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(54) **Titre :** UTILISATION D'UNE COMPOSITION DE FAIBLES PROPRIETES CORROSIVES
(54) **Title:** THE USE OF A COMPOSITION WITH LOW CORROSIVE PROPERTIES

(57) **Abrégé/Abstract:**

The invention relates the use of a composition with low corrosive effect and low freezing point. The composition is prepared by mixing an ammonium cation source with a carboxyl anion source in an appropriate molar or weight ratio, either without a medium or by using an appropriate medium for obtaining liquid or water-soluble organic ammonium carboxylate of formula (1): $[NR^1R^2R^3R^4]+n\ [R^5(COO)_n]^{-n}$, (1), in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1-6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1-6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1-6 carbon atoms and n is an integral 1-6 and thereafter adding possible solvent and at the same time keeping alkali or alkali-earth metal content of the composition in a range of 0.001-30 wt-%, preferably in a range of 0.001-30 wt-% and most preferably in a range of 0.001- 1.0 wt-% and halide content in a range of 0.001-1 wt-% most preferably in a range of 0.001-0.1 wt-%.

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(54) Title: THE USE OF A COMPOSITION WITH LOW CORROSIVE PROPERTIES

(57) Abstract: The invention relates the use of a composition with low corrosive effect and low freezing point. The composition is prepared by mixing an ammonium cation source with a carboxyl anion source in an appropriate molar or weight ratio, either without a medium or by using an appropriate medium for obtaining liquid or water-soluble organic ammonium carboxylate of formula (1): $[NR^1R^2R^3R^4]+n\ [R^5(COO)_n]^{-n}$, (1), in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1-6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1-6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1-6 carbon atoms and n is an integral 1-6 and thereafter adding possible solvent and at the same time keeping alkali or alkali-earth metal content of the composition in a range of 0.001-30 wt-%, preferably in a range of 0.001-30 wt-% and most preferably in a range of 0.001- 1.0 wt-% and halide content in a range of 0.001-1 wt-% most preferably in a range of 0.001-0.1 wt-%.

The use of a composition with low corrosive properties

FIELD OF INVENTION

The invention relates to use according to claim 1.

The invention relates to the use of freezing point depressant compositions which are especially adapted for applications where the biodegradation and low BOD, anti-corrosion and non-scaling as well as biostatic properties are highly required for fluids. These used freezing point depressant compositions are fluids or solutions, which are prepared by mixing solvent to said fluids. Preferably the present invention relates to the use of environmentally benign freezing point depressant compositions for deicing surfaces and for preventing ice formation (anti-icing) on surfaces or within the compositions itself.

BACKGROUND OF INVENTION

Freezing point depressant compositions are used widespreadly for variety of purposes, especially for lowering the freezing point of an aqueous system so that ice cannot be formed on surfaces or within the aqueous systems or for melting ice formed in those aqueous systems.

The effectiveness of the freezing point depressant compositions depends on the molar freezing point lowering effect, the number of ionic species that are made available and to the degree to which the compositions can be dispersed in the liquid phase. Water is the most common liquid phase in which the formation of ice is to be precluded or ice to be melted. Most freezing point depressant compositions are either based on salts such as sodium chloride or potassium formate or alcohols such as glycols and methanol.

Oil based hydraulic and heat transfer fluids have negative environment impact and they also form a favorable growth environment for microbes, from which there results formation of precipitates, and corrosion. The mineral and vegetable oils (bio oils) as well as biodegradable and non-toxic propylene glycol based fluids have the disadvantage that their viscosities increase to detrimentally high values at low temperatures e.g. for the most hydraulic and heat transfer oils the typical operating temperature is only -10 °C. Both ethylene and propylene glycol can operate at lower temperatures, even down to -30 °C, but especially in case of propylene glycol the pumping costs increase remarkably because of the poor heat and power transfer properties. The viscosity of hydraulic and metal cutting fluids should be within range of 10–50 mPas or even higher. The viscosity should not be too low. If the viscosity is very low, for example in order of 1 mPas, simple o-ring seals have to be abandoned in hydraulic equipment and other more expensive options must be used. The low viscosity of metal cutting fluid will cause weakening of the metal surface quality in case of metal cutting. Bio oils and mineral oils are very sensitive to moisture (typically maximum ca. 0.1 wt-%) and high temperatures. Oils are not water soluble, thus water containing acidic and corrosive compounds from oil will concentrate at the bottom of equipment and cause extremely corrosive environment. Separate phases of oil and water will cause pumping problems also. High temperatures will cause danger for fire.

Alkali and alkali-earth metal salts of carboxylic acid such as potassium formate, sodium formate, potassium acetate and sodium acetate have found increasing use in the area of heat transfer and power transfer (hydraulic) and deicing mainly due to their low environment impact and low viscosity at minus temperatures. When using these formate and acetate based alkali and alkali-earth metal salts as heat transfer fluids, they can operate even at -40℃ without noticeable increase in the pumping costs. Corrosion is the drawback of these fluids. High electrical conductivity, over 200 mS/cm, and the tendency to form precipitates are the main reasons for the increased corrosion. Besides corrosion, the alkali and alkali-earth metal salts of carboxylic acid are prone to salting out and precipitate formation. Salt crystals formed at the cleavage of the pumps, on the inner surfaces of the nozzles may cause the whole heat transfer, hydraulic system or NO_X catalyst system to collapse. Pumps start leaking or the nozzles simply clog and thus the fluid cannot pass through. And, the corrosion underneath the crystal precipitates is very severe.

The deicing and anti-icing fluids and these fluid containing compositions, which are used in the airports, have been traditionally formulated from ethylene glycol, propylene glycol, and urea. Ethylene glycols are toxic and thus require expensive treatment and disposal. More safer fluid such as propylene glycol and urea biodegrade too rapidly imposing excess oxygen demand on the environment or the sewage treatment plant. As a consequence, airports were forced to switch to deicers such as compositions comprising fluids based on potassium formate and potassium acetate to reduce biological and chemical oxygen demand. However, a number of airports and air line companies have reported severe corrosion problems with these compositions. Catalytic oxidation (corrosion) of aircraft carbon-carbon composite brakes resulting from potassium formate and potassium acetate has become a major safety issue. Existing literature data has demonstrated that potassium, sodium, and calcium cations are responsible for the catalytic oxidation of carbon, not the formate or acetate anion itself. Furthermore, because potassium formate and potassium acetate have high electrical conductivities and they are prone to salting out i.e. to the salt precipitation over the metal surfaces they have detrimental corrosion effects on electrical connections within the air plane e.g. in the metal plates such as cadmium plated landing gear parts. In 2005 when, when one European airport switched from products based on urea and ethylene glycol to potassium formate based products, corrosion of zinc coated steel occurred on flight structures, as well as on maintenance and ground operation vehicles [ACRP Synthesis, Impact of Airport Pavement Deicing Products on Aircraft and Airfield Infrastructure, 7.1.2009, ISSN 1935-9187, ISBN 978-0-309-09799-4, 2008 Transportation Research Board].

Moreover, the synergistic generation of residue when aircraft anti-icing composition or fluid based on glycols is splattered with potassium formate or acetate runaway deicing fluid presents serious concerns about residue gel hydration and refreezing in flight and has produced potential dangerous rough residues on leading edge surfaces on aircraft. This can negatively affect in-flight handling of the aircraft if deposits occur on or near control surfaces or linkages. Initial research has shown that the thickener used in the aircraft deicer fluids will separate due to the contact with potassium formate or potassium acetate based runaway deicing fluids. [Hille, J., “Deicing and Anti-icing Fluid Residues,” Boeing Aero Magazine, 1st quarter, 2007, pp. 15-21].

In spite of the environmental advantages over the formulae such as urea and glycols, alkali-metal-salt based runaway deicer compositions such as compositions based on potassium formate and potassium acetate present potential problems both in deicing airplanes or airfield infrastructures and also in using to heat transfer as well.

Heat storage chemicals are typically based on hydrated fluoride-, chloride-, sulfate-, and nitrate salts or salt combination. These salts are quite harmful to environment and corrosive especially to light metals such as aluminum and magnesium used in modern auto industry or heat storage plants (e.g. solar heating and electrical heating on low tariff hours) that are areas that can benefits from non corrosive heat storage chemicals.

Other prior art freezing point depressants, such as ethanol and methanol, have toxic effects and high volatility. They are also a cause of offensive smell and fire danger.

US patent 6,835,323 discloses an alkali metal, an alkaline-earth metal salt or an ammonium salt of formic acid for the device which hydrostatically transmit power.

US patent 7,201,982 relates to a method for cooling an electrical system comprising circulating in a cooling system of the electrical system a mixture comprising a heat transfer fluid and one or more carboxylic acid salts thereof. The carboxylic aid is C_5-C_{18} mono or di-carboxylic acid. The carboxylic acid salt (0.001 to 10 wt-%) is dissolved in a water soluble liquid alcohol freezing point depressant such as glycol (90 to 99 wt-%).

US patent 7,306,750 describes the application of one or a mixture of anhydrous salts, selected from the group consisting of the alkali metal salts, alkali-earth metals salts, amine salts and ammonium salts of C_3-C_{18} mono or di-carboxylic acid for storing the thermal energy where in the temperature range of the thermal energy source is 20 to 180°C.

WO patent 2005/042662 discloses the process for producing a deicing/anti-icing fluid that produces monoalkyl esters of long chain fatty acids. The stream includes water, glycerol, and an alkali containing compounds.

US patent 2003/0015685 discloses low corrosive potassium acetate deicing and anti-icing compositions based on the use of C_3-C_{16} aliphatic monobasic acid or the alkali metal, ammonium or amine salt of monobasic acid as a corrosion inhibitor.

US patent 7,452,480 relates to carboxylate salts of amines that are used as components of heat exchange fluids. Fluid contains amine carboxylates, preferably triethanolamine formate from 15 to 80 wt-%, and potassium formate up to 50 wt-%.

It would be represent a notable advance in the state of art if one could develop a freezing point depressant which is environmentally benign, but in spite of that biostatic also, non-corrosive and practically immune to salting out and to precipitate formation.

The ideal freezing point depressant composition for airfield pavement deicing, aircraft deicing and anti-icing, heat storage and heat transfer, metal cutting, NOx removal and hydraulic fluid use:

- should be free of corrosive halides such as chlorides,
- should be free of alkali and alkali-earth metals such as potassium, sodium and calcium,
- should not form precipitates on metal surfaces,
- should have low toxicity,
- should have relatively low biological (BOD) and chemical oxygen demand (COD),
- should have reduced electrical conductivity, preferably below 200 mS/cm, most preferably below 100 mS/cm,
- should be inexpensive to obtain,
- and naturally should be effective at low temperatures, i.e. it should have low viscosity and low freezing point, as well as high specific heat capacity and thermal conductivity.

GENERAL DESCRIPTION OF THE INVENTION

The present inventors have surprisingly found that a liquid or water-soluble organic ammonium carboxylate having the formula (1):

$$[NR^1R^2R^3R^4]^+_n\ [R^5(COO)_n]^{-n}, \qquad (1),$$

in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1–6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1–6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1–6 carbon atoms and n is an integral 1-6 and the viscosity of 0.1– 10,000 Mpas, electrical conductivity in a range of 1.0–200 mPas preferably 1.0 -100 mPas are ideal freezing point depressant compositions which can be used for deicing or anti-icing with low corrosive properties.

Organic ammonium carboxylate stands for a salt or a complex formed of an ammonium cation and a carboxylic anion. Hence one or more ammonium ions of the salt or complex may be primary (RNH_3^+), secondary ($R_2NH_2^+$), tertiary (R_3NH^+) or quaternary (R_4N^+). The carboxylate ion of the salt or complex may be monovalent ($RCOO^-$) or polyvalent ($R(COO^-)_{n>1}$), and in that case it may also comprise unneutralised carboxyl groups (-COOH). In the latter case, R^5 is defined as being substituted with carboxyl.

Group R^5 in formula (1) is preferably hydrogen, substituted alkyl containing 1–6 carbon atoms or unsubstituted alkyl containing 1–6 carbon atoms, more advantageously hydrogen, and substituted alkyl containing 14 carbon atoms or unsubstituted alkyl containing 1-4 carbon atoms. The terms "substituted" and "unsubstituted" refer basically to groups containing heteroatoms. Preferable these groups contain as a heteroatom oxygen or nitrogen (e.g. -OH, $-NH_2$, -COOH).

Since the group R^5 is associated with a carboxylate group, the ammonium carboxylate of formula (1) is preferably based on a lower organic carboxylic acid and it can be prepared from such an acid or its salt. Lower organic acids include lower fatty acids such as formic acid, acetic acid, propionic acid, n- and i-butyric acid, and n- and i-pentanic acid. Useful acids also include benzoic acid and oxycarboxylic acids such as glycolic acid and lactic acid. Lower dicarboxylic acids such as oxalic acid, malonic acid, succinic acid and glutaric acid are also applicable.

Group R^5 of formula (1) is most advantageously hydrogen, methyl or ethyl. In formula (1), n is preferably 1 or 2, most advantageously 1. Consequently, the most advantageous organic ammonium carboxylate used in the method of the invention is based on lower fatty acids.

As mentioned above, the ammonium ion of formula (1) may be primary (RNH_3^+), secondary ($R_2NH_2^+$), tertiary (R_3NH^+) or quaternary (R_4N^+), and then R is typically a substituted or unsubstituted alkyl containing 1–6 carbon atoms. Typical ammonium ions containing unsubstituted alkyls have been formed from water-soluble amines such as methylamine (g), dimethylamine, trimethylamine, ethylamine, diethylamine, etc.

Ammonium ions containing substituted alkyls have typically been formed from water-soluble amines, whose alkyl(s) have been substituted with one or more hydroxyl groups. In formula (1), R_1 is preferably hydrogen and R_2 and R_3 have preferably been selected from the group comprising hydrogen and C_1-C_6-alkyls substituted with a hydroxyl group, preferably from the group comprising hydrogen and C_1-C_4-alkyls substituted with a hydroxyl group. R_4 is preferably a C_1-C_6-alkyl substituted with a hydroxyl group, most advantageously a C_1-C_4-alkyl substituted with a hydroxyl group.

Organic ammonium carboxylates formed of lower alkanolamines are hence particularly useful. Among lower alkanolamines we may cite monoethanolamine, diethanolamine, triethanolamine, monoisopropanolamine, di-isopropanolamine, tri-isopropanolamine, mono-sek-butanolamine, di-sek-butanolamine and tri-sek-butanolamine.

One important group of useful alkanolamines comprises lower alkyl alkanolamines, such as methyl ethanolamine, dimethylethanolamine, diethylethanolamine, butylethanolamine, methyldiethanolamine and ethyldiethanolamine. Additional information about useful alkanolamines can be found in the book Kirk-Othmer, Encyclopedia of Chemical Technology 3rd Ed., Vol. 1, p. 944, which is incorporated in this disclosure.

It is particularly recommendable that R_1 is hydrogen, R_2 and R_3 are selected from the group comprising of hydrogen and ethyl substituted with a hydroxyl group, preferably from the group comprising of hydrogen and 2-hydroxy ethyl, and R_4 is ethyl substituted with a hydroxyl group, preferably 2-hydroxy ethyl. Consequently, the ammonium carboxylate in accordance with the invention is preferably based on ordinary mono, di or triethanolamine.

In the most advantageous embodiment, the organic ammonium carboxylate of formula (I) is selected from the group comprising of a salt or a complex of formic acid and/or lactic acid and monoethanolamine and/or triethanolamine preferably in the weight ratio 80:20–20:80.

In the practice, ammonium carboxylate of formula (1) is prepared e.g. by mixing an ammonium cation source and a carboxyl anion source in the desired molar ratio, either without a medium or by using an appropriate solvent such as water as a medium. When the starting materials are an amine and an acid, they are simply mixed during gentle heating, if necessary. When the starting materials consist of salts, they are typically dissolved separately in water, and then the solutions are combined. If a salt or a complex thus formed is hydrophobic, it will separate from the water phase as an unctuous or paste-like deposit or a wax-like precipitate, and it can be separated from the water phase by any known methods. When both the starting materials and the formed product are hydrophobic, the preparation can be carried out in an organic solvent instead of water. The freezing point depressant composition used in the invention comprises either fluid composing of ammonium carboxylate of formula (1) without solvent or ammonium carboxylate of formula (1) with appropriate solvent. Preferably solvent is an aqueous solution or a dispersion. Chemical stability: Preliminary results indicate that for instance a fluid pair: ethylene amide – formic acid could under special circumstances react and form amid when no solvent is present. Increasing the temperature favours amid formation. Nearly no esters are formed.

The organic ammonium carboxylates of formula (1) as well as compositions and fluids obtained from these carboxylates protect wood material against micro-organisms. We refer here for PCT FI20006-00007 for Granula ltd, where we have demonstrated efficiency of ammonium carboxylates of formula (I) against micro-organisms including several fungi.

The composition with low corrosive effect and low freezing point is prepared by mixing an ammonium cation source with a carboxyl anion source in an appropriate molar or weight ratio, either without a medium or by using an appropriate medium for obtaining liquid or water-soluble organic ammonium carboxylate of formula (1):

$$[NR^1R^2R^3R^4]^+_n\,[R^5(COO)_n]^{-n}, \qquad (1),$$

in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1–6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1–6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1–6 carbon atoms and n is an integral 1–6 and thereafter adding possible solvent and at the same time keeping alkali or alkali-earth metal content of the composition in a range of 0.001–30 wt-%, preferably in a range of 0.001–30 wt-% and most preferably in a range of 0.001–1.0 wt-% and halide content in a range of 0.001–1 wt-% most preferably in a range of 0.001–0.1 wt-%.

The used compositions have low freezing point, low corrosivity, high bacterial resistance and they are environmentally benign and safe to use.

The used freezing point depressant compositions are typically in the form of an aqueous solution or dispersion containing 0.5–100% by weight of the ammonium carboxylate of formula (1), more advantageously 5–70% by weight.

The fluid solutions in water could possess many of the desired properties. For example no ready made emulsions would be needed.

The freezing point depressant composition containing ammonium carboxylate of formula (1) either without a medium or by using an appropriate solvent together with auxiliary substances and possible compatible carboxylates are selected so, that the composition:

- has a low freezing point themselves and will also lower freezing point of an aqueous system in intended application,

- may include alkali or alkali-earth metals in amount of 0.001–30 wt-%, preferably 0.001–30 wt-% and most preferably 0.001–1.0 wt-% and

- may include halides in amount of 0.001–1 wt-% most preferably 0.001–0.1 wt-% and further

- compositions for deicing or anti-icing applications should have viscosity of 0.1–10,000 mpas and electrical conductivity of 1.0–100 mS/cm,

- compositions for heat transfer applications should have viscosity of 0.1–500 Mpas and electrical conductivity of 1.0–100 mS/cm,

- compositions which are used as hydraulic fluids should have viscosity of 5.0–10,000 Mpas and electrical conductivity of 1.0–100 mS/cm.

- grease-like compositions should have viscosity of 100–50,000 Mpas and electrical conductivity of 0.05–100 mS/cm (for example metal cutting fluids).

Because metal corrosion is an electrochemical process, fluids of high conductivity may facilitate corrosion more than low conductivity fluids, and they can have additional detrimental effects on electrical connections within the light fixtures themselves. All compositions used in the invention have a low electrical conductivity (under 200 mS/cm preferably under 100 mS/cm) which lowers their corrosive influence. The low electrical conductivity (below 100 mS/cm) and the lack of halides, alkali and alkali-earth metals makes the fluid non corrosive and immune to precipitate formation. To further facilitative anti-corrosive properties of the composition comprising fluid according to formula (I) and possible solvent, it may be advantageous to strip oxygen from composition by flowing gas (for example nitrogen) through the liquid composition.

Preferably compositions do not contain environmentally questionable chemicals such as oils and are safe to handle also.

The freezing point depressant composition intended for deicing or anti-icing applications, contains preferably 40–60% by weight of ammonium carboxylate of formula (1), most preferably 45–55% by weight. When using a composition for these applications the good properties would be anti freezing, appropriate heat capacity and heat transfer properties, environmental friendliness, anti microbial activity, anti corrosion activity, low evaporation, etc. Some amid formation in the fluid formulation could be an advantage. Compared with other products no solid crystals are formed (here we refer for instance fluid ethylene amine – formic acid presented in table 2 below) no corrosion of carbon fibre brakes, environmental friendliness, economical and good properties against many micro-organisms (see above). One advantageous method of using composition targeted for de-icing surfaces is to heat compositions prior use. Compositions can be heated by using conventional liquid-heating-techniques or by pressing the composition through a microwave nozzle. A suitable composition for this kind of use may be the fluid according to formula I mixed with solvent comprising 1,3-propane diol. One important anti icing application is the prevention of ice formation onto an aircraft wings and onto an airstrip. Specially for anti icing of aircraft wings the composition should have suitable viscosity and surface tension. Viscosity should on the one hand be so high that it will prevent removal of composition from wings and on the other hand the surface tension should be such, that there is no bubble-formation from composition. One can vary the viscosity and surface tension of the freezing point depressant composition considerably, as can be seen example from tables 1 -4, by using different quantities of solvent and by choosing appropriate fluid.

Present heat transfer fluids are complex emulsions of special oils, water, corrosion inhibitors, amides, emulsifiers, anti microbial additives etc. There are many problems due to microbial contamination, evaporation of organics, stability etc. These problems can be solved with the The freezing point depressant composition according to formula (I) which is intended for heat transfer applications. The freezing point depressant composition intended for heat transfer applications contains preferably 5–70% by weight of ammonium carboxylate of formula (1), most preferably 20–40% by weight. From a good heat transfer fluid one requires following properties: a good heat capacity and heat transfer ability, lubrication, environmental friendliness, anti microbial activity, anti corrosiveness activity, low evaporation, etc. Some amid formation in the fluid formulation could also be of advantage. As stated above the compositions targeted to heat transfer applications have low electrical conductivity, 0–100 mS/cm and they contains low level of halides and alkali or alkali-earth metals and therefore their corrosive influence are slight. These compositions fulfills also other requirements for a good heat transfer fluid, for example as to anti microbial activity (see discussion above). Heat capacities for fluids and diluted fluid solutions were found to be high enough for using these compositions as heat transfer fluids. When compared to other common heat transfer fluids one big advantage of using compositions according to invention is, that no solid crystals will be formed.

One special use as a heat transfer fluid of a composition according to formula (1), is the use in connection with heat producing processes, for cooling and transferring heat of a reaction arousen inside a reactor. This kind of use may be, for example, the use as a primary heat transfer fluid which circulates around a reactor where endo- or exothermic chemical reaction or a cold fusion takes place (=the primary heat transfer circulation). The cold fusion reactor may be such as described in WO2009/125444. The fluid in primary heat transfer circulation is usually in direct contact with chemical or cold fusion reactor or at least functionally contacted thereof. The composition according to formula (1) may also be used as a secondary heat transfer fluid which cools the primary heat transfer fluid (=the secondary heat transfer circulation). The secondary heat transfer circulation is usually only functionally contacted with the primary heat transfer circulation, for example via one or more metal layers. By using the compositions according to formula (1) in a primary or secondary heat transfer circulation for transferring heat away from a chemical or cold fusion reactor, one can enlarge the potential operation temperature of a heat transfer fluid. The heat can be transferred in a temperature of range -40..+150 °C. Since the composition of formula (1) has a lowered freezing point this will additionally prevent harmful freezing of heat a transfer fluid during down times of a reactor. When used to cool or to transfer heat away from a metal reactor where a cold fusion process takes place, one can use the liquid or water-soluble organic ammonium carboxylate of the formula (1) in combination with an appropriate radiation capturing substance. For this reason 0.1 -10 wt-% boric containing substance (boric acid, sodium tetraborate etc) or 1 -50 wt-% heavy water can be added into the ammonium carboxylate of formula (1) when the latter is used as a primary heat transfer fluid in connection with a reactor wherein a cold fusion process takes place. When ammonium carboxylate of formula (1) is used in a primary or secondary circulation of chemical or cold fusion reactor for cooling mentioned reactor it can be a homogenous liquid or a heterogeneous dispersion. The heterogeneous dispersion may include solid particles which may also be nano-sized particles.

The freezing point depressant composition to be used as a hydraulic fluid or metal cutting fluid contains preferably 5–70% by weight of ammonium carboxylate of formula (1), most preferably 20–70% by weight.

The freezing point depressant composition used in the invention as a grease preferably contains 70–100% by weight of ammonium carboxylate of formula (1), most preferably 80–100% by weight.

The freezing point depressant composition can be used as a freezing point additive for the urea and water or urea, water and ammonium formate based NO_x –removal-compositions. In this use the composition preferably contains 0.5–50 % by weight of ammonium carboxylate of formula (1), more preferably 1–10 % by weight and most preferably 1-5 % by weight. of ammonium carboxylate of formula (1).

No_x-removal compositions are used in diesel engines which can be found in ships, automobiles, and gas turbines. When these compositions are used in diesel engines of automobiles they are usually injected on a catalyst where No_x-removal process takes place.

A suitable general composition to be used for No_x-removal consists of at least following components (A):

-urea or urea and water (known components)

-a composition according to formula (1) and possibly

-a supply of ammonium ions.

An alternative general No_x-removal composition may be include at least the following components (B):

-an lower carboxylic acid adduct of urea (mono- or dicarboxylic acid adduct) and a supply of ammonium cation of formula $[NR^1R^2R^3R^4]^+_n$. Wherein R_1, R_2, R_3 and R_4 have the same meaning as in formula (1) above and

-a possible supply of ammonium ions.

The function of additional ammonium ion supply in general compositions (A) and (B) is to adjust pH and to remove NO_x.

Preferably the amount of NH_4-equivalents in Nox-removal compositions is the same as NH_4- moieties which 32,5 wt-% aqueous urea solution contains. For this reason the compositions (A) and (B) preferably contains 0.5–50 % by weight of ammonium carboxylate of formula (1).

Some preferable Nox-compositions contain at least following components:

(1)

-urea or urea in water

-monoethanolamine + ammonium acetate or ammonium formiate or monoethanolamine and acetic acid or formic acid

-an ammonium supply for example NH_3 or NH_3 in water

the mono- or dicarboxylic acid salt of urea is preferably a lower carboxylic acid salt of urea and even more preferable mono- or diacetate or mono- or diformiate of urea.

(2)

-monoethanolamine + lower organic acid adduct of urea

-an ammonium supply, for example NH_3 or NH_3 in water

Lower organic acid adduct of urea can be lower mono- or dicarboxylic acid adduct of urea, for example mono- or diacetate of urea or mono- or diformiate of urea.

(3)

-lower organic acid adduct of urea

-a possible ammonium supply.

Lower organic acid adduct of urea can be lower mono- or dicarboxylic acid adduct of urea, for example mono- or diacetate of urea or mono- or diformiate of urea.

With the No_x-removal composition according to invention the NO_X-removal can be optimized in a combustion process.

The freezing point depressant composition is compatible with alkali metal, an alkali- earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or carboxylates of urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof and we include in the invention the combinations of the ammonium carboxylate of formula (1) with alkali metal, an alkaline earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof carboxylates. By using freezing point depressant composition with urea for de-icing or anti icing applications one can lower oxygen demand on the environment or at the sewage treatment plant.

The freezing point depressant compositions containing ammonium carboxylate of formula (1) may contain auxiliary substances as well. Typical auxiliary substances comprise such as additional corrosion inhibitors, biocides, coloring agents, surfactants, and viscosity intensifiers.

Fluids prepared according to the method of the invention can also be substitutes for glycol ethers. Glycol ethers are a group of solvents based on alkyl ethers of ethylene glycol. Glycol ethers are commonly used in paints. These solvents typically have high boiling point, together with the favourable solvent properties of lower molecular weight ethers. Glycol ethers can be also derived of diethylene glycol. Acetates of glycols are a similar kind of potent solvents. Overexposure to glycol ethers can cause anemia (a shortage of red blood cells), intoxication similar to the effects of alcohol, and irritation of the eyes, nose, or skin. In laboratory animals, low-level exposure to certain glycol ethers can cause birth defects and can damage a male's sperm and testicles. By binding glycol ethers, fluids according to invention can be used in many application which require freezing point depression and at the same time also binding hazardous glycol ethers from environment.

One important aspect of the freezing point depressant composition is its reuse. The reuse of freezing point depressant composition is possible especially when recovered from targets where this composition has been used as anti-icing or de-icing fluid or solution for melting ice away or preventing ice formation. This kind of application is for example anti-icing of wings, but also from other applications freezing point depressant can be recovered either in pure form or with some additional material such as dirt (for example when de-icing or anti-icing of an airstrip). By purifying and reprocessing composition it can be reused in number of applications. Also without purifying the composition may be reused if it is collected as substantially pure or if the reuse target is such, that it do not require using pure composition. Exemplary applications are; as in additive for metal cutting or oil drilling fluids (0.5 -30 wt-% if the oil drilling fluid is an alkali or an alkali-earth metal formiate or Ce-formiate), for controlling dust (that is dust binding, evaporation preventing, hygroscopicity control), re-icing of ice tracks, esterification or etherification of material for energy production. One important application is to reuse freezing point depressant compositions for wood treatment; for this application we refer our PCT FI20006-00007 for Granula.

DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

The invention is described below in greater details with the help of examples. Person skilled in the art will recognize that the properties of the compositions studied are such that they will make ideal freezing point depressant fluid for application such as airfield pavement deicing, aircraft deicing and anti-icing, heat storage and heat transfer, metal cutting, NO_x removal and hydraulic fluid uses.

In the following non-restricting examples we have presented some specific applications and properties of compositions (fluids and diluted solutions) as well as method(s) for preparation of these compositions (products). These examples are in no way intended to limit the compositions or their use.

Example 1

A deicing and an anti-icing fluid were prepared by mixing 1 mole of formic acid (99%) with 1 mole of monoethanolamine (99%). Distilled water was added to the fluid mixture in order to made 60% by weight solution in water.

The freezing point of the solution was below -20°C, the electrical conductivity of the fluid was 61 mS/cm at 26°C, and pH of the fluid was 7.55 (measured directly from the solution).

Example 2

A heat transfer fluid was prepared by mixing 1 mole of formic acid (99%) with 1 mole of monoethanolamine (99%). Distilled water was added to the fluid mixture in order to made 40% by weight solution in water.

The freezing point of the solution was below -20°C, the Brookfield DV-I viscosity (20 rpm) was 10 mPas at -20°C, 10 mPas at -10°C, 10 mPas at 0°C, and Bohlin VOR viscosity (shear rate 23.1 1/s) was 4 mPas at 10°C, 3 mPas at 20°C, 2 mPas at 40°C, and 1.5 mPas at 60°C. The electrical conductivity of the fluid was 65 mS/cm at 26°C, and pH of the fluid was 7.54 (measured directly from the solution).

Example 3

A hydraulic fluid was prepared by mixing 1 mole of acetic acid (99%) with 1 mole of monoethanolamine (99%). Distilled water was added to the fluid mixture in order to made 60% by weight solution in water.

The freezing point of the solution was below -20°C, the Brookfield DV-I viscosity (20 rpm) was 80 mPas at -20°C, 60 mPas at -10°C, 40 mPas at 0°C, and Bohlin VOR viscosity (shear rate 23.1 1/s) was 23 mPas at 10°C, 15 mPas at 20°C, 8 mPas at 40°C, and 5 mPas at 60°C. The electrical conductivity of the fluid was 25.9 mS/cm at 26°C, and pH of the fluid was 7.34 (measured directly from the solution).

Example 4

A metal cutting fluid was prepared by mixing 1 mole of lactic acid (99%) with 1 mole of monoethanolamine (99%). Distilled water was added to the fluid mixture in order to made 90% by weight solution in water.

The freezing point of the solution was below -20°C, the Brookfield DV-I viscosity (20 rpm) was 4000 mPas at -20°C, 2050 mPas at -10°C, 1970 mPas at 0°C, and Bohlin VOR viscosity (shear rate 23.1 1/s) was 511 mPas at 10°C, 250 mPas at 20°C, 73 mPas at 40°C, and 30 mPas at 60°C. The electrical conductivity of the fluid was 2.31 mS/cm at 23°C, and pH of the solution was 8.6 (measured directly from the solution).

Example 5

A metal cutting fluid concentrate (= fluid without water) could substantially reduce the logistic costs. Interest is specially in fluids which include the ethanolamine and lactic acid. Contact angle between formulate and metal should be further decreased. This can be made with a small addition of surfactant. From these metal cutting fluid is an example a highly effective grease product (e.g. for the surface protection at low temperatures) which is an example of the product or products of the invention has the following composition and properties.

A metal cutting fluid as a grease was prepared by mixing 1 mole of lactic acid (99%) with 1 mole of triethanolamine (99%). No distilled water was added to the mixture.

The grease was not frozen and clear (no crystals or precipitates) at -20°C, the Brookfield DV-I viscosity (20 rpm) was over 20,000 mPas at -20°C, over 20,000 mPas at -10°C, 24,300 mPas at 0°C, and Bohlin VOR viscosity (shear rate 23.1 1/s) was 10,760 mPas at 10°C, 3955 mPas at 20°C, 736 mPas at 40°C, and 240 mPas at 60°C. The electrical conductivity of the grease was 0.207 mS/cm at 25°C, and pH of the fluid was 7.33 (measured directly from the solution).

Fluids and solutions in examples 6–23 have been made in the same way as presented in examples 1–5, that is, by mixing 1 mole of an ammonium cation source and 1 mole of a carboxyl anion source (unless otherwise shown) together for obtaining a concentrated fluid and then adding distilled water to the concentrated fluid, for obtaining diluted solutions.

Table 1

In table 1 has been shown formation of possible precipitates from fluids and diluted solutions obtained from fluids. Temperature was 20–25 ℃.

Code/ex	fluid Wt-% from solution fluid	100	90	80	60	40	20	5	pH of 2% solution
EAE /6	ethanolamine / acetic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	6.8
EAMa /7	ethanolamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	
EAM /8	ethanolamine / formic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	3.7
EAP/ 9	ethanolamine / propionic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	7.1
EAOx/ 10	ethanolamine / oxalic acid	White hard powder		30% clear *	30% clear	30% clear	Clear	Clear	8.2
EAF/11	ethanolamine / H_3PO_4 (85%)	White powder		70% dissolved	Clear, dissolved				9.2
EAGLIC -A/12	ethanolamine / glycolic acid								
EAGLIC -B/13	ethanolamine / glycolic acid**								
EAGNIC -A/14	ethanolamine / glyconic acid								
EAGNIC -B/15	ethanolamine / glyconic acid**								

EDAE/16	ethylenediamine / acetic acid	Hard presicipate	Hard presicipate	Clear	Clear	Clear	Clear	Clear	7.8
EDA-Ma/17	ethylenediamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	6.5
EDAM/18	ethylenediamine / formic acid	Presicipate	Presicipate	Clear	Clear	Clear	Clear	Clear	6.1
EDAP/19	ethylenediamine / propionic acid	Hard, crystalline	not done	Precisipate	Clear	Clear	Clear	Clear	8.1
TEAE/20	triethanolamine / acetic acid	Clear	slight turbidity	slight turbidity	slight turbidity	slight turbidity	slight turbidity	slight turbidity	6.33
TEA-Ma/21	triathanolamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear	7.2
TEAM/22	triethanolamine / formic acid	Hard, crystalline	slight turbidity	slight turbidity	slight turbidity	slight turbidity	slight turbidity	slight turbidity	6.2
TEAP/23	triethanolamine / propionic acid	Clear	Clear	Clear	slight turbidity	slight turbidity	slight turbidity	slight turbidity	6.6

* some crystallines after 1 month storage

** mixing 1 mole of cation source and 2 mole of anion source for obtaining concentrated fluid

Table 2

The fluid and solution samples from examples 6–23 were subjected to chilling to a temperature of +4 °C and then to further cooling to a temperature of -20 °C. In these temperatures the possible turbidity, precisipation of these samples was observed.

ex	Temperature +4 C	100	90	80	60	40	20	5
6	ethanolamine / acetic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
7	ethanolamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
8	ethanolamine / formic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
9	ethanolamine / propionic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
10	ethanolamine / oxalic acid			as 30% solution precipitate			Clear	Clear
11	ethanolamine / H3PO4 85%							
12	ethanolamine / glycolic acid							
13	ethanolamine / glycolic acid **							
14	ethanolamine / glyconic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
15	ethanolamine / glyconic acid**	Clear	Clear	Clear	Clear	Clear	Clear	Clear
16	ethylenediamine / acetic acid	*********	1/1 precipitate	½ precipitate	Clear	Clear	Clear	Clear
17	ethylenediamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear

18	ethylenediamine / formic acid	*********	precipitate	Clear	Clear	Clear	Clear	Clear
19	ethylenediamine / propionic acid	*********	********	*******	precipitate	Clear	Clear	Clear
20	triethanolamine / acetic acid	1/1 precipitate	Clear	Clear	Clear	Clear	Clear	Clear
21	triathanolamine / lactic acid	Clear	Clear	Clear	Clear	Clear	Clear	Clear
22	triethanolamine / formic acid	*********	Hard	Clear	Clear	Clear	Clear	Clear
23	triethanolamine / propionic acid	Clear	Clear	Clear	turbidity	turbidity	turbidity	turbidity

ex	Temperature -20 °C	100	90	80	60	40	20	5
6	ethanolamine / acetic acid	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	frozen	frozen
7	ethanolamine / lactic acid	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ iquid state	frozen	frozen	frozen
8	ethanolamine / formic acid	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	frozen	frozen	frozen
9	ethanolamine / propionic acid	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	frozen	frozen
10	ethanolamine / oxalic acid							
11	ethanolamine / H3PO4 85%							
12	ethanolamine / glycolic acid							
13	ethanolamine / glycolic acid**							

14	ethanolamine / glyconic acid	Clear/ liquid		frozen not hard				
15	ethanolamine / glyconic acid**	almost frozen		frozen hard				
16	ethylenediamine / acetic acid							
17	ethylenediamine / lactic acid	Clear/ liquid state				frozen	frozen	frozen
18	ethylenediamine / formic acid	*******	Precipitate	Clear/ liquid state		frozen	frozen	frozen
19	ethylenediamine / propionic acid	*******	********	********	precipitate	frozen	frozen	frozen
						30% frozen	frozen	frozen
20	triethanolamine / acetic acid	Hard	Hard	Clear/liquid	Clear/liquid state	frozen	frozen	frozen
21	triathanolamine / lactic acid	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	Clear/ liquid state	frozen	frozen	frozen
22	triethanolamine / formic acid	********	Hard	Clear/ liquid state	Clear/ liquid state	frozen	frozen	frozen
23	triethanolamine / propionic acid	specific crystals	Hard	Liquid state	Liquid	frozen	frozen	frozen

** 1 mole of cation source and 2 mole of anion source

Table 3

In table 3 is shown electrical conductivity, surface tension and pH of fluid and solution samples for fluids and solutions of examples 6–23.

	diluted with water wt-% fluid from solution	**100**	**90**	**80**	**60**	**40**	**20**	**5**	
Fluid									pH 2%-solution
ethanolamine / acetic acid	Electrical conductivity mS/cm	0.534	2.24	7.1	25.9	46.9	47.8	20.2	6.8
	T °C	25.4	25.9	26	25.6	25.4	25.1	24.9	
	pH	8.0	7.8	7.7	7.3	7.1	6.9	6.8	
	surface tension dyn/cm	52.0	56.0			52.0		65.0	
ethanolamine / lactic acid	Electrical conductivity mS/cm	0.541	2.31	5.91	17.8	29.7	28.5	11.69	7.6
	T °C	22.7	22.5	22.4	22.2	22.1	22.1	22	
	pH	8.8	8.6	8.6	8.6	8.6	8.7	8.7	
surface tension	dyn/cm	56.0	58.0	59.0	59.0	57.0	51.0	60.1	
ethanolamine / formic acid	Electrical conductivity mS/cm	15.9	27.3	40.4	61	65	46.9	16	3.7
	T °C	26.1	25.9	25.8	25.6	25.5	25.5	25.8	
	pH	4.0	3.9	3.8	3.6	3.5	3.4	3.5	
surface tension	dyn/cm	67.0	69.0	68.0	64.0	51.0	48.0	56.0	
ethanolamine / propionic acid	Electrical conductivity mS/cm	0.378	1.98	5.42	18.4	33.4	35.6	15.9	7.1
	T °C	24.3	23.9	23.9	23.5	23.4	23.2	23.2	
	pH	8.4	8.2	8.0	7.7	7.4	7.2	7.1	
surface tension	dyn/cm	hardened	43.0		51.0		56.0	55.1	

ethanolamine / oxalic acid	Electrical conductivity mS/cm					30% 69.8	63.6	22.5	8.2
	T ℃					24.5	25	25	
	pH					8.5	8.5	8.2	
surface tension	dyn/cm								
ethanolamine / H3PO4 85%	Electrical conductivity mS/cm								8.2
	T ℃								
	pH								
surface tension	dyn/cm								
ethanolamine / glycolic acid	Electrical conductivity mS/cm								
	T ℃								
	pH	9.9							
ethanolamine / glycolic acid**	Electrical conductivity mS/cm								
	T ℃								
	pH	4.7	4.5	4.4					
ethanolamine / glyconic acid	Electrical conductivity mS/cm								
	T ℃								
	pH	10.3	10.3	10.3					
ethanolamine / glyconic acid**	Electrical conductivity mS/cm								
	T ℃								
	pH	8.7	8.5	8.6					
ethylenediamine / acetic acid	Electrical conductivity mS/cm	HARD	2.84	5.66	15.6	25.2	23.8	9.61	7.8
	T ℃		26.9	26.8	26.6	26.6	26.2	26.2	
	pH		8.5	8.4	8.2	8.2	8.1	8.0	
surface tension	dyn/cm	crystalline	crystalline	crystalline	58.0	43.0		48.0	

ethylenediamine / lactic acid	Electrical conductivity mS/cm	0.218	1.246	4.77	19.9	37.3	38	16	6.5
	T ℃	25.1	25.7	24.7	24.7	24.4	24.2	24.2	
	pH	8.0	7.9	7.7	7.5	7.4	7.3	7.0	
surface tension	dyn/cm	60.0		62.0			58.0	61.0	
ethylenediamine / formic acid	Electrical conductivity mS/cm	solid *	18.6	30.4	50.3	55.9	40.7	13.7	6.1
	T ℃		23	22.8	22.7	22.6	22.5	22.5	
	pH	7.2	7.0	6.9	6.6	6.5	6.4	6.2	
surface tension	dyn/cm			57.0	52.0		65.0	47.0	
ethylenediamine / propionic acid	Electrical conductivity mS/cm	solid	ei lam.	5.15	11.9	19.1	19.1	8.53	8.1
	T ℃			25.8	25.8	25.6	25.5	25.8	
	pH			8.5	8.3	8.2	8.1	8.1	
surface tension	dyn/cm	crystalline	crystalline	crystalline	crystalline	46.0	49.0	45.0	
triethanolamine / acetic acid	Electrical conductivity mS/cm	0.158	0.935	5.45	12.08	23.7	24.6	10.36	6.33
	T ℃	26.5	26.1	25.9	25.8	25.6	25.7	25.5	
	pH	6.9	6.8	6.7	6.6	6.6	6.5	6.5	
surface tension	dyn/cm	47.0		36.0			34.0	45.0	
triathanolamine / lactic acid	Electrical conductivity mS/cm	0.207	0.934	3.46	10.16	17.4	17.1	6.73	7.2
	T ℃	25.1	25.2	24.8	25	24.9	24.9	214.8	
	pH	7.3	7.2	7.2	7.2	7.2	7.2	7.2	
surface tension	dyn/cm								
triethanolamine / formic acid	Electrical conductivity mS/cm	Hard, crystalline	2.54	7.05	31.5	40.7	36.4	14.2	6.2
	T ℃		24.7	24.6	24.5	24.7	24.5	24.5	
	pH		6.2	6.2	6.2	6.0	6.2	6.0	

surface tension	dyn/cm							
triethanolamine / propionic acid	Electrical conductivity mS/cm	0.24	0.868	2.25	6.52	17.6	19.4	8.53
	T °C	24.7	24.6	24.6	24.5	24.4	24.3	24.3
	pH	7.2	7.2	7.0	6.8	6.7	6.6	6.6
surface tension	dyn/cm	42.0		40.0			35.0	

* liquide state
+60°C

** 1 mole of cation source and 2 mole of anion source

As can be seen from tables 1–3 fluids and diluted solutions down to 60 wt-% were almost all solutions in liquid state in -20 °C and thus have lowered freezing point compared to distilled water. These fluids and solutions have also low electrical conductivity (01–65 mS/cm). As can be seen from table 2 these fluids and diluted solutions thereof are nor prone for precipitating. Since the electrical conductivity is low for compositions according to examples 1–23 and they are not prone to precipitate these compositions will not cause a corrosive environment.

Table 4

In table 4 has been given results from viscosity measurements compositions of examples 6–23. Viscosity was measured with Bohlin method (bold numbers) at shear rate 23.1 1/s and with Brookfield method (normal numbers) at shear rate 20 rpm. Additionally electrical conductivity, ph and redox potential was measured for these compositions comprising fluids and solutions prepared from these fluids by adding distilled water.

monoethanolamine / acetic acid water	fluid Wt-% from solution water wt-%	100 0	90 10	80 20	60 40	40 60	20 80	5 95
	°C	**VISCO-SITY mPas**			***Bohlin VOR viscosity*** Brookfield DV-I viscosity		***shear rate 23.1 1/s*** 20 rpm sp3	
viscosity mPas /	-20 (repeat)	>20000	>20000	12450	170	35	X	X
	-20	>20000	16740	1700	80	20	X	X
	-10	>20000	5150	700	60	15	10	5
	0	27850	2160	330	40	10	10	5
	10	***15250***	***1152***	***210***	***23***	***6***	***2***	***1.7***
	20	***5665***	***556***	***118***	***15***	***5***	***2***	***1.3***
	40	***1220***	***154***	***41***	***8***	***3***	***1.5***	***1.1***
	60	***345***	***63***	***20***	***5***	***2***	***1***	***0.7***
conductivity mS /cm		0.534	2.24	7.1	25.9	46.9	47.8	20.2
T °C		25.4	25.9	26	25.6	25.4	25.1	24.9
pH °C 22		7.96	7.81	7.68	7.34	7.07	6.87	6.79
REDOX		+31	+54	+69	+107	+146	+179	+216

Composition: monoethanolamine / formic acid	fluid Wt-% from solution	100	90	80	60	40	20	5
water	water wt-%	0	10	20	40	60	80	95
	pale oily light liquid							
	°C	**VISCO-SITY mPas**			***Bohlin VOR viscosity*** Brookfield DV-I viscosity		***shear rate 23.1 1/s*** 20 rpm sp3	
viscosity mPas /	-30							
	-20	4350	680	230	30	10	X	X
	-10	2830	410	130	20	10	5	X
	0	1335	240	75	15	10	5	5
	10	***646***	***123***	***41***	***9***	***4***	***2***	***1.5***
	20	***325***	***72***	***26***	***6***	***3***	***1.7***	***1.2***
	40	***119***	***31***	***13***	***4***	***2***	***1.2***	***0.95***
	60	***47***	***17***	***7***	***3***	***1.5***	***1.1***	***0.9***
conductivity mS /cm		15.9	27.3	40.4	61	65	46.9	16
T °C		26.1	25.9	25.8	25.6	25.5	25.5	25.8
pH / 22°C		7.75	7.67	7.6	7.55	7.54	7.53	7.51
REDOX potential		-321	-244	-164	-110	-75	-48	+4

Composition:								
monoethanolamine / lactic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	**VISCOSITY mPas**			***Bohlin VOR viscosity*** Brookfield DV-I viscosity		***shear rate 23.1 1/s*** 20 rpm sp3	
viscosity mPas /	-30							
	-20	>20000	4000					
	-10	24000	2050					
	0	15600	1970	470	60	20	12	
	10	***4675***	***511***	***126***	***18.8***	***5.5***	***2.5***	***1.7***
	20	***1930***	***250***	***67***	***12.5***	***4***	***2***	***1.3***
	40	***420***	***73***	***25***	***7.1***	***2.4***	***1.4***	***1***
	60	***150***	***30***	***13***	***3.5***	***1.6***	***0.8***	***0.8***
conductivity mS /cm		0.541	2.31	5.91	17.8	29.7	28.5	11.69
T °C		22.7	22.5	22.4	22.2	22.1	22.1	22
pH °C 22		8.75	8.6	8.59	8.59	8.56	8.65	8.66
REDOX		-31	-20	+9	+33	+50	+70	+103

Composition:								
Monoethanolamine / propionic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
solid wax-like/crystalline								
	°C	**EAP1-7 VISCOSITY mPas**			***Bohlin VOR viscosity*** Brookfield DV-I viscosity		***shear rate 23.1 1/s*** 20 rpm sp3	
viscosity mPas /	-30							
	-20	>200000	15200	2600	190	60	X	X
	-10							
	0							
	10	***6675***	***660***	***163***	***24***	***7***	***3***	***1.6***
	20	***2880***	***334***	***92***	***16***	***5***	***2.2***	***1.1***
	40	***725***	***108***	***37***	***8***	***3***	***1.4***	***0.9***
	60	***260***	***46***	***19***	***5***	***2***	***1.1***	***0.7***
conductivity mS /cm		0.378	1.98	5.42	18.4	33.4	35.6	15.9
T °C		24.3	23.9	23.9	23.5	23.4	23.2	23.2
pH °C 24		8.38	8.18	8.02	7.69	7.43	7.23	7.09
REDOX		hard	-21	-1	+50	+96	+128	+175

Composition:								
Monoethanolamine / glycolic acid		**100**	**90**	**80**	**60**	**40**	**20**	**5**
water		**0**	**10**	**20**	**40**	**60**	**80**	**95**
light yellow clear liquid								
	℃	**VISCO-SITY mPas**			**Bohlin VOR viscosity** Brookfield DV-I viscosity		**shear rate 23.1 1/s**	
viscosity mPas /	-30							
	-20							
	-10							
	0							
	10	**277**						
	20	**140**						
	40	**48**						
	60	**22**						
conductivity mS /cm T ℃								
pH ℃		**9.9**						
REDOX		**-183**						

Composition:								
ethylendiamine / acetic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	**VISCOSITY mPas**			***Bohlin VOR viscosity***		***shear rate 23.1 1/s***	
					Brookfield DV-I viscosity			20 rpm sp3
viscosity mPas /	-30							
	-20							
	-10							
	0							
	10				***19.2***	***7***	***2.5***	***1.6***
	20	***hard wax***	***different crystals***	***long crystals***	***13***	***5***	***2***	***1.3***
	40				***6.5***	***3***	***1.4***	***0.9***
	60				***5***	***2***	***1.3***	***0.85***
conductivity mS /cm		hard	2.84	5.66	15.6	25.2	23.8	9.61
T °C			26.9	26.8	26.6	26.6	26.2	26.2
			porridge precipitated					
pH measurement: temperature same as in conductivity measurement			8.52	8.36	8.23	8.16	8.09	7.98
			crystalline mush	sticky crystals				
REDOX POTENTIAL					+5	+42	+63	+90

Composition:								
ethylendiamine / lactic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	yellow oily liquid							
	°C	VISCOSITY mPas			**Bohlin VOR viscosity** Brookfield DV-I viscosity		**shear rate 23.1 1/s** 20 rpm sp3	
viscosity mPas /	-30							
	-20							
	-10							
	0		10300	910	60	24		
	10	**74130**	**2647**	**308**	**26**	**6.4**	**2.6**	**1.8**
	20	**18700**	**1013**	**151**	**16**	**4.6**	**2**	**1.4**
	40	**2460**	**250**	**49**	**8**	**2.7**	**1.3**	**1.1**
	60	**650**	**76**	**21**	**5**	**2**	**0.8**	**0.7**
conductivity mS /cm		0.218	1.246	4.77	19.9	37.3	38	16
T °C		25.1	25.7	24.7	24.7	24.4	24.2	24.2
pH °C 25		8.03	7.87	7.7	7.52	7.37	7.25	6.98
REDOX		-23	+1	+6	+32	+48	+62	+59

Composition:								
ethylendiamine / formic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	VISCOSITY mPas			Bohlin VOR viscosity		shear rate 23.1 1/s	
					Brookfield DV-I viscosity		20 rpm sp3	
viscosity mPas /	-30							
	-20							
	-10							
	0							
	10			16	5.6	2.8	1.9	1.5
	20			11	4.3	2.3	1.4	1.2
	40			6	2.7	1.8	1	0.8
	60			4	2	1.2	0.9	0.7
conductivity mS /cm		solid *	18.6	30.4	50.3	55.9	40.7	13.7
T °C			23	22.8	22.7	22.6	22.5	22.5
pH °C 22		7.15	6.99	6.86	6.62	6.49	6.35	6.24
*conductivity measurement can be done at about 60°C		crystalline	crystalline					
REDOX				-390	-220	-130	-85	-18

ethylendiamine / propionic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	**VISCOSITY mPas**			*Bohlin VOR viscosity* Brookfield DV-I viscosity		***shear rate 23.1 1/s*** 20 rpm sp3	
viscosity mPas /	-30							
	-20							
	-10							
	0							
	10				***21***	***7***	***3***	***1.6***
	20	***hard crystalline***		***2/3 crystalline***	***14***	***4.9***	***2***	***1.4***
	40				***7***	***2.9***	***1.5***	***1***
	60				***4***	***1.8***	***1.1***	***0.85***
conductivity mS /cm		solid	ei lam.	5.15	11.9	19.1	19.1	8.53
T °C				25.8 (crystalline)	25.8	25.6	25.5	25.8
pH °C 25				8.52 plenty of precipitation	8.32	8.17	8.08	7.97
REDOX					crystals	-23	-2	+27

Composition:								
triethanolamine / acetic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	VISCOSITY mPas			**Bohlin VOR viscosity** Brookfield DV-I viscosity		**shear rate 23.1 1/s**	
viscosity mPas /	-30							
	-20							
	-10							
	0	crystallized	41900	260	65	22	12	crystals formed
	10	**15090**	**1810**	**104**	**28**	**6.4**	**2.6**	**1.6**
	20	**5252**	**759**	**58**	**18**	**4.6**	**2**	**1.3**
	40	**1060**	**191**	**23**	**9**	**2.8**	**1.4**	**0.9**
	60	**230**	**62**	**12**	**5**	**1.9**	**1.1**	**0.9**
conductivity mS /cm		0.158	0.935	5.45	12.08	23.7	24.6	10.36
T °C		26.5	26.1	25.9	25.8	25.6	25.7	25.5
pH temperature in measurement same as in conductivity measurement		6.91	6.81	6.71	6.63	6.55	6.49	6.46
REDOX		-58	-49	-21	+7	+41	+66	+96

Composition:								
triethanolamine / lactic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	**VISCO-SITY mPas**			***Bohlin VOR viscosity*** Brookfield DV-I viscosity		***shear rate 23.1 1/s***	20 rpm sp3
viscosity mPas /	-30							
	-20	>20000	19800					
	-10	>20000	5050					
	0	24300	1950					
	10	***10760***	***1067***	***228***	***21.1***	***5.7***	***2.5***	***1.7***
	20	***3955***	***452***	***120***	***13.7***	***4.4***	***2***	***1.4***
	40	***736***	***119***	***41***	***7.2***	***2.4***	***1.4***	***0.9***
	60	***240***	***45***	***19***	***4.3***	***1.7***	***1***	***0.9***
conductivity mS /cm		0.207	0.934	3.46	10.16	17.4	17.1	6.73
T °C		25.1	25.2	24.8	25	24.9	24.9	24.8
pH temperature in measurement same as in conductivity measurements		7.33	7.22	7.17	7.17	7.18	7.21	7.22
REDOX		-97	-121	-115	-33	+9	+39	+63

Composition::								
triethanolamine / formic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
	°C	mPas			**Bohlin VOR viscosity** Brookfield DV-I viscosity		**shear rate 23.1 1/s** 20 rpm sp3	
viscosity mPas /	-30							
	-20							
	-10							
	0							
	10	hard	**558**	**138**	**9.3**	**4.5**	**2.3**	**1.6**
	20	hard	**296**	**80**	**6.8**	**3.5**	**1.8**	**1.3**
	40		**94**	**33**	**4**	**2.2**	**1.3**	**0.9**
	60		**42**	**17**	**2.6**	**1.8**	**1.1**	**0.7**
conductivity mS /cm		Hard crystalline	2.54	7.05	31.5	40.7	36.4	14.2
T °C			24.7	24.6	24.5	24.7	24.5	24.5
pH temperature in measurement same as in conductivity measurements			6.23	6.19	6.16	5.95	6.19	6
REDOX			1/2 crystallized	-410	-231	-170	-102	-24

Composition::								
triethanolamine / propionic acid		100	90	80	60	40	20	5
water		0	10	20	40	60	80	95
					Bohlin VOR vis-cosity			
	°C	**VISCO-SITY mPas**					***shear rate 23.1 1/s***	
					Brook-field DV-I viscosity			20 rpm sp3
viscosity mPas /	-30							
	-20							
	-10							
	0	15000	2930	620	70	20	12	froze
	10	***5941***	***960***	***262***	***34***	***7.4***	***2.8***	***1.6***
	20	***2150***	***485***	***134***	***21***	***5.4***	***2.1***	***1.3***
	40	***490***	***120***	***45***	***10.4***	***3***	***1.5***	***0.9***
	60	***145***	***44***	***20***	***6.5***	***2***	***0.8***	***0.7***
conductivity mS /cm		0.24	0.868	2.25	6.52	17.6	19.4	8.53
T °C		24.7	24.6	24.6	24.5	24.4	24.3	24.3
pH temperature in measurement same as in conductivity measurements		7.22	7.23	6.99	6.81	6.7	6.62	6.56
REDOX		-117	-104	-140	-60	-11	+26	+73

As can be seen from table 4 the viscosity of compositions varies considerably depending on the quality of the fluid in a composition and fluid – solvent proportion (w/w). For example instead of using formic acid and monoethanolamine (at least 40 wt-% aqueous solvent) as demonstrated in example 2 one could also use monoethanolamine and acetic acid (at least 40 wt-% aqueous solvent) or monoethanolamine and lactic acid (at least 20 wt-% aqueous solvent) as an heat transfer composition. No solid crystals will be formed for instance if one uses combination ethanol amine / formic acid as a heat transfer fluid (compare table 2 above). Avoiding solid crystals is also a beneficial property for instance for an anti- freezing and a de-icing fluid.

Heat capacities for fluids and diluted fluid solutions in examples 1–23 were found to be between (2100–2500) J/kgK. As can be seen from table 4 their REDOX potential varied from ca -300 mV to +200 mV depending on fluid and water content of a composition. This gives interesting possibilities to choose pH and redox-potential. Some specific properties like heat transfer, anti corrosion, anti microbial activity, wetting, contact angle, power to disperse, chemical stability should be assessed for the final formulations.

Example batch operated apparatus assembly and their use have been described above. The following clauses setup some of the combinations of features envisaged by the present disclosure.

1. A method for preparing a composition with low corrosive effect and low freezing point, by mixing an ammonium cation source with a carboxyl anion source in an appropriate molar or weight ratio, either without a medium or by using an appropriate medium for obtaining liquid or water-soluble organic ammonium carboxylate of formula (1):

$$[NR^1R^2R^3R^4]^+_n\,[R^5(COO)_n]^{-n}, \qquad (1),$$

in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1–6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1–6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1–6 carbon atoms and n is an integral 1–6 and

thereafter adding possible solvent and at the same time keeping alkali or alkali-earth metal content of the composition in a range of 0.001–30 wt-%, preferably in a range of 0.001–30 wt-% and most preferably in a range of 0.001–1.0 wt-% and halide content in a range of 0.001–1 wt-% most preferably in a range of 0.001–0.1 wt-%.

2. The method as defined in clause 1, **characterized** in that R^5 is hydrogen, a substituted or unsubstituted alkyl containing 1–6 carbon atoms, preferably hydrogen, a substituted or unsubstituted alkyl containing 1–4 carbon atoms, and n is 1 or 2, preferably 1.

3. The method as defined in clause 2, **characterized** in that R^5 is hydrogen, methyl or ethyl.

4. The method as defined in clause 2, **characterized** in that R^1 is hydrogen, R^2 and R^3 are selected from the group comprising hydrogen and C_1-C_6 alkyls substituted with a hydroxyl group, preferably in the group comprising hydrogen and C_1-C_4-alkyls substituted with a hydroxyl group, and R_4 is a C_1-C_6-alkyl substituted with a hydroxyl group, preferably a C_1-C_4-alkyl substituted with a hydroxyl group.

5. The method as defined in clause 4, **characterized** in that R_1 is hydrogen, R_2 and R_3 are selected from the group comprising hydrogen and ethyl substituted with a hydroxyl group, preferably in the group comprising hydrogen and 2-hydroxyethyl, and R_4 is an ethyl substituted with a hydroxyl group, preferably 2-hydroxy ethyl.

6. The method as defined in clause 1, **characterized** in that the organic ammonium carboxylate of formula (1) is a salt of formic acid and monoethanolamine and/or triethanolamine or a salt of lactic acid and monoethanolamine and/or triethanolamine.

7. The method as defined in clause 6, **characterized** in that the organic ammonium carboxylate of formula (1) is a mixture of a salt of formic acid or lactic acid and monoethanolamine, preferably in the weight ratio 80:20–20:80.

8. The method as defined in clause 1, **characterized** in that the organic ammonium carboxylate of formula (1) is prepared in the form of an aqueous solution preferably with water, in which the ammonium carboxylate concentration is in the range 0.5–100% wt-%, preferably 5–70% wt-% while the freezing point of the composition is kept in the range of -5 to -50 °C.

9. The method as defined in clause 8, **characterized** in that the prepared aqueous solution of organic ammonium carboxylate of formula (1) contains organic ammonium carboxylate of formula (1) and water in a weight ratio in the range 1:20–20:1, preferably in the range 1:6–1:1.

10. The method as defined in any of clauses 1 to 9, **characterized** in that into liquid or water-soluble organic ammonium carboxylate of formula (1) and possible solvent is additionally mixed an alkali metal, an alkaline earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof so that the composition contains 5 to 97.5 wt-% of water or alkali metal, an alkaline earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof provided that alkali or alkali-earth metal content is kept in a range of 0.001–30 wt-%.

11. The method as defined in any of clauses 1 to 10, **characterized** in that into the composition is included auxiliary substances such as additional corrosion inhibitors, biocides, coloring agents, surfactants, and viscosity intensifiers from 0.001 to 10 wt-%.

12. The use of composition comprising liquid or water-soluble organic ammonium carboxylate of formula (1):

$$[NR^1R^2R^3R^4]^+_n\ [R^5(COO)_n]^{-n}, \qquad (1),$$

in which R^1, R^2, and R^3 are selected from the group comprising hydrogen, substituted and unsubstituted alkyls containing 1–6 carbon atoms, R^4 is a substituted or unsubstituted alkyl containing 1–6 carbon atoms, R^5 is hydrogen, a substituted or unsubstituted hydrocarbon containing 1–6 carbon atoms and n is an integral 1-6 either without a medium or by using an appropriate medium, as a freezing point depressant.

13. The use defined in clause 12, wherein R^5 is hydrogen, a substituted or unsubstituted alkyl containing 1–6 carbon atoms, preferably hydrogen, a substituted or unsubstituted alkyl containing 1–4 carbon atoms, and n is 1 or 2, preferably 1.

14. The use as defined in clause 13 wherein R^5 is hydrogen, methyl or ethyl.

15. The use defined in clause 14, wherein R^1 is hydrogen, R^2 and R^3 are selected from the group comprising hydrogen and C_1-C_6 alkyls substituted with a hydroxyl

group, preferably in the group comprising hydrogen and C_1-C_4-alkyls substituted with a hydroxyl group, and R_4 is a C_1-C_6-alkyl substituted with a hydroxyl group, preferably a C_1-C_4-alkyl substituted with a hydroxyl group.

16. The use defined in clause 15, wherein R_1 is hydrogen, R_2 and R_3 are selected from the group comprising hydrogen and ethyl substituted with a hydroxyl group, preferably in the group comprising hydrogen and 2-hydroxyethyl, and R_4 is an ethyl substituted with a hydroxyl group, preferably 2-hydroxy ethyl.

17. The use defined in clause 12, wherein the organic ammonium carboxylate of formula (1) is a salt of formic acid and monoethanolamine and/or triethanolamine or a salt of lactic acid and monoethanolamine and/or triethanolamine.

18. The use defined in clause 17, wherein the organic ammonium carboxylate of formula (1) is a mixture of a salt of formic acid or lactic acid and monoethanolamine, preferably in the weight ratio 80:20–20:80.

19. The use as defined in clause 12, wherein the organic ammonium carboxylate of formula (1) is prepared in the form of an aqueous solution preferably with water, in which the ammonium carboxylate concentration is in the range 0.5–100% wt-%, preferably 5–70% wt-% while the freezing point of the composition is kept in the range of -5 to -50°C.

20. The use as defined in clause 19, wherein the prepared aqueous solution of organic ammonium carboxylate of formula (1) contains organic ammonium carboxylate of formula (1) and water in a weight ratio in the range 1:20–20:1, preferably in the range 1:6–1:1.

21. The use as defined in any of clauses 12 to 20, wherein into liquid or water-soluble organic ammonium carboxylate of formula (1) and possible solvent is additionally mixed an alkali metal, an alkaline earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof so that the composition contains 5 to 97.5 wt-% of water or alkali metal, an alkaline earth metal or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof provided that alkali or alkali-earth metal content is kept in amount of 0.001–30 wt-%.

22. The use as defined in any of clauses 12 to 21, wherein into the composition is included auxiliary substances such as additional corrosion inhibitors, biocides, coloring agents, surfactants, and viscosity intensifiers from 0.001 to 10 wt-%.

23. The use defined in clause 12 wherein the composition is additionally used for deicing or anti-icing, heat storage or heat transfer, metal cutting, grease, NOx removal or as a hydraulic fluid.

24. The use defined in clause 23, wherein the composition has a viscosity of 0.1–10,000 Mpas, its electrical conductivity is in a range of 1.0–100 mPas and said composition is used for lowering freezing point of an aqueous system and additionally for deicing or anti-icing.

25. The use defined in clause 24 for airfield pavement deicing or aircraft deicing and anti-icing.

26. The use defined in clause 12 wherein the composition has viscosity of 0.1–500 mpas and electrical conductivity of 1.0–100 mS/cm and the composition is additionally used for a heat transfer application.

27. The use according to clause 26 wherein the composition contains formic acid, acetic acid or lactic acid and monoethanolamine.

28. The use defined in clause 12 wherein the composition is a grease-like composition with viscosity of 100–50,000 mpas and electrical conductivity of 0.05–100 mS/cm.

29. The use defined in clause 12 wherein the composition has viscosity of 5.0–10,000 mpas and electrical conductivity of 1.0–100 mS/cm and the composition is used as a hydraulic composition.

30. The use defined in clause 12 wherein the composition is additionally used for binding glycol ethers.

31. The reuse of the composition defined in clause 1 after it has been used for any of the uses defined in claims 12 -30.

32. The reuse of the composition defined in clause 31 for treating wood material, dust controlling, additive for metal cutting or oil drilling, re-icing of ice tracks, esterification or etherification of material for energy production.

CLAIMS

1. The use of composition comprising liquid or water-soluble organic ammonium carboxylate of formula (1):

$$[NR^1R^2R^3R^4]^+_n\,[R^5(COO)_n]^{-n}, \qquad (1),$$

in which R^1 is hydrogen R^2, and R^3 are selected from the group comprising hydrogen, unsubstituted alkyls containing 1–4 carbon atoms or C_1-C_4-alkyls substituted with a hydroxyl group, R^4 is preferably a C_1-C_4-alkyl substituted with a hydroxyl group, R^4 is a substituted alkyl containing 1–6 carbon atoms or unsubstituted alkyl containing 1–6 carbon atoms and substituted with a hydroxyl group, preferably a C_1-C_4-alkyl substituted with a hydroxyl group, R^5 is hydrogen, a substituted or unsubstituted alkyl containing,1–6 carbon atoms, preferably a substituted or unsubstituted alkyl containing 1–4 carbon atoms more preferably hydrogen, methyl or ethyl, and n is 1 or 2, preferably 1 and the viscosity of 0.1–50, 000 Mpas, electrical conductivity in a range of 0.05–100 mS/cm preferably in a range of 1.0 -100 mS/cm in deicing or anti-icing or as a freezing point depressant with low corrosive properties provided that when R^5 means hydrogen $NR^1R^2R^3R^4$ do not mean together triethanolamine.

2. The use defined in claim 1, wherein the organic ammonium carboxylate of formula (1) is such that when R^1 means hydrogen, R^2 and R^3 are selected from the group comprising hydrogen and ethyl substituted with a hydroxyl group, preferably in the group comprising hydrogen and 2-hydroxyethyl, and R^4 is an ethyl substituted with a hydroxyl group, preferably 2-hydroxy ethyl.

3. The use defined in claim 1, wherein the organic ammonium carboxylate of formula (1) is a salt of formic acid and monoethanolamine and triethanolamine or a salt of lactic acid and monoethanolamine and/or triethanolamine.

4. The use defined in claim 3, wherein the organic ammonium carboxylate of formula (1) is a mixture of a salt of formic acid or lactic acid and monoethanolamine, preferably in the weight ratio 80:20–20:80.

5. The use as defined in claim 1, wherein the organic ammonium carboxylate of formula (1) is prepared in the form of an aqueous solution preferably with water, in which the ammonium carboxylate concentration is in the range 0.5–100% wt-%, preferably 5–70% wt-% while the freezing point of the composition is kept in the range of -5 to -50°C.

6. The use as defined in claim 7, wherein the prepared aqueous solution of organic ammonium carboxylate of formula (1) contains organic ammonium carboxylate of formula (1) and water in a weight ratio in the range 1:20–20:1, preferably in the range 1:6–1:1.

7. The use as defined in claim 1 wherein the the organic ammonium carboxylate of formula (1) contains formic acid, acetic acid or lactic acid and monoethanolamine.

8. The use as defined in any of claims 1 to 7, wherein into liquid or water-soluble organic ammonium carboxylate of formula (1) and possible solvent is additionally mixed an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or a mixture thereof so that the composition contains 5 to 97.5 wt-% of water or an ammonium salts of C_1-C_6 monocarboxylic acids or urea or ethylene glycol or propylene glycol, or glycerol or lower alkanol, preferably methanol or ethanol or a mixture thereof.

9. The use as defined in any of claims 1 to 8, wherein into the composition is included auxiliary substances such as additional corrosion inhibitors, biocides, coloring agents, surfactants, and viscosity intensifiers from 0.001 to 10 wt-%.

10. The use defined in any of the previous claims wherein the organic ammonium carboxylate of formula (1) is used for airfield pavement deicing or aircraft deicing and anti-icing.

11. The use defined in any of the claims 1 – 11 wherein the composition is additionally used for heat storage or heat transfer, or as a metal cutting grease, for NOx removal or as a hydraulic fluid.

12. The use defined in claim 11 wherein the composition has viscosity of 0.1–50,000 mpas and electrical conductivity of 1.0–100 mS/cm and the composition is additionally used for a heat transfer application.

13. The use defined in claim 12 wherein the composition is used in a primary or in a secondary heat transfer circulation of a reactor wherein an exothermic chemical reaction or a cold fusion reaction takes place.

14. The use defined in claim 13 wherein the composition is used in a primary heat transfer circulation in contact with a reactor wherein a cold fusion process takes place.

15. The use defined in claim 13 wherein the composition has viscosity of 5.0–10,000 mpas and electrical conductivity of 1.0–100 mS/cm and the composition is used as a hydraulic composition.

16. The use defined in claim 13 wherein the composition is a grease-like composition with viscosity of 100–50,000 mPas and electrical conductivity of 0.05–100 mS/cm.

17. The use defined in claim 1 wherein the composition is additionally used for binding glycol ethers.