/kg. The toxicity of HAB sulfonate oral LD(50) is 438 mg/kg (Rat). So, HAB and HAB sulfonate are less toxic than mineral oil even highly refined mineral oil. Use of oleate with HAB will also reduce toxicity. Another benefit in utilizing HAB is value addition. Adding some vegetable oil or mono-ester from vegetable oil will be additional advantage but it will increase the cost of soluble cutting oil concentrate. Its percentage in concentrate depends on the nature of emulsifier. This component is needed to provide lubricating properties to the soluble cutting oil or emulsified metalworking fluid.

[0054] The concentration of heavy alkyl benzene component is in the range of 40 to 85 weight percent of the metalworking fluid concentrate.

[0055] EMULSIFIER: Emulsifier is to produce oil-water stable emulsion but it should not be harmful to metal surface or operators. The emulsifier component is selected from heavy alkylate sodium sulfonates, sodium carboxylate (caprylic or mix fatty acid from vegetable oils particularly from ricebran, neem, mahua, karanja, castor, linseed and jatropha), ammonium oleate, sodium oleate, triethanolamine oleate, diethanolamine oleate or Dodecyl Toluene sodium sulfonate or mixtures thereof. Oleate is fatty acid salt and its combination will be more eco-friendly. Similarly HAB sulfonate and dodecyl toluene sulfonate are less toxic than petroleum sulfonate. Emulsifier blended with the oil. It is needed in formulation to achieve stable water-HAB emulsion. Emulsifier is necessary for easy formation of HAB-water emulsion, to provide detergency, wettability and chips removal properties to the emulsion.

[0056] The concentration range of emulsifier component is 10 to 40 weight percent of the metalworking fluid concentrate.

[0057] LUBRICITY BOOSTER: Lubricity is also known as antiwear. It protects two rubbing metal surfaces from wear and tear. From the experiment it was found that lubricity of HAB is quite good but in oil state. In oil/water emulsion state the percentage of HAB becomes very low and a suitable lubricity booster is needed to provide suitable lubricity even in low concentration in emulsion form. lubricity booster component, a vegetable oil, is mixed in the metalworking fluid to improve the lubricity characteristic in the metalworking fluid. Vegetable oil is a triester/triglyceride and well known for its high lubricity. It can be considered as additive. It will further reduce the toxicity of the formulation because vegetable oil is an eco-friendly product. the vegetable oil component for lubricity booster is a karanja oil, neem oil, rice-bran oil, Mahua oil, castor oil or mixtures thereof. These are non edible oil and can used for industrial purpose.

[0058] The concentration of vegetable oil component for lubricity boost is in the range of 2 to 10 weight percent of the metalworking fluid concentrate.

[0059] ADDITIVE: the role of additives are very complex. Some time it is needed to enhance the performance as in the case of extreme pressure additive, some time it is act as reserve strength as in the case of lubricity booster, some time it act as reducer of bad effect as in the case of anti-oxidant/anti-fungal agent/etc. and these are compatible to each other and with HAB. So, synergistic combination of additive is needed, which should be compatible to HAB and its emulsion in water. There are several specialty additive combinations are available in market but its synergistic effect with HAB is not known. So, various additives are tested with HAB and its emulsion in water and some additives are found compatible with HAB and its emulsion. If this combination is available in market then there is no harm to utilize those additive packs. The recommended additive components are:

ANTIOXIDANT: at least one antioxidant/stabilizer additive is mixed in the fluid is an alkyl phenol or aromatic amine or substituted tetrazole selected from 2,6-ditertiary butyl phenol, 2,6-ditertiary p-cresol, Diphenylamine, Tertiary butyl phenol amino tetrazole and 2,6-dioctyl phenylene diamine or mixture thereof. The anti-oxidant will protect oil and other organic chemical from oxidation to loose their characteristics.

[0060] The concentration of antioxidant component is in the range of 0.005 to 0.05 weight percent of metalworking fluid concentrate.

[0061] FUNGICIDES: a fungicides, is also mixed with fluid to prevent the mould and bacterial growth in the emulsion. The fungicide component is a phenol or phenolic acid selected from o-cresol, phenol, m-cresol and cresylic acid or mixture thereof.

[0062] The concentration of fungicide component is in the range of 0.005 to 0.05 weight percent of metalworking fluid concentrate.

[0063] EXTREME PRESSURE ADDITIVE: During metalworking like cutting, rubbing, drilling, etc. the metal sur-

faces experience high load to develop cold-welding and deformation of surfaces. It deteriorates the quality of product. Extreme pressure additive prevents the cold-welding. At least one extreme pressure additive component is an organic sulphide or phosphosulfurized metal salt selected from dibenzyl disulphide, sulfurized vegetable oil, phosphosulfurized decyl oleate molybdate and phosphothio pentadecyl phenol molybdate or mixture thereof. Extreme pressure additive, is mixed with the fluid to protect cutting-tools while metalworking at high temperature and load.

[0064] The concentration of extreme pressure additive component is in the range of 0.005 to 0.05 weight percent of metalworking fluid concentrate.

[0065] ANTIRUST ADDITIVE: In the moist atmosphere of high temperature, metals are prone to rust particularly iron. To minimize rusting, antirust component is used at least one antirust additive is mixed to the fluid for preventing iron metal surface from rusting. The anti-rust component is a triazole or sulfonate selected from 1H-benzotriazole, ditertiary butylated IH-Benzotriazole, calcium petroleum sulfonate and calcium heavy alkylate sulfonate.

[0066] The concentration of anti-rust component is in between 50 to 500 mg/kg.

[0067] CO-SURFACTANT: It is for increasing the strength of emulsifier. In concentrate it is useful for solubilization of water and water soluble component in oil (HAB). In oil/water emulsion it helps in producing smaller droplets of oil in water and makes it more stable. A co-surfactant is needed to increase the stability of oil-water micro-emulsion micelles and to enhance the action of the emulsifier. The co-surfactant component is an alcohol selected from isopropanol, n-butanol, iso-butanol, iso-amyl alcohol, 2-ethyl-1-hexanol, mono & poly glycol such as diethylene glycol and tri ethylene glycol or mixture thereof.

[0068] The concentration of co-surfactant component is in the range of 1 to 10 weight percent of the metalworking fluid concentrate.

[0069] COUPLING AGENT: It is a water soluble component to help main the emulsifier by increasing its range and decreasing the cost of emulsifier. To enhance oil-water coupling or emulsification. Mixing of a coupling agent has additional advantage in formation of oil-water emulsion and act as a booster with main emulsifier. The coupling agent component is sulfonates (molecular weight less than 350) selected from ligno sulfonate, petroleum sulfonate, sodium dodecyl benzene sulfonate and sodium lauryl sulphate.

[0070] The concentration of coupling agent component is in the range of 0.5 to 10 weight percent of the metalworking fluid concentrate.

[0071] ALKALI: it is optional component and used when water hardness is higher. If the concentrate is formulated for use in soft-water (hardness below 100 mg/litre—demineralised water) then alkali is not needed. If formulation is targeted for higher hardness then alkali component is needed for emulsion stability. The quantity of alkali will depend on type of hardness and its effect on emulsifier precipitation. When by experiment the quantity of alkali requirement is fixed for one range of hardness then it will remain constant. Use of extra alkali for soft water will give solution (more transparent with pale straw color) like emulsion, which may not be acceptable to market. The pH of the fluid must be alkaline, preferably 7 to 10 for stability of the components particularly emulsifiers. So, if required, an aqueous alkali is added the alkali component is an alkali and alkaline earth metal salt selected from sodium carbonate, sodium hydrogen carbonate, calcium carbonate, calcium oxide or mixture thereof.

[0072] The concentration of alkali component is in the range of 0.5 to 8 weight percent of the metalworking fluid concentrate.

[0073] PROCESS FOR CONCENTRATE: For tailoring of the commercially available heavy alkylate, it should be fractionated by vacuum distillation, which should be done at 1 bar or 760 mm Hg vacuum and about 210° C., first 5 to 50 percent by weight cut and last 5 percent by weight cut should be left and 55 to 90 percent by weight middle cut should be taken for formulation. This is needed because lower fraction contains un-reacted paraffin and olefin impurity, which will reduce the emulsion stability. Moreover, the flash point of this fraction is very low also. It is better to separate this fraction. Higher/last 5% fraction contains polymerised, oxidized and high molecular weight compound content. During high temperature distillation or fractionation some oxidation, darkening and polymerization may takes place. So, purification of HAB is required. The methods are micro filtration, column chromatography, distillation, etc. The preferred method is to pass HAB from an absorbent column. The absorbent material can be silica-gel or clay or any other suitable absorbent. After passing from absorbent column the heavy alkyl benzene is mixed with selected emulsifier. The Emulsifier should not contain moisture/water of more than 2%. Mixing should be done at 1200 rpm stirring of lab stirrer. On larger scale equivalent force is required. The mixture is homogenized at 30 to 100° C. (preferably at 70° C. for one hour) for 30 minutes to one hour with stirring to obtain clear solution. At that temperature "Lubricity booster" should be added. Then, a coupling agent in the fluid should be added with continued stirring.

[0074] Now an additive package is added i.e. addition of mixture of antioxidant, fungicide, extreme pressure additive, antirust additive and co-surfactant are added. The mixture is further homogenized for 30 minutes. If the emulsifier has no moisture then 1 to 2% water is added to improve the strength of mixture, which is a micro-emulsion. Care should be taken to keep the quantity to a ratio of 100% and further homogenized for 30 minutes. The pH of the solution should be 8 to 9. If it is lower, then, it is adjusted to 7-9 preferable 8 to 9 by adding sodium carbonate. If pH is higher, lower it by addition of oleic acid. The solution is cooled down to room temperature with stirring. After the addition of all the components the mixture is homogenized. Then it is conditioned by keeping it at room temperature for 24 hours undisturbed. The final product is a soluble metalworking fluid concentrate or soluble cutting oil concentrate. It should be stored in a vessel. It is verified that this formulation meets the requirement of Bureau of Indian Standard (BIS) IS 1115. At the time of use the dilute emulsion of the soluble oil may be prepared by mixing the concentrate in water with vigorous agitation for 1 to 5 minutes in the ratio of 20:80 to 80:20 as per requirements of the metal work and nature of metal. For general metalworking purpose 20:80 ratio of concentrate: water will be suitable. For production of water—HAB emulsion or workable soluble cutting oil, concentrate should be shaken/stirred in water at-least for two minutes.

[0075] EMULSION PREPARATION: emulsion of the soluble cutting oil may be prepared by:

[0076] I. Mixing/stirring the concentrate fluid with 20 to 80 weight percent water to convert the fluid into emulsion.

[0077] II. Water should be soft i.e. of hardness up to 100.

[0078] III. Temperature of water should be in the range of 10 to 40° C.

[0079] IV. Stirring should be 1300 RPM for 2 litre volume or equivalent force.

[0080] V. Time should be 2 to 5 minutes.

[0081] VI. The emulsion is useful as soluble cutting oil.

[0082] It will be apparent from the foregoing that the present invention provides non-toxic lubricant component by using heavy alkyl benzene and useful for making formulation for metalworking soluble oil. This invention further provides a suitable new application for heavy alkyl benzene as a by-product to increase its value.

[0083] The invention will now be further described by the following examples, which are given only for the purpose of illustration and not intended to limit the scope of the invention.

[0084] Although the invention has been described in conjunction with examples and by reference to the embodiments thereat it is evident that many alternatives, modifications and variations will be apparent to those skilled in art in light of the foregoing description, accordingly it is intended in the invention to embrace these and all such alternatives, variations and modifications as may fall with in the spirit and scope of the appended claims.

EXAMPLE 1

[0085] TAILORING OF HEAVY ALKYLATE: 1 Kg. of commercial heavy alkylates (A), a heavy waste of detergent class linear alkyl benzene (LAB), was fractionated by vacuum distillation. The heavier cut, 0.65 Kg. (having 65 weight percent of total alkylate) was taken for base-stock preparation. The typical properties of the alkylate are:

Density at 15° C., gm/ml: 0.8805, Kinetic viscosity at 40° C., cst: 52.73, Viscosity index: 40. Refractive index at 20° C.: 1.49026, Pour point: (−)36° C., Molecular weight: 441±5, Distillation range: 415° C. above, Poly-aromatics or olefinic compounds: Negligible.

EXAMPLE 2

[0086] TAILORING OF ALKYLATE: 1 Kg. of commercial alkylates (B), waste alkyl benzene from other stream of detergent class linear alkyl benzene (LAB), was fractionated by vacuum distillation. The heavier cut, 0.6 Kg. (having 60 weight percent of total alkylate) was taken for base-stock preparation. The typical properties of the alkylate are:

Density at 15° C., gm/ml: 0.8806, Kinetic viscosity at 40° C., cst: 50.11, Viscosity index: 55, Refractive index at 20° C.: 1.49106, Pour point: (−)33° C., Molecular weight: 428±5, Distillation range: 400° C. above, Poly-aromatics or olefinic compounds: Negligible

EXAMPLE 3

[0087] TAILORING OF HEAVY ALKYLATE: 1 Kg. of commercial heavy alkylates (C), a heavy waste fraction of detergent class linear alkyl benzene (LAB) from other stream, was fractionated by vacuum distillation. The heavier cut 0.7 Kg (having 70 weight percent of total alkylate) was taken for base-stock preparation. The typical properties of the alkylate are:

Density at 15° C., gm/ml: 0.8807, Kinetic viscosity at 40° C., cst: 48.32, Viscosity index: 46, Refractive index at 20° C.: 1.49028, Pour point: (−)30° C., Molecular weight: 441±5, Distillation range: 395° C. above, Poly-aromatics or olefinic compounds: Negligible

EXAMPLE 4

Preparation of Base Oil (A)

[0088] Tailored heavy alkylate of example-1 was passed through silica gel column to remove oxidized product or treated with absorbent clay such as fuller's earth by mixing and thoroughly stirred for 50 minutes at 80° C. and filtering it through G-4 sintered glass funnel. The typical physico-chemical characteristics of the heavy alkylate are:

Kinetic viscosity at 40° C., cst: 55, Viscosity index: 143, Oxidation Stability, IP 48/97: Pass (increase in viscosity 0.9%), Pour point: (−)24° C., RoBOT test 95° C.: 250 minutes, Flash point: 158° C.: Acid number, mg KOH: 0.005, Poly-aromatics or olefinic compounds: Negligible

EXAMPLE 5

Preparation of Base Oil (B)

[0089] Tailored alkylate from example-2 was passed through silica gel column to remove oxidized product or treated with absorbent clay such as fuller's earth by mixing and thoroughly stirred for 50 minutes at 80° C. and filtering it through G-4 sintered glass funnel. The typical physico-chemical characteristics of the base oil are:

Kinetic viscosity at 40° C., cst: 52, Viscosity index: 120, Oxidation Stability, IP 48/97: Pass (increase in viscosity 0.78%), Pour point: (−)27° C., RoBOT test 95° C.: 210 minutes, Flash point: 155° C., Acid number, mg KOH: 0.005, Poly-aromatics or olefinic compounds: Negligible

EXAMPLE 6

Preparation of Base Oil (C)

[0090] Tailored alkylate from example-3 was passed through silica gel column to remove oxidized product or treated with absorbent clay such as fuller's earth by mixing and thoroughly stirred for 50 minutes at 80° C. and filtering it through G-4 sintered glass funnel. The typical physico-chemical characteristics of the blended base oil are:

Kinetic viscosity at 40° C., cst: 53, Viscosity index: 131, Oxidation Stability, IP 48/97: Pass (increase in viscosity 0.9%), Pour point: (−)24° C., RoBOT test 95° C.: 220 minutes, Flash point: 156° C., Acid number, mg KOH: 0.005, Poly-aromatics or olefinic compounds: Negligible

EXAMPLE 7

Preparation of Metalworking Concentrate (A1)

[0091] The base oil (A) 65 grams (in 65 weight percent) was mixed with heavy alkyl benzene sodium sulfonate 21 gram (in 21 weight percent) and karanj oil 5 grains (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent in concentration of 1 gram (in 1.0 weight percent of the fluid), 2,6, dietriary butyl 4 methyl phenol 0.05 gram (0.05 weight %) as antioxidant, phenol 0.05 grain (0.05 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum

salt of phosphosulfurized decyl oleate 40 weight %) in 0.05 grams (0.05 weight %) as extreme pressure additive, 1H-benzotriazole 0.05 gram (0.05 weight %) as antirust additive and iso-butanol grams (5.0 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 2.7 grams (2.7 weight percent) of water was added during mixing as solubilization promoter and the fluid further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.1 gram (0.1 weight percent). The solution was cooled down to room temperature with stirring.

EXAMPLE 8

Preparation of Metalworking Concentrate (A2)

[0092] The base oil (A), 60 grams (in 60 weight percent) was mixed with sodium oleate 24 grams (in 24 weight percent) and neem oil 8.36 grams (8.36 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then sodium dodecyl benzene sulfonate as coupling agent 1.0 gram (in concentration of 1.0 weight percent of the fluid), 2,6, ditertiary butyl phenol 0.006 gram (0.006 weight %) as antioxidant, cresylic acid 0.005 grain (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.025 gram (0.025 weight %) as extreme pressure additive, ditertiary butylated 1H-benzotriazole 0.004 gram (0.004 weight %) as antirust additive and isobutanol 5.5 grams (5.5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.0 grams (3.0 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.1 gram (0.1 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 9

Preparation of Metalworking Concentrate (A3)

[0093] The base oil (A) in 65 grams (65 weight percent) was mixed with dodecyl toluene sodium sulfonate in 20 grams (20 weight percent) and ricebran oil 1.78 grams (1.78 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then lauryl sulfonate as coupling agent in concentration of 5 grams (5 weight percent of the fluid), 2,6, ditertiary p-cresol 0.005 grams (0.005 weight %) as antioxidant, cresylic acid 0.005 gram (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.005 gram (0.005 weight %) as extreme pressure additive, calcium petroleum sulfonate 0.005 gram (0.005 weight %) as antirust additive and (iso amyl alcohol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 2.7 grams (2.7 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding calcium oxide 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 10

Preparation of Metalworking Concentrate (A4)

[0094] The base oil (A), 51 gram (in 51 weight percent) was mixed with sodium salt of fatty acid from ricebran oil (carboxylate) 30 grams (in 30 weight percent) and castor oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then sodium petroleum sulfonate (molecular weight 400-430) as coupling agent in concentration of 5.417 grams (5.417 weight percent of the fluid concentrate), diphenyl amine 0.048 grams (0.048 weight %) as antioxidant, o-cresol 0.005 grams (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized pentadecyl phenol 40 weight %) 0.025 grams (0.025 weight %) as extreme pressure additive, calcium heavy alkyl benzene sulfonate 0.005 gram (0.005 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) in 5 grams (5 weight percent of the metalworking fluid) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3 grams (3.0 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.5 grain (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 11

Preparation of Metalworking Concentrate (A5)

[0095] The base oil (A), 50 gram (in 50 weight percent) was mixed with sodium salt of fatty acid from neem oil (carboxylate) 31.16 grams (in 31.16 weight percent) and karanja oil 5 gram (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent 5 gram (in concentration of 5 weight percent of the fluid), ditertiary butyl phenol amino tetrazole 0.013 gram (0.013 weight %) as antioxidant, phenol 0.005 gram (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.009 gram (0.009 weight %) as extreme pressure additive, ditertiary butyl 1H-benzotriazole 0.013 gram (0.013 weight %) as antirust additive and (isobutanol+ethylene glycol 50/50 by weight) 5 grains (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.3 grams (3.3 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding calcium carbonate 0.5 grain (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 12

Preparation of Concentrate (B1)

[0096] The base oil (B) 62 grams (in 62 weight percent) was mixed with heavy alkyl benzene sodium sulfonate in 20 grams (20 weight percent) and neem oil 5 grams (5 weight

percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then sodium dodecyl benzene sulfonate as coupling agent in concentration of 5 grams (5 weight percent of the fluid), 2,6, dioctyl phenylene diamine 0.005 gram (0.005 weight %) as antioxidant, cresylic acid 0.005 gram (0.005 weight %) as fungicide, dibenzyl disulfide 0.005 gram (0.005 weight %) as extreme pressure additive, 1H-benzotriazole 0.005 gram (0.005 weight %) as antirust additive and (iso butanol+isopropyl alcohol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 2.5 grams (2.5 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.48 gram (0.48 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 13

Preparation of Metalworking Concentrate (B2)

[0097] The base oil (B) 63 grams (in 63 weight percent) was mixed with heavy alkyl benzene sodium sulfonate 21 grams (in 21 weight percent) and ricebran oil 2 gram (2 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then (ligno sulfonate+sodium dodecyl benzene sulfonate 50/50 by weight) as coupling agent 5.5 grams (in concentration of 5.5 weight percent of the fluid), 2,6, ditertiary butyl 4 methyl phenol 0.043 gram (0.043 weight %) as antioxidant, m-cresol 0.003 gram (0.003 weight %) as fungicide, Molybdenum salt of phosphosulfurized decyl oleate 0.045 gram (0.045 weight %) as extreme pressure additive, ditertiary butyl 1H-benzotriazole 0.009 gram (0.009 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 2.9 grains (2.9 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 14

Preparation of Metalworking Concentrate (B3)

[0098] The base oil (B) 52 grains (in 52 weight percent) was mixed with triethanolamine oleate in 30 grams (30 weight percent) and acetylated castor oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then (ligno sulfonate+sodium dodecyl benzene sulfonate 50/50 by weight) as coupling agent in concentration of 5 grams (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.028 grams (0.028 weight %) as antioxidant, cresylic acid 0.01 gram (0.01 weight %) as fungicide, Molybdenum salt of phosphosulfurized pentadecyl phenol 0.027 gram (0.027 weight %) as extreme pressure additive, 1H-benzotriazole 0.025 gram (0.025 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grain (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 2.41 grams (2.41 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The of the solution was adjusted to 7-9 by adding calcium oxide 0.5 grain (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 15

Preparation of Metalworking Concentrate (B4)

[0099] The base oil (B) 50 grams (in 50 weight percent) was mixed with diethanolamine oleate 31 grams (in 31 weight percent) and neem oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent in concentration of 5 grams (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.028 gram (0.028 weight %) as antioxidant, o-cresol 0.018 gram (0.018 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphothio pentadecyl phenol 40 weight %) 0.027 gram (0.027 weight %) as extreme pressure additive, ditertiary butyl 1H-benzotriazole 0.027 gram (0.027 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 grams (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding calcium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 16

Preparation of Metalworking Concentrate (B5)

[0100] The base oil (B) 54 grams (in 54 weight percent) was mixed with sodium salt of fatty acid from karanj oil (carboxylate) 27.9 grams (in 27.9 weight percent) and neem oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then lauryl sulfonate as coupling agent in concentration of 5 grams (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.035 grams (0.035 weight %) as antioxidant, cresylic acid 0.005 grams (0.005 weight %) as fungicide, dibenzyl disulfide 0.035 gram (0.035 weight %) as extreme pressure additive, 1H-benzotriazole 0.025 gram (0.025 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 grams (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 17

Preparation of metalworking concentrate (C1)

[0101] The base oil (C) 51 grams (in 51 weight percent) was mixed with sodium oleate 30 grams (in 30 weight percent)

and neem oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent in concentration of 5 grams (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.035 gram (0.035 weight %) as antioxidant, (cresylic acid+phenol 50/50 by weight) 0.005 gram (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.035 gram (0.035 weight %) as extreme pressure additive, ditertiary butyl 1H-benzotriazole 0.025 gram (0.025 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 grams (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding calcium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 18

Preparation of Metalworking Concentrate (C2)

[0102] The base oil (C) 54 grams (in 54 weight percent) was mixed with mixed emulsifier (heavy alkyl benzene sodium sulfonate 50 weight %+sodium oleate 50 weight %) 27 grams (in 27 weight percent) and karanja oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent 5 grams (in concentration of 5 weight percent) of the fluid, (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.035 grain (0.035 weight %) as antioxidant, o-cresol 0.005 grain (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.025 gram (0.025 weight %) as extreme pressure additive, 1H-benzotriazole 0.035 grain (0.035 weight %) as antirust additive and (iso butanol+ethylene glycol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 grams (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 19

Preparation of Metalworking Concentrate (C3)

[0103] The base oil (C) 52 grams (in 52 weight percent) was mixed with sodium salt of acetylated fatty acid from castor oil (carboxylate) 29 grams (in 29 weight percent) and neem oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then sodium dodecyl benzene sulfonate as coupling agent in concentration of 5 gram (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.025 gram (0.025 weight %) as antioxidant, phenol 0.005 gram (0.005 weight %) as fungicide, dibenzyl disulfide 0.035 gram (0.035 weight %) as extreme pressure additive, ditertiary butyl 1H-benzotriazole 0.035 gram (0.035 weight %) as antirust additive and (iso butanol+ethylene glycol 50150 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 gram (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding calcium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 20

Preparation of Metalworking Concentrate (C4)

[0104] The base oil (C) 59 grams (in 59 weight percent) was mixed with mixed emulsifier (heavy alkyl benzene sodium sulfonate in 33 weight %+sodium oleate in 33 weight %+triethanolamine oleate in 34 weight %) 22 grams (in 22 weight percent) and karanja oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate as coupling agent in concentration of 5 grams (5 weight percent) of the fluid, (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.035 grams (0.035 weight %) as antioxidant, m-cresol 0.005 gram (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized decyl oleate 40 weight %) 0.025 gram (0.025 weight %) as extreme pressure additive, (1H-benzotriazole+calcium heavy alkylbenzene sulfonate 50/50 by weight) 0.035 gram (0.035 weight %) as antirust additive and (diethylene glycol+ethylhexanol 50/50 by weight) 5 grams (in 5 weight percent of the metalworking fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 gram (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium carbonate 0.5 gram (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 21

Preparation of Metalworking Concentrate (C5)

[0105] The base oil (C) 53 grams (in 53 weight percent) was mixed with mixed emulsifier sodium salt of fatty acid from (karanj oil 50 weight %+ricebran oil 50 weight %) (carboxylate) 28 grams (in 28 weight percent) and ricebran oil 5 grams (5 weight percent of metalworking fluid concentrate) as component for lubricity. The mixture was homogenized at 30 to 100° C. for one hour with stirring to obtain clear solution. Then ligno sulfonate in concentration of 5 gram (5 weight percent of the fluid), (2,6, ditertiary butyl 4 methyl phenol+diphenyl amine 50/50 by weight) 0.035 gram (0.035 weight %) as antioxidant, cresylic acid 0.005 gram (0.005 weight %) as fungicide, (dibenzyl disulfide 30 weight %+Sulfurized neem oil 30 weight %+Molybdenum salt of phosphosulfurized pentadecyl phenol 40 weight %) 0.025 grain (0.025 weight %) as extreme pressure additive, 1H-benzotriazole 0.035 grain (0.035 weight %) as antirust additive and diethylene glycol 5 grams (in 5 weight percent of the metalworking

fluid concentrate) as co-surfactant were added. The mixture was further homogenized for 30 minutes. 3.4 grams (3.4 weight percent) of water was added during mixing as solubilization promoter and further homogenized for 30 minutes. The pH of the solution was adjusted to 7-9 by adding sodium hydrogen carbonate 0.5 grain (0.5 weight %). The solution was cooled down to room temperature with stirring.

EXAMPLE 22

Preparation of Soluble Cutting Oil (Metalworking Fluid) Emulsion

[0106] The soluble oil concentrate then mixed with water in various ratio and shaken to produce oil-water emulsion. This emulsion was evaluated for its different characteristics. There are thousands of results out of which results of only three samples are given here. The soluble oil concentrate A1, B1 and C1 are diluted in water of harness 400 mg/litre. 10 grams of soluble oil concentrate was mixed with 90 ml of water and stirred for 2 minutes according to standard method. It was found that the characteristics of the concentrate and emulsion are at par with the specifications.

EXAMPLE 23

[0107]

TYPICAL CHARACTERISTICS OF SOLUBLE OIL

SN	Formulation	K. Viscosity 40° C. - Cst	Total Acid No- mg KOH	Ash %	WSD on HFRR	Clarity	Flash Point-° C.	Reactable Sulphur at 100° C.
1	A-I	23.3	NIL	0.009	0.368	Clear	210	NIL
2	B-I	26.2	NIL	0.008	0.473	Clear	215	NIL
3	C-I	24.5	NIL	0.006	0.396	Clear	213	NIL

TYPICAL EVALUATION OF SOLUBLE OIL

SN	Formulation	Copper corrosion	Deposit test	Emulsion stability	Cast iron rust Test	Saponification value - mg KOH	Low temp Stability	Frothing Test
1	A-I	<1	NIL	Pass	Pass	4.8	Pass	Pass
2	B-I	<1	NIL	Pass	Pass	4.5	Pass	Pass
3	C-I	<1	NIL	Pass	Pass	4.6	Pass	Pass

We claim:

1. A process for metalworking fluid from a heavy alkylate, concentrate composition comprising;

(a) heavy alkylate having C20 to C22 alkyl carbon atoms on benzene ring, to replace mineral oil, in the concentration range of 40 to 85 weight percent of the metal working fluid concentrate,

(b) at least one sulfonate or oleate emulsifier in the range of 10 to 40 weight percent of the metalworking fluid concentrate,

(c) a synergetic combination of additives, (c1) at least one vegetable oil lubricity booster component in the concentration range of 2-10 percent of metal working fluid concentrate, (c2) an alkyl phenol or aromatic amine antioxidant component is in the concentration range of 50-500 mg/kg, (c3) a phenol fungicide component in the concentration range of 50-500 mg/kg, (c4) an organic sulfide or phosphosulfurized metal salt extreme pressure additive component in the concentration range of 50-500 mg/kg in the metal working fluid concentrate, (c5) a triazole or sulfonate antirust component in the concentration range of 50-500 mg/kg in the metal working fluid concentrate, (c6) an alcohol co-surfactant component in the range of 1-10 weight percent of metal working fluid concentrate, (c7) a sulfonate coupling agent in the range of 0.5 to 10 weight percent of metal working fluid concentrate, (c8) alkali or alkaline earth metal salt component in the range of 8-10 weight percent of metal working fluid concentrate, (d) said process comprises the steps of tailoring the heavy alkylate, removing of insoluble matter from the heavy alkylate followed by addition of emulsifier and vegetable oil to obtain the mixture; homogenising the resultant mixture at a temperature in the range of 30 to 100 degree Celsius; for about one hour with stirring; adding the antioxidant, fungicide, extreme pressure additives, anti trust component, co-surfactant, coupling agent, alkali, followed by addition of water to make up the quantity about 1 kg; homogenizing the mixture for about 30 minutes, adjusting the pH to 7-9 by addition of sodium carbonate; and cooling the resultant metal working fluid at room temperature, wherein the composition is suitable for use as soluble metalworking fluid as admixture or emulsion with water in concentration range from 20 to 80 weight percent.

2. The composition as claimed in claim **1**, wherein the heavy Alkylate is a non-toxic lube oil component having heavy alkyl benzene of C20-C22 alkyl carbon atom, a heavy fraction by-product separated from detergent class alkyl benzene during manufacture, wherein the Heavy alkyl benzene consists of a mixture of substituted benzenes, wherein the Benzene is substituted with alkyl chain wherein the Alkyl chains are straight-chain paraffin or branch-chain paraffin, and average of C20-C22 alkyl carbon atom, at single or two places of benzene ring, and no poly-aromatics or olefin compounds are present in the heavy alkylates.

3. The composition as claimed in claim **1**, wherein the emulsifier is selected from the group consisting of heavy alkylate sodium sulfonates, sodium carboxylate, sodium oleate, triethanolamine oleate, diethanolamine oleate or dodecyl toluene sodium sulfonate or mixtures thereof.

4. The composition as claimed in claim **1**, wherein the lubricity booster is a vegetable oil selected from the group consisting of karanja oil, neem oil, rice-bran oil, castor oil or mixtures thereof.

5. The composition as claimed in claim **1**, wherein the antioxidant component is selected from the group consisting of an alkyl phenol, aromatic amine, substituted tetrazole selected from 2,6-ditertiary butyl phenol, 2,6-ditertiary p-cresol, diphenylamine, Tertiary butyl phenol amino tetrazole and 2,6-dioctyl phenylene diamine or mixtures thereof.

6. The composition as claimed in claim **1**, wherein the fungicide component is a phenol or phenolic acid selected from the group consisting of o-cresol, phenol, m-cresol and cresylic acid or mixtures thereof.

7. The composition as claimed in claim **1**, wherein the extreme pressure additive component is an organic sulphide or phosphosulfurized metal salt selected from the group consisting of dibenzyl disulphide, sulfurized vegetable oil, phosphosulfurized decyl oleate molybdate and phosphothio pentadecyl phenol molybdate or mixtures thereof.

8. The composition as claimed in claim **1**, wherein the anti-rust component is a triazole or sulfonate selected from the group consisting of 1H-benzotriazole, ditertiary butylated 1H-Benzotriazole, calcium petroleum sulfonate and calcium heavy alkylate sulfonate or mixtures thereof.

9. The composition as claimed in claim **1**, wherein the co-surfactant component is a alcohol selected from the group consisting of isopropanol, n-butanol, iso-butanol, iso-amyl alcohol, 2-ethyl-1-hexanol, mono & poly glycol such as diethylene glycol and tri ethylene glycol or mixtures thereof.

10. The composition as claimed in claim **1**, wherein the coupling agent component is sulfonates (molecular weight less than 350) selected from the group consisting of ligno sulfonate, petroleum sulfonate, sodium dodecyl benzene sulfonate and sodium lauryl sulphate or mixtures thereof.

11. The composition as claimed in claim **1**, wherein the alkali component is an alkali and alkaline earth metal salt selected from the group consisting of sodium carbonate, sodium hydrogen carbonate, calcium carbonate and calcium oxide or mixtures thereof.

12. The composition as claimed in claim **1**, wherein the composition is suitable for use as soluble metal working fluid as emulsion or admixture with water in concentration range from 20 to 80 weight percent and useful for metal cutting, drilling, lathing, grinding or machining.

13. Process for metalworking fluid from heavy alkylate, concentrate as claimed in claim **1**, said process comprises the steps of;

(a) tailoring the commercially available heavy alkylate, commercial heavy alkylates was fractionated by vacuum distillation, which should be done at 1 bar or 760 mm Hg vacuum and about 210° C., first 5 to 50 percent by weight cut and last 5 percent by weight cut should be left and middle cut of 55 to 90 percent by weight should be taken for formulation,

(b) removing of insoluble or oxidized matter from the heavy alkylate followed by addition of emulsifier and vegetable oil to obtain the solution;

(c) homogenising the resultant mixture at a temperature in the range of 30 to 100° C. for about one hour with stirring of force equivalent to 1300 RPM for 2 litre material;

(d) adding the antioxidant, fungicide, extreme pressure additives, anti trust component, co-surfactant, coupling agent, alkali;

(f) adjusting the pH of the solution to 7-9 by addition of sodium carbonate; and

(e) followed by addition of water to make up the quantity about 1 kg, and homogenising the mixture for about 30 minutes and cooling the resultant metal working fluid at room temperature.

14. The process as claimed in claim **13**, wherein the concentration of heavy alkyl benzene component is in the range of 40 to 85 weight percent of the metalworking fluid concentrate.

15. The process as claimed in claim **13**, wherein the concentration of emulsifier component is in the range of 10 to 40 weight percent of the metalworking fluid concentrate.

16. The process as claimed in claim **13**, wherein the concentration of vegetable oil component for lubricity boost is in the range of 2 to 10 weight percent of the metalworking fluid concentrate.

17. The process as claimed in claim **13**, wherein the concentration of antioxidant component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

18. The process as claimed in claim **13**, wherein the concentration of fungicide component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

19. The process as claimed in claim **13**, wherein the concentration of extreme pressure additive component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

20. The process as claimed in claim **13**, wherein the concentration of anti-rust component is in the range of 50 to 500 mg/kg of the metalworking fluid concentrate.

21. The process as claimed in claim **13**, wherein the concentration of co-surfactant component is in the range of 1 to 10 weight percent of the metalworking fluid concentrate.

22. The process as claimed in claim **13**, wherein the concentration of coupling agent component is in the range of 0.5 to 10 weight percent of the metalworking fluid concentrate.

23. The process as claimed in claim **13**, wherein the concentration of alkali component is in the range of 0.5 to 8 weight percent of the metalworking fluid concentrate.

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