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(54) USE OF AN AQUEOUS SOLUTION CONTAINING DISSOLVED FERRATE (VI) IONS FOR CLEANING A SOLID SURFACE, RESPECTIVE METHODS, RESPECTIVE WASHING AND/OR CLEANING AGENTS, RESPECTIVE SOLUTIONS AND/OR SUSPENSIONS, RESPECTIVE CLEANING MACHINE AND/OR WASHING MACHINE, RESPECTIVE KIT AND RESPECTIVE USES

(57) The invention relates to the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a further specified solid surface from a further specified soil.

The invention also relates to respective methods for cleaning a solid surface. The invention also relates to the respective use of an aqueous solution containing dissolved ferrate (VI) ions as a demulsifier. The invention also relates to the respective washing agent and/or cleaning agent comprising an aqueous solution and/or suspension containing dissolved ferrate (VI) ions. The invention also relates to the respective method for producing a respective washing agent and/or cleaning agent. The invention also relates to the respective solutions. The invention also relates to a respective cleaning machine. The invention also relates to a respective kit. The invention also relates to the use of a respective kit.

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Description

[0001] The invention relates to the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a further specified solid surface from a further specified soil.

[0002] The invention also relates to respective methods for cleaning a solid surface. The invention also relates to the respective use of an aqueous solution containing dissolved ferrate (VI) ions as a demulsifier. The invention also relates to the respective washing agent and/or cleaning agent comprising an aqueous solution and/or suspension containing dissolved ferrate (VI) ions. The invention also relates to the respective method for producing a respective washing agent and/or cleaning agent. The invention also relates to the respective solutions. The invention also relates to a respective cleaning machine. The invention also relates to a respective kit. The invention also relates to the use of a respective kit.

[0003] Document DE 10 2017 127 160 A1 discloses a cleaning and/or spin-drying device for cleaning and/or drying crates, comprising a crate inlet for receiving crates to be cleaned and/or dried, a crate outlet for dispensing crates, a rotating device arranged between the crate inlet and the crate outlet and having a substantially vertical rotary shaft and a rotary plate arranged on the upper side thereof, and optionally a spraying device, in order to spray a crate to be cleaned with a cleaning fluid, the cleaning and/or spin-drying device being designed in such a way that a crate to be cleaned and/or spin-dried is placed with an inner side of the crate base on the turntable, the turntable being arranged at a distance below the crate outlet in a spin-drying position of the crate in which the crate is subjected to a cleaning and/or spin-drying process.

[0004] In the state of the art at least the following problems and disadvantages and the following demands exist: Frequently high temperatures and high energy consumption is needed for cleaning solid surfaces. This is frequently regarded as significant disadvantage and a demand for cleaning with lower energy consumption exists.

[0005] Cleaning results, especially at low temperatures are often disadvantageous. A demand for better cleaning results when cleaning at lower temperatures especially at temperatures below 40 °C, below 35 °C and below 30 °C. Overall, a demand for cleaning solid surfaces with minimal use of energy input exists.

[0006] Storage of cleaning agents often takes up an undesirable high amount of space for storage. For transportation of cleaning agents, large amounts are undesirable. A demand for smaller amounts of cleaning agents in transportation and storage exists. A demand for cleaning agents and cleaning methods exists that lead to the same cleaning results as known from the state of the art or better cleaning results than known from the state of the art with a lesser amount of cleaning agent preferably a lesser amount with regard to less volume and/or less weight, more preferably with regard to less volume and less weight.

[0007] Surfactants used in solid surface cleaning methods are frequently released into the environment, together with the wastewater, after cleaning. The release of surfactants into wastewater and into the environment is frequently undesirable. Removal of surfactants from wastewater is frequently associated with an undesirably high technical effort. From the prior art, a demand results, for cleaning methods that use as little surfactants as possible, preferably no surfactants.

[0008] Cleaning agents for solid surface cleaning methods frequently comprise bleach that releases chlorine. The release of chlorine is frequently regarded as disadvantageous in solid surface cleaning, especially due to the negative environmental aspects associated therewith. From the prior art a need exists for cleaning methods that use cleaning agents which do not release chlorine during and/or after use.

[0009] From the prior art, a need exists for cleaning methods that use cleaning agents which do not react to form adsorbable organic halides (AOX) during and/or after use.

[0010] In many cases, the presence of foam in solid surface cleaning methods is unwanted. There is a demand in the prior art for solid surface cleaning methods with little foaming during the cleaning process, preferably no foaming during the cleaning process.

[0011] A demand exists for solid surface cleaning methods employing solid surface cleaning agents that are environmentally harmless.

[0012] The present invention is defined in the claims and described in detail hereinafter.

[0013] The present invention relates, in its categories, to the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface, to a method for cleaning a solid surface, to a use of an aqueous solution containing dissolved ferrate (VI) ions as a demulsifier, to a washing agent and/or cleaning agent comprising an aqueous solution containing dissolved ferrate (VI) ions, to a method for producing a respective washing agent and/or cleaning agent, to a solution, to a cleaning machine and to a kit. Embodiments, aspects or properties that are described in connection with one of these categories or described as preferred are each correspondingly or analogously applicable to the respective other categories, and vice versa.

[0014] Unless stated otherwise, preferred aspects or embodiments of the invention and their various categories can be combined with other aspects or embodiments of the invention and their various categories, especially with other preferred aspects or embodiments. The combination of respectively preferred aspects or embodiments with one another again results in preferred aspects or embodiments of the invention.

[0015] In a primary aspect of the present invention, the above-specified objectives are achieved and the above-specified

problems are solved in whole or in part by the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface, preferably for cleaning solid surfaces.

[0016] The term "ferrate(VI) ion" refers to the inorganic anion with the chemical formula $[FeO_4]^{2-}$.

[0017] Within the context of the current invention, the term "cleaning" means the process of removing unwanted substances, such as dirt and other impurities, from an object; in the technical field of the invention, such unwanted substances are also referred to as soiling.

[0018] In many cases, it is preferred that the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface does not involve the additional use of surfactants.

[0019] Especially when used without surfactants, the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface is associated with favourably low foaming.

[0020] No chlorine is released during and/or after the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface.

[0021] No part of the aqueous solution containing dissolved ferrate (VI) ions reacts to form adsorbable organic halides (AOX) during and/or after the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface.

[0022] The aqueous solution containing dissolved ferrate (VI) ions is environmentally harmless.

[0023] Document NL2029165B1 discloses a method for manufacturing ferrate, the method comprising the steps of: - providing an electrochemical cell having an anode containing iron, and a cathode that is placed at a distance from the anode; - inserting an alkaline solution into the electrochemical cell; - applying, by a power supply, an electric potential between the iron containing anode and the cathode; including the step - inducing a current density on one or more surfaces of the anode in the range of 1 A/cm^2 to 500 A/cm^2.

[0024] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred),

- whereby the solid surfaces are selected from the group consisting of:
    - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,
      and

- whereby the aqueous solution containing dissolved ferrate (VI) ions is used for cleaning surfaces soiled with a soil selected from the group consisting of:
    - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt
      and/or
    - for cleaning a surface soiled with a soiling selected from the group consisting of:
        - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:
            - blood,
            - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
            - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
            - fish and/or fishbone
            - slaughterhouse waste,
            - mayonnaise,
            - salad sauces,
            - salad dressings,
            - sauces and/or dips,
            - vegetables,
            - yoghurt;

- soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

  - edible plant oils,
  - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
  - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
  - fish bone,
  - marinades,
  - butter,
  - milk,
  - egg, preferably egg white and/or egg yolk
  - chocolate,
  - margarine,
  - slaughterhouse waste,
  - salad sauces,
  - salad dressings,
  - sauces,
    and
  - yoghurt;

- soiling containing carbohydrates,
  preferably soiling containing carbohydrates selected from the group consisting of soiling by:

  - cane,
  - fruit,
  - ice cream,
  - jam,
  - dough
  - juice, preferable fruit juice and/or vegetable juice,
  - ketchup,
  - lemonade,
  - sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
  - vegetables,
  - starch,
  - syrup,
    and
  - sugar;
    and
  - mixtures thereof.

[0025] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred),

- whereby the solid surfaces are selected from the group consisting of:

- glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,
  and

- whereby the aqueous solution containing dissolved ferrate (VI) ions is used for cleaning surfaces soiled with a soil selected from the group consisting of:

  - for cleaning a surface soiled with a soiling selected from the group consisting of:

    - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

- blood,
- animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish and/or fishbone
- slaughterhouse waste,
- mayonnaise,
- salad sauces,
- salad dressings,
- sauces and/or dips,
- vegetables,
- yoghurt;

- soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

  - edible plant oils,
  - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
  - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
  - fish bone,
  - marinades,
  - butter,
  - milk,
  - egg, preferably egg white and/or egg yolk
  - chocolate,
  - margarine,
  - slaughterhouse waste,
  - salad sauces,
  - salad dressings,
  - sauces,
    and
  - yoghurt;

- soiling containing carbohydrates,
  preferably soiling containing carbohydrates selected from the group consisting of soiling by:

  - cane,
  - fruit,
  - ice cream,
  - jam,
  - dough
  - juice, preferable fruit juice and/or vegetable juice,
  - ketchup,
  - lemonade,
  - sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
  - vegetables,
  - starch,
  - syrup,
    and
  - sugar;
    and
  - mixtures thereof.

[0026] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred),

- whereby the solid surfaces are selected from the group consisting of:
  - glass, plastic, metal, wood and/or stone, each coated or uncoated,

    preferably selected from the group consisting of:
    - glass, plastic and metal, each coated or uncoated,

    more preferably selected from the group consisting of:
    - plastic and metal, each coated or uncoated,

    even more preferably selected from the group consisting of:
    - plastic, coated or uncoated, whereby the plastic is preferably polypropylene, yet more preferably uncoated polypropylene;
      and/or
- whereby the use preferably occurs in the areas selected from the group consisting of:
  - household, industry, commerce and institutions, ships, port facilities, sports and leisure facilities;
    and/or
- whereby the solid surfaces are selected from surfaces of
  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
    and
  - pallets;

    preferably the solid surfaces are selected from surfaces of:
    - boxes,
    - cutlery,
    - cookware,
    - cars,
    - workwear;

- personal protective equipment
  and

- pallets;

more preferably the solid surfaces are surfaces of boxes.

[0027] In many cases it is especially preferred that the use occurs in food processing plants and/or feed processing plants.

[0028] The use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning other solid surfaces than those specified above is also possible but the use for the above specified surfaces is in many cases preferred.

[0029] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby the aqueous solution of ferrate (VI) additionally comprises:

- dissolved calcium ions, preferably dissolved Ca(II),
  and/or, preferably "and"

- dissolved magnesium ions, preferably dissolved Mg(II),

preferably in an amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L.

[0030] Methods to determine these amounts are known to the skilled person.

[0031] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby

- the concentration of dissolved ferrate (VI) ions in the aqueous solution containing dissolved ferrate (VI) ions is in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions;
  and/or

- within the aqueous solution containing dissolved ferrate (VI) ions, the ratio of

  - the amount of dissolved sodium ions, preferably dissolved Na(I),
    to

  - the amount of dissolved ferrate (VI) ions
    is in the range from 30:0.3 to 1:1, preferably in the range from 28.75:0.34 to 27.6:1.02, more preferably in the range from 27.6:1.02 to 25:1;
    and/or

- within the aqueous solution containing dissolved ferrate (VI) ions, the ratio of

  - the amount of dissolved potassium ions, preferably dissolved K(I),
    to

  - the amount of dissolved ferrate (VI) ions
    is in the range from 35.03:0.3 to 33.408:1.02, preferably in the range from 34.8:0.34 to 34.8:1.02.

[0032] Methods to determine these amounts and ranges are known to the skilled person.

[0033] In many cases, the concentration of dissolved ferrate (VI) ions is significantly lower (in many cases approximately 10 times lower) than the concentration of surfactants applied in comparable cleaning processes.

[0034] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby the aqueous solution containing dissolved ferrate (VI) ions is used

- for cleaning surfaces soiled with a soil selected from the group consisting of:

  - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee,

bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
and/or

- for cleaning a surface soiled with a soiling selected from the group consisting of:

  - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

    - blood,
    - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
    - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
    - fish and/or fishbone
    - slaughterhouse waste,
    - mayonnaise,
    - salad sauces,
    - salad dressings,
    - sauces and/or dips,
    - vegetables,
    - yoghurt;

  - soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

    - edible plant oils,
    - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
    - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
    - fish bone,
    - marinades,
    - butter,
    - milk,
    - egg, preferably egg white and/or egg yolk
    - chocolate,
    - margarine,
    - slaughterhouse waste,
    - salad sauces,
    - salad dressings,
    - sauces,
      and
    - yoghurt;

  - soiling containing carbohydrates,
    preferably soiling containing carbohydrates selected from the group consisting of soiling by:

    - cane,
    - fruit,
    - ice cream,
    - jam,
    - dough
    - juice, preferable fruit juice and/or vegetable juice,

- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,
  and
- sugar;
  and

- mixtures thereof.

[0035] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby during the use the temperature of the aqueous solution containing dissolved ferrate (VI) ions never exceeds a temperature of 85 °C, preferably 60 °C, more preferably 50 °C, even more preferably 30 °C, most preferably 25 °C.

[0036] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby

- the aqueous solution containing dissolved ferrate (VI) ions additionally contains ethaneperoxoic acid,
  and/or

- the cleaning comprises a disinfection.

[0037] The substance termed "ethaneperoxoic acid" is known to the skilled person and is frequently also designated by the terms "peracetic acid" or "peroxyacetic acid".

[0038] The above described combined use of the aqueous solution containing dissolved ferrate (VI) ions with ethaneperoxoic acid is especially preferred to achieve both, cleaning and disinfection. The abovementioned effects and advantages of the present invention are also achieved here.

[0039] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby the aqueous solution containing dissolved ferrate (VI) ions

- additionally comprises surfactants,

  - independently selected from:

    - anionic surfactants, preferably soaps, amine oxides, alkylbenzene sulfonates, alkane sulfonates, alkyl sulfates and alkylethersulfates;
      and/or

    - non-ionic surfactants, preferably fatty alcohol ethoxylates, alkylphenol ethoxylates, sorbitan fatty acid esters, alkylpolyglucosides, and N-methylglucamides;
      and/or

    - cationic surfactants, preferably quaternary ammonium compounds and salts of C_{10} to C_{22} primary amines;
      and/or

  - amphoteric surfactants, preferably amidoalkyl betaines.

[0040] Suitable surfactants of these types are known to the skilled person and such surfactants are commercially available.

[0041] The skilled person knows suitable surfactants from common general knowledge.

[0042] It is preferred that the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface, preferably for cleaning solid surfaces, does not lead to an inacceptable amount of foaming during the use. The skilled person is aware that especially foaming behaviour depends on type, combination and amount of surfactants used and thus choses to apply surfactants or mixtures thereof depending on the requirements of the individual case.

[0043] The skilled person is aware of the environmental effects of different surfactants and accounts for such consequences when using surfactants.

[0044] In many cases, when surfactants are used in a cleaning process together with the aqueous solution containing dissolved ferrate (VI) ions, lower amounts of surfactants are needed to achieve the same cleaning result compared to the same cleaning process using surfactants only (but no aqueous solution containing dissolved ferrate (VI) ions).

[0045] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby the aqueous solution containing dissolved ferrate (VI) ions is essentially free of surfactants, preferably completely free of surfactants.

[0046] In many cases, particularly positive results are obtained by the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface, preferably for cleaning solid surfaces, whereby the aqueous solution containing dissolved ferrate (VI) ions is essentially free of surfactants, preferably completely free of surfactants.

[0047] In these cases, positive cleaning results are achieved without the well-known disadvantages associated with the use of surfactants.

[0048] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby during the use the pH of the aqueous solution containing dissolved ferrate (VI) ions is never below pH 7, preferably never below pH 8, more preferably never below pH 8.5, even more preferably never below pH 9, most preferably never bellow pH 9.5.

[0049] In many cases particularly positive cleaning results are achieved with the use according to the present invention, preferably in combination with particularly low concentrations of cleaning agent, when the use occurs at an pH as defined above.

[0050] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby the aqueous solution containing dissolved ferrate (VI) ions

- is essentially free of chlorine bleach, preferably completely free of chlorine bleach;
  and/or
- is essentially free of hydrochloric acid, preferably completely free of hydrochloric acid;
  and/or
- is essentially free of sulfuric acid, preferably completely free of sulfuric acid;
  and/or
- is essentially free of nitric acid, preferably completely free of nitric acid;
  and/or
- is essentially free of ethylenediaminetetraacetic acid (EDTA) and salts thereof, preferably completely free of ethylenediaminetetraacetic acid (EDTA) and salts thereof;
  and/or
- is essentially free of nitrilotriacetic acid (NTA) and salts thereof, preferably completely free of nitrilotriacetic acid (NTA) and salts thereof;
  and/or
- is essentially free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof, preferably completely free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof;
  and/or
- is essentially free of methylglycinediacetic acid (MGDA) and salts thereof, preferably completely free of methylglycinediacetic acid (MGDA) and salts thereof;
  and/or
- is essentially free of β-alanine diacetic acid (β-ADA) and salts thereof, preferably completely free of β-alanine diacetic acid (β-ADA) and salts thereof.

[0051] In the field of the current invention, the use of chlorine bleach is frequently undesirable.

[0052] In the field of the current invention, the use of hydrochloric acid is frequently undesirable.

[0053] In the field of the current invention, the use of sulfuric acid is frequently undesirable.

[0054] In the field of the current invention, the use of nitric acid is frequently undesirable.

[0055] In the field of the current invention, the use of ethylenediaminetetraacetic acid (EDTA) and salts thereof is frequently undesirable.

[0056] In the field of the current invention, the use of nitrilotriacetic acid (NTA) and salts thereof is frequently undesirable.

[0057] In the field of the current invention, the use of diethylenetriaminepentaacetic acid (DTPA) and salts thereof is frequently undesirable.

[0058] In the field of the current invention, the use of methylglycinediacetic acid (MGDA) and salts thereof is frequently undesirable.

[0059] In the field of the current invention, the use of β-alanine diacetic acid (β-ADA) and salts thereof is frequently undesirable.

[0060] The positive results and effects achieved with the present invention are preferably achieved without the above

substances.

[0061] The present invention, with its various aspects, especially and preferably relates to a use (as described above, preferably as identified above as preferred), whereby during the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning surfaces,

- wherein the surface is a soiled surface
  and/or, preferably "and"

- wherein

  - at least a fraction of dissolved ferrate (VI) ions
    reacts with

  - at least a fraction of soil
    so that dissolved iron (III) ions result.

[0062] In many cases, preferably cases wherein the surface is a soiled surface, the effects and advantages associated with the present invention are achieved in a particularly positive extent, if the above-defined reaction between dissolved ferrate (VI) ions and soil resulting in dissolved iron (III) ions occurs.

[0063] The invention also relates to a method for cleaning a solid surface, comprising the following steps:

S1 preparing or providing an aqueous solution containing dissolved ferrate (VI) ions;
preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions, more preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions in a predefined quantity;

S2 preparing or providing a soiled surface.

[0064] The advantages and effects associated with the use of the present invention are particularly well achieved in cases where the use of the present invention is according to the method of the present invention.

[0065] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), comprising the following steps:

S1 preparing or providing an aqueous solution containing dissolved ferrate (VI) ions;
preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions, more preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions in a predefined quantity;

S2 preparing or providing a soiled surface

- wherein the solid surface is selected from the group consisting of:

  - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,
    and

- wherein the solid surface is soiled

  - with a soil selected from the group consisting of:

    - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
      and/or

- with a soil selected from the group consisting of:

  - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

    - blood,
    - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
    - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
    - fish and/or fishbone
    - slaughterhouse waste,
    - mayonnaise,
    - salad sauces,
    - salad dressings,
    - sauces and/or dips,
    - vegetables,
    - yoghurt;

  - soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

    - edible plant oils,
    - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
    - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
    - fish bone,
    - marinades,
    - butter,
    - milk,
    - egg, preferably egg white and/or egg yolk
    - chocolate,
    - margarine,
    - slaughterhouse waste,
    - salad sauces,
    - salad dressings,
    - sauces,
      and
    - yoghurt;

  - soiling containing carbohydrates,
    preferably soiling containing carbohydrates selected from the group consisting of soiling by:

    - cane,
    - fruit,
    - ice cream,
    - jam,
    - dough
    - juice, preferable fruit juice and/or vegetable juice,
    - ketchup,
    - lemonade,
    - sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
    - vegetables,
    - starch,
    - syrup,
      and
    - sugar;

and

- mixtures thereof.

[0066] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), whereby
the aqueous solution containing dissolved ferrate (VI) ions is prepared or provided in step S1 in a predefined quantity; and

- the following additional steps are carried out after preparing or providing an aqueous solution containing dissolved ferrate (VI) ions in step S1:

  S1-1 preparing or providing a predefined quantity of water;
  and

  S1-2 contacting intermixing of

  - the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1;
    and
  - the predefined quantity of water prepared or provided in step S1-1;
    so that a diluted aqueous solution containing dissolved ferrate (VI) ions results.

[0067] With method according to the present invention including steps S1-1 and S1-2 desirably small amounts of aqueous solution containing dissolved ferrate (VI) ions are needed for transportation and storage whilst, in combination therewith, desirably positive cleaning results are achieved.

[0068] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), comprising the following step:
S3 contacting

- the soiled surface prepared or provided in step S2
  and
- the soil on soiled surface prepared or provided in step S2
  with
- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1,
  or
  the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,

so that at least a fraction of the soil is dissolved in the aqueous solution containing dissolved ferrate (VI) ions or in the diluted aqueous solution containing dissolved ferrate (VI) ions
and

so that a partially cleaned solid surface or a cleaned solid surface results.

[0069] In many cases, particularly positive cleaning results are achieved by contacting the soil and the soiled surface with an aqueous solution containing dissolved ferrate (VI) ions (diluted or undiluted, preferably as defined above) so that at least a fraction of the soil is dissolved in the aqueous solution containing dissolved ferrate (VI) ions (diluted or undiluted, preferably as defined above) and so that a partially cleaned solid surface or a cleaned solid surface results. The further advantages and effects of the present invention (as described herein, preferably as described herein as preferred) are achieved.

[0070] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), comprising

- the following additional step after the contacting in step S3:
  S4-1 cleaning of the solid surface with water so that a further partially cleaned solid surface or a cleaned solid surface results; and/or

- the following additional step after the contacting in step S3:
  S4-2 final rinsing of the solid surface with water, preferably with water and a rinsing agent, so that a cleaned solid surface results; and/or

- the following additional step after the contacting in step S3:
  S5 drying the cleaned solid surface so that a dried cleaned solid surface results; and/or

- the following additional step before preparing or providing the soiled surface in step S2:
  S2a pre-cleaning the solid surface with water or with an aqueous solution so that the solid surface prepared or provided in step S2 is a pre-cleaned solid surface.

[0071] In many cases it is disadvantageous if significant amounts of soil, ferrate (VI) ions and/or surfactants are attached to the solid surface, after cleaning, In such cases, step S4-1 (carried out after step S3) and/or step S4-2 (carried out after step S3, preferably also carried out after step S4-1) is carried out.

[0072] In many cases it is disadvantageous if the surface of the solid surface after cleaning remains wet for undesirably long period of time. In such cases, step S5 (carried out after step S3, preferably also carried out after step S4-1, more preferably also carried out after step S4-2) is carried out.

[0073] In many cases when the solid surface to be cleaned is covered with particularly large amounts of soil, step S2a (carried out after step S2) is carried out to improve the overall cleaning result.

[0074] A further cleaned solid surface can be a cleaned solid surface.

[0075] In cases where the method is carried out in an embodiment comprising step S4, step S5 is carried out after step S3 and after step S4.

[0076] In cases where the method is carried out in an embodiment comprising step S4-1 and/or step S4-2, step S5 is carried out after step S3 and after step S4-1 and/or after step S4-2.

[0077] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- during step S3, the temperature of the aqueous solution containing dissolved ferrate (VI) ions always within the range of 15 °C to 80 °C, preferably always within the range of 20 °C to 60 °C, more preferably always within the range of 25 °C to 50 °C, yet more preferably always within the range of 27 °C to 35 °C;
  and/or

- the temperature of the aqueous solution containing dissolved ferrate (VI) ions never exceeds 80 °C, preferably never exceeds 40 °C, more preferably never exceeds 35 °C, yet more preferably never exceeds 30 °C.

[0078] The advantages associated with low temperature cleaning are combined here with very advantageous cleaning results. In many cases highly advantageous cleaning results are achieved at temperatures so low that equally advantageous cleaning results cannot be achieved at these low temperatures (under otherwise equal conditions) with surfactants instead of the aqueous solution containing dissolved ferrate (VI) ions. As a consequence, in such cases the method according to the present invention is carried out with favourably low use of energy input.

[0079] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1 contains dissolved ferrate (VI) ions in an amount of 0.0002 wt.-% to 1.2 wt.-%, preferably from 0.0006 wt.-% to 1.1 wt.-%, more preferably from 0.0034 wt.-% to 1.02 wt.-% with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1;
  and/or

- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2 contains dissolved ferrate (VI) ions in an amount of 0.0002 wt.-% to 0.025 wt.-%, preferably from 0.0006 wt.-% to 0.022 wt.-%, more preferably from 0.0008 wt.-% to 0.020 wt.-% with regard to the total mass of the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2;
  and/or

- the volume ratio of

  - the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step

S1
to

- the predefined quantity of water prepared or provided in step S1-1;
  is in the range of 1:1 to 1:2500, preferably in the range of 1:1.1 to 1:2000, more preferably in the range of 1:1.2 to 1:1500, yet more preferably in the range of 1:5 to 1:1000.

[0080] With the above-defined amounts and ratios, particularly positive combinations of the advantages and effects associated with the present invention are achieved.

[0081] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the contacting in step S3,
  and/or

- the further cleaning of the solid surface with water in step S4-1
  and/or

- the final rinsing of the solid surface with water, preferably with water and a rinsing agent, in step S4-2
  and/or

- the pre-cleaning of the solid surface with water or with an aqueous solution in step S2a
  is carried out using spray nozzles as means of application.

[0082] In many cases, step S3, step S4-1, step S4-2, step S2a and/or the overall method of the present invention are carried out favourably fast and energy efficient using spray nozzles as means of application.

[0083] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- wherein the solid surfaces are selected from the group consisting of:
  - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,

    preferably selected from the group consisting of:

    - glass, plastic, metal, wood and/or stone, each coated or uncoated,

    more preferably selected from the group consisting of:

    - glass, plastic and metal, each coated or uncoated,

    even more preferably selected from the group consisting of:

    - plastic and metal, each coated or uncoated,

    yet more preferably selected from the group consisting of:

    - plastic, preferably uncoated plastic, whereby the plastic is preferably polypropylene;
      and/or

- wherein the method is carried out in the areas selected from the group consisting of:
  - household, industry, commerce and institutions, ships, port facilities, sports and leisure facilities;
    and/or

- wherein the solid surfaces are selected from surfaces of
  - boxes,

- glass bottles and non-glass bottles,
- crockery, especially bowls, cups, plates, and serving dishes,
- cutlery,
- drinking glasses
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

preferably the solid surfaces are selected from surfaces of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

more preferably the solid surfaces are surfaces of boxes.

[0084] The effects and advantages of the present invention are particularly well achieved with the solid surfaces defined above.

[0085] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1 additionally comprises:

  - dissolved calcium ions, preferably dissolved Ca(II),
    and

  - dissolved magnesium ions, preferably dissolved Mg(II),

  preferably in a combined total amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L;
  and/or, preferably "and"

- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2 additionally comprises:

  - dissolved calcium ions, preferably dissolved Ca(II),
    and/or, preferably "and"

  - dissolved magnesium ions, preferably dissolved Mg(II),

  preferably in a combined total amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L.

[0086] In many cases it is preferred to use water containing the above-defined amounts of dissolved calcium ions, preferably dissolved Ca(II), and dissolved magnesium ions, preferably dissolved Mg(II), to produce both, the aqueous solution containing dissolved ferrate (VI) ions the diluted aqueous solution containing dissolved ferrate (VI) ions. In many cases tap water is used. In these cases, the method according to the present invention is carried out in a favourably efficient and low cost manner.

[0087] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the concentration of dissolved ferrate (VI) ions in
  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    is in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions;
    and/or
- within
  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    the ratio of
  - the amount of dissolved sodium ions, preferably dissolved Na(I),
    to
  - the amount of dissolved ferrate (VI) ions
    is in the range from 30:0.3 to 1:1, preferably in the range from 28.75:0.34 to 27.6:1.02, more preferably in the range from 27.6:1.02 to 25:1;
    and/or
- within
  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    the ratio of
  - the amount of dissolved potassium ions, preferably dissolved K(I),
    to
  - the amount of dissolved ferrate (VI) ions
    is in the range from 35.03:0.3 to 33.408:1.02, preferably in the range from 34.8:0.34 to 34.8:1.02.

[0088] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred),

- wherein the solid surface is soiled with a soil selected from the group consisting of:
  - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
    and/or
- wherein the solid surface is soiled with a soil selected from the group consisting of:
  - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group

consisting of soiling by:

- blood,
- animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish and/or fishbone
- slaughterhouse waste,
- mayonnaise,
- salad sauces,
- salad dressings,
- sauces and/or dips,
- vegetables,
- yoghurt;

- soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

- edible plant oils,
- animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish bone,
- marinades,
- butter,
- milk,
- egg, preferably egg white and/or egg yolk
- chocolate,
- margarine,
- slaughterhouse waste,
- salad sauces,
- salad dressings,
- sauces,
  and
- yoghurt;

- soiling containing carbohydrates, preferably soiling containing carbohydrates selected from the group consisting of soiling by:

- cane,
- fruit,
- ice cream,
- jam,
- dough
- juice, preferable fruit juice and/or vegetable juice,
- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,
  and
- sugar;
  and

- mixtures thereof.

[0089] The effects and advantages of the present invention are achieved.

[0090] Also solid surfaces soiled with other soils can be cleaned with the method according to the present invention.

[0091] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein the temperature

- of the aqueous solution containing dissolved ferrate (VI) ions during preparing or providing an aqueous solution containing dissolved ferrate (VI) ions in step S1;
  and/or
- of the soiled surface, during preparing or providing a soiled surface in step S2;
  and/or
- of the predefined quantity of water during preparing or providing a predefined quantity of water in step S1-1;
  and/or
- of the predefined quantity of water during contacting intermixing in step S1-2;
  and/or
- of the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions during contacting intermixing in step S1-2;
  and/or
- of the diluted aqueous solution containing dissolved ferrate (VI) ions upon resulting in step S1-2;
  and/or
- of the soiled surface during contacting in step S3;
  and/or
- of the soil on soiled surface during contacting in step S3;
  and/or
- of the soil on soiled surface during contacting in step S3;
  and/or
- of the aqueous solution containing dissolved ferrate (VI) ions during contacting in step S3;
  and/or
- of the diluted aqueous solution containing dissolved ferrate (VI) ions during contacting in step S3;
  and/or
- of the partially cleaned solid surface and the cleaned solid surface during cleaning of the solid surface with water in step S4-1;
  and/or
- of the cleaned solid surface during final rinsing of the solid surface with water in step S4-2;
  and/or
- of the cleaned solid surface and the dried cleaned solid surface during drying the cleaned solid surface in step S5;
  and/or
- of the pre-cleaned solid surface during pre-cleaning the solid surface with water or with an aqueous solution in step S2a;

never exceeds a temperature of 80 °C, preferably 60 °C, more preferably 40 °C, even more preferably 35 °C, yet more preferably 30 °C.

It is especially preferably that the temperature of solid surface and of the aqueous solution containing dissolved ferrate (VI) ions never exceeds a temperature of 80 °C, preferably 60 °C, more preferably 40 °C, even more preferably 35 °C, yet more preferably 30 °C whilst carrying out the method (as described above, preferably as identified above as preferred).

[0092] With the method according to the present invention, good cleaning results are also achieved at low temperatures, especially temperatures as defined above. These good cleaning results at low temperatures are achieved in combination with a favourably low amount of cleaning agent.

[0093] In many cases these effects and advantages are achieved in further combination with favourably little foaming.

[0094] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the cleaned solid surface
  and/or

- the dried cleaned solid surface
  is a disinfected solid surface.

[0095] In many cases, disinfection is achieved or improved by the additional use of ethaneperoxoic acid in the method according to the present invention. Depending on the requirements of the individual case, the skilled person choses alternative disinfectants and/or further disinfectants from his common general knowledge and tests their suitability (for disinfection and/or for use together with the aqueous solution containing dissolved ferrate (VI) ions) in simple routine experiments without undue burden.

[0096] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred),

- wherein

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or

  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    additionally comprise surfactants,

  - independently selected from:

    - anionic surfactants, preferably soaps, amine oxides, alkylbenzene sulfonates, alkane sulfonates, alkyl sulfates and alkylethersulfates;
      and/or

    - non-ionic surfactants, preferably fatty alcohol ethoxylates, alkylphenol ethoxylates, sorbitan fatty acid esters, alkylpolyglucosides, and N-methylglucamides;
      and/or

    - cationic surfactants, preferably quaternary ammonium compounds and salts of C_{10} to C_{22} primary amines;
      and/or

  - amphoteric surfactants, preferably amidoalkyl betaines.
    or

- wherein

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or

  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    are essentially free of surfactants, preferably completely free of surfactants.

[0097] The skilled person knows suitable surfactants from common general knowledge. The effects and advantages discussed hereinabove with regard to the use according to the present invention are achieved and the relevant teachings apply.

[0098] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein the pH of

- the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
  is never below pH 7, preferably never below pH 8, more preferably never below pH 8.5, even more preferably never below pH 9, most preferably never bellow pH 9.5.

[0099] Carrying out the method according to the present invention with a pH as defined above leads, in many cases, to particularly positive cleaning results, preferably in combination with particularly low concentrations of cleaning agent.

[0100] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred), wherein

- the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
  is
  - essentially free of chlorine bleach, preferably completely free of chlorine bleach;
    and/or
  - essentially free of hydrochloric acid, preferably completely free of hydrochloric acid;
    and/or
  - essentially free of sulfuric acid, preferably completely free of sulfuric acid;
    and/or
  - essentially free of nitric acid, preferably completely free of nitric acid;
    and/or
  - essentially free of ethylenediaminetetraacetic acid (EDTA) and salts thereof, preferably completely free of ethylenediaminetetraacetic acid (EDTA) and salts thereof;
    and/or
  - essentially free of nitrilotriacetic acid (NTA) and salts thereof, preferably completely free of nitrilotriacetic acid (NTA) and salts thereof;
    and/or
  - essentially free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof, preferably completely free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof;
    and/or
  - essentially free of methylglycinediacetic acid (MGDA) and salts thereof, preferably completely free of methylglycinediacetic acid (MGDA) and salts thereof;
    and/or
  - essentially free of β-alanine diacetic acid (β-ADA) and salts thereof, preferably completely free of β-alanine diacetic acid (ß-ADA) and salts thereof;
    and/or
  - is essentially free of nitrates, preferably completely free of nitrates;
    and/or
  - is essentially free of phosphates, preferably completely free of phosphates;
    and/or
  - is essentially free of adsorbable organic halogen compounds, preferably completely free of adsorbable organic halogen compounds.

[0101] In the field of the current invention, methods comprising the use of chlorine bleach are frequently undesirable.
[0102] In the field of the current invention, methods comprising the use of hydrochloric acid are frequently undesirable.
[0103] In the field of the current invention, methods comprising the use of sulfuric acid are frequently undesirable.
[0104] In the field of the current invention, methods comprising the use of nitric acid are frequently undesirable.
[0105] In the field of the current invention, methods comprising the use of ethylenediaminetetraacetic acid (EDTA) and salts thereof are frequently undesirable.
[0106] In the field of the current invention, methods comprising the use of nitrilotriacetic acid (NTA) and salts thereof are frequently undesirable.
[0107] In the field of the current invention, methods comprising the use of diethylenetriaminepentaacetic acid (DTPA) and salts thereof are frequently undesirable.
[0108] In the field of the current invention, methods comprising the use of methylglycinediacetic acid (MGDA) and salts thereof are frequently undesirable.
[0109] In the field of the current invention, methods comprising the use of β-alanine diacetic acid (β-ADA) and salts thereof are frequently undesirable.
[0110] In the field of the current invention, methods comprising the use of cleaning agents comprising nitrates are frequently undesirable.
[0111] In the field of the current invention, methods comprising the use of cleaning agents comprising phosphates are frequently undesirable.
[0112] In the field of the current invention, methods comprising the use of cleaning agents comprising adsorbable organic halides (AOX) are frequently undesirable.
[0113] The positive results and effects achieved with the present invention are preferably achieved without the above substances.
[0114] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred),

- wherein
  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
    and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
    contains ferrate (VI) ions in an amount in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the respective solution;
    and/or
- wherein during the contacting in step S3
  - at least a fraction of dissolved ferrate (VI) ions
    reacts with
  - at least a fraction of soil
    so that dissolved ferrate (III) ions result.

[0115] In many cases, favourably good cleaning results are achieved in combination with favourably low amount of cleaning agent when the method of the present invention is carried out with ferrate (VI) ions present in the above-defined amounts. The aforementioned effects and advantages associated with the present invention are achieved.
[0116] The present invention, with its various aspects, especially and preferably relates to a method (as described above, preferably as identified above as preferred),

- wherein the aqueous solution containing dissolved ferrate (VI) ions is provided as predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions by means of automated dosing, preferably automated dosing utilizing conductivity.

[0117] That the aqueous solution containing dissolved ferrate (VI) ions is provided as predefined quantity means that the quantity is a defined quantity based on a recipe or a defined measurement value.
[0118] Automatic dosing is known to the person skilled in the field of the present invention and the skilled person chooses suitable methods depending on the demands of the specific case. Parameters on which automatic dosing can be based,

are known to the skilled person and include result of spectroscopic measurements and results of conductivity measurements.

[0119] In many cases, the method according to the present invention is carried out in a favourably efficient way if automated dosing is used for providing the aqueous solution containing dissolved ferrate (VI) ions is provided as predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions.

[0120] The invention also relates to a use of an aqueous solution containing dissolved ferrate (VI) ions as a demulsifier, preferably in a method for cleaning a solid surface, more preferably in a method for cleaning a solid surface (as described above, preferably as identified above as preferred).

[0121] The aforementioned effects and advantages are in many cases achieved in a particularly positive manner when an aqueous solution containing dissolved ferrate (VI) ions is used as a demulsifier in a method according to the present invention (as described above, preferably as identified above as preferred).

[0122] Demulsifiers, or emulsion breakers, are a class of specialty chemicals used to separate emulsions, for example, water in oil. They are commonly used in the processing of crude oil, which is typically produced along with significant quantities of saline water. Demulsifiers and their demulsifying properties are known to the skilled person. The skilled person thus knows when a demulsifying property is observed. Demulsifiers are commercially available.

[0123] The invention also relates to a washing agent and/or cleaning agent comprising an aqueous solution containing dissolved ferrate (VI) ions.

[0124] The washing and/or cleaning agent according to the present invention is particularly well suited for the use according to the present invention and for use in the method according to the present invention.

[0125] The effects and advantages mentions in connection with the use according to the present invention and/or the method according to the present invention are achieved particularly well with a washing agent according to the present invention and/or cleaning agent according to the present invention.

[0126] Washing agent and/or cleaning agent comprising an aqueous solution containing dissolved ferrate (VI) ions are in many cases capable of washing and/or cleaning solid surfaces at lower temperatures and/or with lower amounts of washing agent and/or cleaning agent (active amounts respectively) than washing agents and/or cleaning agents based on surfactants.

[0127] The advantages associated with the invention are especially well fulfilled with a washing agent according to the present invention.

[0128] The advantages associated with the invention are especially well fulfilled with a cleaning agent according to the present invention.

[0129] The present invention, with its various aspects, especially and preferably relates to a washing agent and/or cleaning agent (as described above, preferably as identified above as preferred), comprising an aqueous solution of alkali ions, preferably K(I) ions and/or Na(I) ions, more preferably Na (I) ions.

[0130] The effects and advantages described herein with regard to the presence of alkali ions are achieved.

[0131] The present invention, with its various aspects, especially and preferably relates to a washing agent and/or cleaning agent (as described above, preferably as identified above as preferred),

- having a pH of pH 7 or more, preferably of pH 8 or more, more preferably of pH 8.5 or more, even more preferably of pH 9 or more, most preferably of pH 9.5 or more.

[0132] The present invention, with its various aspects, especially and preferably relates to a cleaning agent (preferably as described above, more preferably as identified above as preferred), comprising an aqueous solution containing dissolved ferrate (VI) ions and

- having a pH of pH 7 or more, preferably of pH 8 or more, more preferably of pH 8.5 or more, even more preferably of pH 9 or more, most preferably of pH 9.5 or more.

[0133] The effects and advantages described herein with regard to pH are achieved.

[0134] The invention also relates to a method for producing a washing agent and/or cleaning agent, preferably a washing agent and/or cleaning agent (as described above, preferably as identified above as preferred), comprising the following step:

- preparing or providing an aqueous solution comprising dissolved ferrate (VI) ions and preferred additionally comprising an aqueous solution of alkali ions, preferably K(I) ions and/or Na(I) ions, more preferred Na (I) ions and even more preferred additionally having a pH of pH 7 or more, preferably of pH 8 or more, more preferably of pH 8.5 or more, even more preferably of pH 9 or more, most preferably of pH 9.5 or more.

[0135] The washing agent according to the present invention and/or cleaning agent according to the present invention

are preferably and particularly efficiently produced in a method for producing a washing agent and/or cleaning agent according to the present invention.

[0136] The invention also relates to a solution and/or suspension, preferably washing fleet and/or wastewater, more preferably washing fleet, comprising

- dissolved ferrate (VI) ions, preferably in an amount of 0.0002 wt.-% to 1.2 wt.-%, more preferably from 0.0006 wt.-% to 1.1 wt.-%, even more preferably from 0.0034 wt.-% to 1.02 wt.-% with regard to the total mass of the solution and/or suspension;
  and
- one two or more substances selected from the group consisting of:
  - plant cell
  - animal cell
  - lipid
  - protein
  - starch
    and
  - sugar.

[0137] The effects and advantages described herein with regard to various aspects of the present invention are achieved.

[0138] The invention also relates to a cleaning machine and/or washing machine,

- comprising one, two or more a storage tanks for or containing an aqueous solution comprising dissolved ferrate (VI) ions
  and/or
- comprising one, two or more tubings for or containing an aqueous solution comprising dissolved ferrate (VI) ions and/or
- comprising one, two or more dosing devices for or containing an aqueous solution comprising dissolved ferrate (VI) ions
  and/or
- comprising one, two or more cleaning chambers and/or washing chambers
  - for washing and/or cleaning with an aqueous solution comprising dissolved ferrate (VI) ions
    and/or
  - containing an aqueous solution comprising dissolved ferrate (VI) ions
    and/or
- containing an aqueous solution comprising dissolved ferrate (VI) ions and/or
- suitable for washing and/or cleaning at least one, preferably at least ten, more preferably all, of the objects selected from the group consisting of:
  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment

and

- pallets;

preferably selected from group consisting of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

more preferably the solid surfaces are surfaces of boxes;
and/or

- for industrial use.

[0139] The method according to the present invention is preferably and advantageously carried out by means of a washing machine according to the present invention and/or a cleaning machine according to the present invention.

[0140] The effects and advantages described herein with regard to various aspects of the present invention are achieved.

[0141] The invention also relates to a kit of parts comprising:

- ferrate (VI) ions
  and

- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide

preferably comprising

- ferrate (VI) ions,
- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide
  and
- water;

more preferably comprising

- ferrate (VI) ions
- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide
- water,
  and

- a soiled object selected from the group consisting of:

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
    and
  - pallets;

preferably selected from group consisting of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

more preferably the solid surfaces are surfaces of boxes;

even more preferably comprising

- ferrate (VI) ions
- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide
- water,
- a soiled object selected from the group consisting of:
  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
    and
  - pallets;

  preferably selected from group consisting of:

  - boxes,
  - cutlery,
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
    and
  - pallets;

  more preferably the solid surfaces are surfaces of boxes;
  and
- a cleaning machine and/or washing machine, suitable for washing and/or cleaning at least one of the objects selected from the group consisting of:
  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,

- cars,
- workwear;
- personal protective equipment
  and
- pallets

preferably selected from group consisting of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

more preferably the solid surfaces are surfaces of boxes.

[0142] With the kit according to the present invention the method according to the present invention is carried out in a particularly efficient and advantageous way. With the kit according to the present invention the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface according to the present invention is realised in a particularly efficient and advantageous way.

[0143] The effects and advantages described herein with regard to various aspects of the present invention are achieved.

[0144] The invention also relates to a use of a kit (as described above, preferably as identified above as preferred) for cleaning hard surfaces,

- selected from the group consisting of:

  - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,
    and/or

  - from the group consisting of:

    - boxes,
    - glass bottles and non-glass bottles,
    - crockery, especially bowls, cups, plates, and serving dishes,
    - cutlery,
    - drinking glasses
    - cookware,
    - cars,
    - workwear;
    - personal protective equipment
      and
    - pallets

    preferably for cleaning hard surfaces, selected from the group consisting of:

    - boxes,
    - glass bottles and non-glass bottles,
    - crockery, especially bowls, cups, plates, and serving dishes,
    - cutlery,
    - drinking glasses
    - cookware,
    - cars,
    - workwear;
    - personal protective equipment

and
- pallets;

preferably selected from group consisting of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
  and
- pallets;

more preferably the solid surfaces are surfaces of boxes;

preferred from a soil

- selected from the group consisting of:

  - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt; and/or

- selected from the group consisting of:

  - for cleaning a surface soiled with a soiling selected from the group consisting of:

    - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

      - blood,
      - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
      - fish and/or fishbone
      - slaughterhouse waste,
      - mayonnaise,
      - salad sauces,
      - salad dressings,
      - sauces and/or dips,
      - vegetables,
      - yoghurt;

    - soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

      - edible plant oils,
      - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,

- fish bone,
- marinades,
- butter,
- milk,
- egg, preferably egg white and/or egg yolk
- chocolate,
- margarine,
- slaughterhouse waste,
- salad sauces,
- salad dressings,
- sauces,
  and
- yoghurt;

- soiling containing carbohydrates,
  preferably soiling containing carbohydrates selected from the group consisting of soiling by:

  - cane,
  - fruit,
  - ice cream,
  - jam,
  - dough
  - juice, preferable fruit juice and/or vegetable juice,
  - ketchup,
  - lemonade,
  - sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
  - vegetables,
  - starch,
  - syrup,
    and
  - sugar;
    and

- mixtures thereof.

[0145] With the use of the kit according to the present invention the method according to the present invention is carried out in a particularly efficient and advantageous way.

[0146] With the use of the kit according to the present invention the use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface according to the present invention is realised in a particularly efficient and advantageous way.

[0147] The effects and advantages described herein with regard to various aspects of the present invention are achieved.

Examples:

Example 1: washing of euroboxes

[0148] Cleaning experiments were carried out in a cleaning system of the type Contino CWD 1503 3-2-2 BD5, commercially available from the company KITZINGER Maschinenbau GmbH, Handewitt, Germany.

[0149] The system works according to the counterflow principle. This means that the water from zone 4 (see below) flows into zone 3 (see below). From zone 3, the water flows via overflows into zone 2 (see below) and zone 1 (see below). The overflow in zone 1 (see below) leads into the sewage system. Thus, during operation, the water volume is fed through the rinsing in zone 4.

[0150] The goods to be cleaned were solid surfaces of euroboxes (crates) in sizes E1, E2 and E3 made of polypropylene, soiled with fat, meat, and blood from the slaughter of pigs, cattle, chickens and turkeys as well as marinades and seasoning salts.

[0151] Unless specified differently, the usual operating parameters of the cleaning system as suggested by the manufacturer were used.

1-1 Solutions

[0152] The following solutions were prepared:

Solution A:

[0153] An aqueous solution containing dissolved ferrate (VI) ions with the following composition was prepared as solution A:

- dissolved ferrate (VI) ions at a concentration of 2 wt.-% with respect to the total mass of solution A; and
- dissolved sodium hydroxide at a concentration of 50 wt.-% with respect to the total mass of solution A.

[0154] No further additives were added to solution A, but account for source of water as defined in this present example.

Solution B:

[0155] An aqueous solution containing dissolved ferrate (VI) ions with the following composition was prepared as solution B by suitable dilution of solution A (see hereinabove) with water:

- dissolved ferrate (VI) ions at a concentration of 0.0008 wt.-% with respect to the total mass of solution B; and
- dissolved sodium hydroxide at a concentration of 0.02 wt.-% with respect to the total mass of solution B.

[0156] No further additives were added to Solution B, but account for source of water as defined in this present example. After preparation, Solution B was used directly after preparation.

Solution C:

[0157] An aqueous solution containing ethaneperoxoic acid (CAS Number 79-21-0) was prepared as solution C so that solution C contained 0.03 wt.-% of ethaneperoxoic acid with respect to the total mass of solution C. No further additives were added to Solution C but account for source of water as defined in this present example. Solution C was used directly after preparation.

1-2 Procedure

[0158] The euroboxes were transported through the machine by means of a conveyor belt and pass through the following five zones:

1. First the euroboxes pass through the "pre-cleaning" zone in which the euroboxes are pre-cleaned by application of water at ca. 20 °C via spray nozzles with a pressure of 2 bar. No heating is applied in this zone.

2. After the "pre-cleaning" zone, the conveyor belt transports the euroboxes to the second zone, the "main washing" zone. In the "main washing" zone, the euroboxes are washed by application of Solution B (as described hereinabove) at ca. 30 °C via spray nozzles with a pressure of 2 bar.

3. After the "main washing" zone, the conveyor belt transports the euroboxes to the third zone, the "clear washing with spray pressure" zone. In the "clear washing with spray pressure" zone, the euroboxes are washed by application water at ca. 20 °C via spray nozzles with a pressure of 2 bar. No heating is applied in this zone.

4. After the "clear washing with spray pressure" zone, the conveyor belt transports the euroboxes to the fourth zone, the "rinsing" zone, where the euroboxes are rinsed with of Solution C (as described hereinabove) at ca. 20 °C (500 L/h)

5. After the "rinsing" zone, the conveyor belt transports the euroboxes to the fifth zone, the "drying" zone, where the boxes are dried by a fan.

[0159] In cases where small residues of ethaneperoxoic acid on the cleaned euroboxes are problematic, solution C can alternatively be used for washing in the "clear washing with spray pressure" zone (third zone) instead of water and with pure water being used in the rinsing zone (fourth zone), instead of solution C.

Comparative example A

[0160] Cleaning experiments in comparative example A were carried out in the same cleaning system, with the same solutions, the same parameters and according to the same procedure as in Example 1 of the present text with the only exception that Ferrate (VI) was not present in the solutions and instead suitable mixtures of surfactants were used. Specifically this means that the same temperatures were used and that the total mass concentration of surfactants in comparative example A was equal to the total mass concentration of dissolved ferrate (VI) ions in Example 1 (hereinabove).

[0161] The goods to be cleaned were solid surfaces of euroboxes (crates) in sizes E1, E2 and E3 made of polypropylene, soiled with fat, meat, and blood from the slaughter of pigs, cattle, chickens and turkeys as well as marinades and seasoning salts.

Example 2: Optical evaluation of cleaning results

[0162] Euroboxes (crates) in sizes E1, E2 and E3 made of polypropylene, soiled with fat, meat, and blood from the slaughter of pigs, cattle, chickens and turkeys as well as marinades and seasoning salts were cleaned according to example 1 of the present text and according to comparative example A of the current text.

[0163] After drying (after exiting the drying zone), the euroboxes were visually inspected and the cleaning results were assessed in a blind test by a panel of 10 people, each with several years of experience with industrial cleaning.

[0164] In all cases, the cleaning results for the euroboxes cleaned according to example 1 were assessed to be better than the cleaning results for the euroboxes cleaned according to comparative example A.

Example 3:

[0165] Euroboxes (crates) in sizes E1, E2 and E3 made of polypropylene, soiled with fat, meat, and blood from the slaughter of pigs, cattle, chickens and turkeys as well as marinades and seasoning salts were cleaned according to example 1 of the present text and according to comparative example A of the current text.

[0166] After drying (after exiting the drying zone), an ATP swab-test was made on a cleaned surface of each eurobox using an "Lumitester SMART", commercially available from the company Zeller GmbH, Austria. The ATP-value is a well-accepted indicator of the quantitative load of organic residues in industrial cleaning.

[0167] For the euroboxes cleaned according to example 1, all ATP-values were below 1000 RLU (Relative Light Units) which is regularly considered as limit value for the cleanliness of cleaned surfaces. For the euroboxes cleaned according to comparative example A, all ATP-values were above 1000 RLU.

Example 4:

[0168] Euroboxes (crates) in sizes E1, E2 and E3 made of polypropylene, soiled with fat, meat, and blood from the slaughter of pigs, cattle, chickens and turkeys as well as marinades and seasoning salts were cleaned according to example 1 of the present text and according to comparative example A of the current text.

[0169] After drying (after exiting the drying zone), a swab-sample was taken from a cleaned surface of each eurobox, transferred to suitable cell culture media. Then the media were incubated in an incubator for 48 h at 37°C and the number of colony-forming units (CFU) was counted.

[0170] For the euroboxes cleaned according to example 1, all ATP-values were below 10 CFU/ 10 cm^2. For the euroboxes cleaned according to comparative example A, all ATP-values were above 10 CFU/ 10cm^2.

Example 5:

[0171] Further own experiments have shown that equally positive results than those observed in Examples 2, 3 and 4 were obtained when surfaces were cleaned that were selected from:

- glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated.

[0172] In these experiments, the equally positive results were obtained when cleaning the following soiling:

- soiling containing protein, specifically:

  - blood,
  - animal meat originating from poultry, pig and cattle,
  - animal bones originating from poultry, pig and cattle,
  - fish and fishbone
  - slaughterhouse waste,
  - mayonnaise,
  - salad sauces,
  - salad dressings,
  - sauces and/or dips,
  - vegetables,
  - yoghurt;

- soiling containing edible fats and/or edible oils, specifically:

  - edible plant oils,
  - animal fat originating from poultry, pig, cattle and fish,
  - animal bones originating from poultry, pig and cattle,
  - fish bone,
  - marinades,
  - butter,
  - milk,
  - egg, preferably egg white and/or egg yolk
  - chocolate,
  - margarine,
  - slaughterhouse waste,
  - salad sauces,
  - salad dressings,
  - sauces,
    and
  - yoghurt;

- soiling containing carbohydrates, specifically:

  - cane,
  - fruit,
  - ice cream,
  - jam,
  - dough
  - juice, preferable fruit juice and/or vegetable juice,
  - ketchup,
  - lemonade,
  - sauces and dips including salad sauces, salad dressings, and dips;
  - vegetables,
  - starch,
  - syrup,
    and
  - sugar;
    and

- mixtures thereof.

Claims

1. Use of an aqueous solution containing dissolved ferrate (VI) ions for cleaning a solid surface

- whereby the solid surface is selected from the group consisting of:

  - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated, and

- whereby the aqueous solution containing dissolved ferrate (VI) ions is used

  - for cleaning a surface soiled with a soil selected from the group consisting of:

    - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
      or

  - for cleaning a surface soiled with a soiling selected from the group consisting of:

    - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

      - blood,
      - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
      - fish and/or fishbone
      - slaughterhouse waste,
      - mayonnaise,
      - salad sauces,
      - salad dressings,
      - sauces and/or dips,
      - vegetables,
      - yoghurt;

    - soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

      - edible plant oils,
      - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
      - fish bone,
      - marinades,
      - butter,
      - milk,
      - egg, preferably egg white and/or egg yolk
      - chocolate,
      - margarine,
      - slaughterhouse waste,
      - salad sauces,
      - salad dressings,
      - sauces,
      and
      - yoghurt;

- soiling containing carbohydrates,
preferably soiling containing carbohydrates selected from the group consisting of soiling by:

- cane,
- fruit,
- ice cream,
- jam,
- dough
- juice, preferable fruit juice and/or vegetable juice,
- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,
and
- sugar;
and

- mixtures thereof.

2. Use according to claim 1,

- whereby the solid surfaces are selected from the group consisting of:

  - glass, plastic, metal, wood and/or stone, each coated or uncoated,

  preferably selected from the group consisting of:

  - glass, plastic and metal, each coated or uncoated,

  more preferably selected from the group consisting of:

  - plastic and metal, each coated or uncoated,

  even more preferably selected from the group consisting of:

  - plastic, coated or uncoated, whereby the plastic is preferably polypropylene, more preferably uncoated polypropylene;
  and/or

- whereby the use preferably occurs in the areas selected from the group consisting of:

  - household, industry, commerce and institutions, ships, port facilities, sports and leisure facilities;
  and/or

- whereby the solid surfaces are selected from surfaces of

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
  and

- pallets;
preferably the solid surfaces are selected from surfaces of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment
and
- pallets;

more preferably the solid surfaces are surfaces of boxes;
and/or

- whereby the aqueous solution of ferrate (VI) additionally comprises:

- dissolved calcium ions, preferably dissolved Ca(II),
and/or
- dissolved magnesium ions, preferably dissolved Mg(II) ;
preferably in an amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L;
and/or

- whereby

- the concentration of dissolved ferrate (VI) ions in the aqueous solution containing dissolved ferrate (VI) ions is in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions;
and/or
- within the aqueous solution containing dissolved ferrate (VI) ions, the ratio of

- the amount of dissolved sodium ions, preferably dissolved Na(I),
to
- the amount of dissolved ferrate (VI) ions
is in the range from 30:0.3 to 1:1, preferably in the range from 28.75:0.34 to 27.6:1.02, more preferably in the range from 27.6:1.02 to 25:1;
and/or

- within the aqueous solution containing dissolved ferrate (VI) ions, the ratio of

- the amount of dissolved potassium ions, preferably dissolved K(I),
to
- the amount of dissolved ferrate (VI) ions
is in the range from 35.03:0.3 to 33.408:1.02, preferably in the range from 34.8:0.34 to 34.8:1.02.

3. Use according to any of the preceding claims,

- whereby during the use the temperature of the aqueous solution containing dissolved ferrate (VI) ions never exceeds a temperature of 85 °C, preferably 60 °C, more preferably 50 °C, even more preferably 30 °C, most preferably 25 °C;
and/or
- whereby

- the aqueous solution containing dissolved ferrate (VI) ions additionally contains ethaneperoxoic acid,
and/or
- the cleaning comprises a disinfection.

4. Use according to any of the preceding claims,

- whereby the aqueous solution containing dissolved ferrate (VI) ions

  - additionally comprises surfactants,

    - independently selected from:

      - anionic surfactants, preferably soaps, amine oxides, alkylbenzene sulfonates, alkane sulfonates, alkyl sulfates and alkylethersulfates;
      and/or
      - non-ionic surfactants, preferably fatty alcohol ethoxylates, alkylphenol ethoxylates, sorbitan fatty acid esters, alkylpolyglucosides, and N-methylglucamides;
      and/or
      - cationic surfactants, preferably quaternary ammonium compounds and salts of C_{10} to C_{22} primary amines;
      and/or
      - amphoteric surfactants, preferably amidoalkyl betaines;
      and/or

- whereby the aqueous solution containing dissolved ferrate (VI) ions is essentially free of surfactants, preferably completely free of surfactants;
and/or
- whereby during the use the pH of the aqueous solution containing dissolved ferrate (VI) ions is never below pH 7, preferably never below pH 8, more preferably never below pH 8.5, even more preferably never below pH 9, most preferably never bellow pH 9.5;
and/or
- whereby the aqueous solution containing dissolved ferrate (VI) ions

  - is essentially free of chlorine bleach, preferably completely free of chlorine bleach;
  and/or
  - is essentially free of hydrochloric acid, preferably completely free of hydrochloric acid;
  and/or
  - is essentially free of sulfuric acid, preferably completely free of sulfuric acid;
  and/or
  - is essentially free of nitric acid, preferably completely free of nitric acid;
  and/or
  - is essentially free of ethylenediaminetetraacetic acid (EDTA) and salts thereof, preferably completely free of ethylenediaminetetraacetic acid (EDTA) and salts thereof;
  and/or
  - is essentially free of nitrilotriacetic acid (NTA) and salts thereof, preferably completely free of nitrilotriacetic acid (NTA) and salts thereof;
  and/or
  - is essentially free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof, preferably completely free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof;
  and/or
  - is essentially free of methylglycinediacetic acid (MGDA) and salts thereof, preferably completely free of methylglycinediacetic acid (MGDA) and salts thereof;
  and/or
  - is essentially free of ß-alanine diacetic acid (ß-ADA) and salts thereof, preferably completely free of ß-alanine diacetic acid (ß-ADA) and salts thereof;
  and/or

- whereby during the use of the aqueous solution containing dissolved ferrate (VI) ions for cleaning surfaces,

  - the surface is a soiled surface
  and/or,
  - at least a fraction of dissolved ferrate (VI) ions

reacts with
at least a fraction of soil
so that dissolved iron (III) ions result.

5. Method for cleaning a solid surface, comprising the following steps:

S1 preparing or providing an aqueous solution containing dissolved ferrate (VI) ions;
preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions, more preferably preparing or providing a predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions in a predefined quantity;
S2 preparing or providing a soiled surface

- wherein the solid surface is selected from the group consisting of:

  - glass, ceramic, plastic, metal, wood and/or stone, each coated or uncoated,
  and

- wherein the solid surface is soiled

  - with a soil selected from the group consisting of:

    - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt; or

  - with a soil selected from the group consisting of:

    - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

      - blood,
      - animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
      - fish and/or fishbone
      - slaughterhouse waste,
      - mayonnaise,
      - salad sauces,
      - salad dressings,
      - sauces and/or dips,
      - vegetables,
      - yoghurt;

    - soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

      - edible plant oils,
      - animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
      - animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
      - fish bone,

- marinades,
- butter,
- milk,
- egg, preferably egg white and/or egg yolk
- chocolate,
- margarine,
- slaughterhouse waste,
- salad sauces,
- salad dressings,
- sauces,

and

- yoghurt;

- soiling containing carbohydrates,

preferably soiling containing carbohydrates selected from the group consisting of soiling by:

- cane,
- fruit,
- ice cream,
- jam,
- dough
- juice, preferable fruit juice and/or vegetable juice,
- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,

and

- sugar;

and

- mixtures thereof.

6. Method according to claim 5,

- whereby

the aqueous solution containing dissolved ferrate (VI) ions is prepared or provided in step S1 in a predefined quantity;

and

- the following additional steps are carried out after preparing or providing an aqueous solution containing dissolved ferrate (VI) ions in step S1:

S1-1 preparing or providing a predefined quantity of water;

and

S1-2 contacting intermixing of

- the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1;

and

- the predefined quantity of water prepared or provided in step S1-1;

so that a diluted aqueous solution containing dissolved ferrate (VI) ions results;

and/or

- whereby the method comprises the following step:

S3 contacting

- the soiled surface prepared or provided in step S2
and
- the soil on soiled surface prepared or provided in step S2
with
- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1,
or

the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
so that at least a fraction of the soil is dissolved in the aqueous solution containing dissolved ferrate (VI) ions or in the diluted aqueous solution containing dissolved ferrate (VI) ions
and
so that a partially cleaned solid surface or a cleaned solid surface results.

7. Method according to claim 6, comprising

- the following additional step after the contacting in step S3:
S4-1 cleaning of the solid surface with water so that a further partially cleaned solid surface or a cleaned solid surface results; and/or
- the following additional step after the contacting in step S3:
S4-2 final rinsing of the solid surface with water, preferably with water and a rinsing agent, so that a cleaned solid surface results; and/or
- the following additional step after the contacting in step S3:
S5 drying the cleaned solid surface so that a dried cleaned solid surface results; and/or
- the following additional step before preparing or providing the soiled surface in step S2:
S2a pre-cleaning the solid surface with water or with an aqueous solution so that the solid surface prepared or provided in step S2 is a pre-cleaned solid surface.

8. Method according to any of the preceding claims 5 to 7,

- wherein

- during step S3, the temperature of the aqueous solution containing dissolved ferrate (VI) ions always within the range of 15 °C to 80 °C, preferably always within the range of 20 °C to 60 °C, more preferably always within the range of 25 °C to 50 °C, yet more preferably always within the range of 27 °C to 35 °C;
and/or
- the temperature of the aqueous solution containing dissolved ferrate (VI) ions never exceeds 80 °C, preferably never exceeds 40 °C, more preferably never exceeds 35 °C, yet more preferably never exceeds 30 °C;
and/or

- wherein

- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1 contains dissolved ferrate (VI) ions in an amount of 0.15 wt.-% to 1.2 wt.-%, preferably from 0.2 wt.-% to 1.1 wt.-%, more preferably from 0.34 wt.-% to 1.02 wt.-% with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1;
and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2 contains dissolved ferrate (VI) ions in an amount of 0.0015 wt.-% to 0.025 wt.-%, preferably from 0.002 wt.-% to 0.022 wt.-%, more preferably from 0.0034 wt.-% to 0.020 wt.-% with regard to the total mass of the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2;
and/or
- the volume ratio of
- the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1
to
- the predefined quantity of water prepared or provided in step S1-1;
is in the range of 1:1 to 1:2500, preferably in the range of 1:1.1 to 1:2000, more preferably in the range of 1:1.2

to 1:1500, yet more preferably in the range of 1:5 to 1:1000;
and/or

- wherein

  - the contacting in step S3,
  and/or
  - the further cleaning of the solid surface with water in step S4-1
  and/or
  - the final rinsing of the solid surface with water, preferably with water and a rinsing agent, in step S4-2
  and/or
  - the pre-cleaning of the solid surface with water or with an aqueous solution in step S2a
  is carried out using spray nozzles as means of application;
  and/or

- wherein

  - the solid surfaces are selected from the group consisting of:

    - glass, plastic, metal, wood and/or stone, each coated or uncoated,
    preferably selected from the group consisting of:

      - glass, plastic and metal, each coated or uncoated,

    more preferably selected from the group consisting of:

      - plastic and metal, each coated or uncoated,

    even more preferably selected from the group consisting of:

      - plastic, coated or uncoated, whereby the plastic is preferably polypropylene, more preferably uncoated polypropylene;
      and/or

- wherein the method is carried out in the areas selected from the group consisting of:

  - household, industry, commerce and institutions, ships, port facilities, sports and leisure facilities;
  and/or

- wherein the solid surfaces are selected from surfaces of

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
  and
  - pallets;
  preferably the solid surfaces are selected from surfaces of:

    - boxes,
    - cutlery,
    - cookware,
    - cars,

- workwear;
- personal protective equipment
and
- pallets;

more preferably the solid surfaces are surfaces of boxes;
and/or

- wherein

- the aqueous solution containing dissolved ferrate (VI) ions prepared or provided in step S1 additionally comprises:

- dissolved calcium ions, preferably dissolved Ca(II),
and/or
- dissolved magnesium ions, preferably dissolved Mg(II),

referably in an amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L;
and/or

- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2 additionally comprises:

- dissolved calcium ions, preferably dissolved Ca(II)
and/or
- dissolved magnesium ions, preferably dissolved Mg(II),

preferably in an amount of 1 mg/L to 950 mg/L, more preferably in an amount of 2 mg/L to 100 mg/L, even more preferably in an amount of 3 mg/L to 40 mg/L;
and/or

- wherein

- the concentration of dissolved ferrate (VI) ions in

- the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
is in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the aqueous solution containing dissolved ferrate (VI) ions;
and/or

- within

- the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
the ratio of
- the amount of dissolved sodium ions, preferably dissolved Na(I),
to
- the amount of dissolved ferrate (VI) ions
is in the range from 30:0.3 to 1:1, preferably in the range from 28.75:0.34 to 27.6:1.02, more preferably in the range from 27.6:1.02 to 25:1;
and/or

- within

- the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
and/or
- the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
the ratio of
- the amount of dissolved potassium ions, preferably dissolved K(I),
to
- the amount of dissolved ferrate (VI) ions
is in the range from 35.03:0.3 to 33.408:1.02, preferably in the range from 34.8:0.34 to 34.8:1.02.

9. Method according to any of the preceding claims 5 to 8,

- wherein the solid surface is soiled

- with a soil selected from the group consisting of:

- alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
and/or

- with a soil selected from the group consisting of:

- soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

- blood,
- animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish and/or fishbone
- slaughterhouse waste,
- mayonnaise,
- salad sauces,
- salad dressings,
- sauces and/or dips,
- vegetables,
- yoghurt;

- soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

- edible plant oils,
- animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish bone,
- marinades,
- butter,
- milk,
- egg, preferably egg white and/or egg yolk
- chocolate,
- margarine,

- slaughterhouse waste,
- salad sauces,
- salad dressings,
- sauces,
and
- yoghurt;

- soiling containing carbohydrates, preferably soiling containing carbohydrates selected from the group consisting of soiling by:

- cane,
- fruit,
- ice cream,
- jam,
- dough
- juice, preferable fruit juice and/or vegetable juice,
- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,
and
- sugar;
and

- mixtures thereof;
and/or

- wherein the temperature

- of the aqueous solution containing dissolved ferrate (VI) ions during preparing or providing an aqueous solution containing dissolved ferrate (VI) ions in step S1;
and/or
- of the soiled surface, during preparing or providing a soiled surface in step S2;
and/or
- of the predefined quantity of water during preparing or providing a predefined quantity of water in step S1-1;
and/or
- of the predefined quantity of water during contacting intermixing in step S1-2;
and/or
- of the predefined quantity of the aqueous solution containing dissolved ferrate (VI) ions during contacting intermixing in step S1-2;
and/or
- of the diluted aqueous solution containing dissolved ferrate (VI) ions upon resulting in step S1-2;
and/or
- of the soiled surface during contacting in step S3;
and/or
- of the soil on soiled surface during contacting in step S3;
and/or
- of the soil on soiled surface during contacting in step S3;
and/or
- of the aqueous solution containing dissolved ferrate (VI) ions during contacting in step S3;
and/or
- of the diluted aqueous solution containing dissolved ferrate (VI) ions during contacting in step S3;
and/or
- of the partially cleaned solid surface and the cleaned solid surface during cleaning of the solid surface with water in step S4-1;

and/or
- of the cleaned solid surface during final rinsing of the solid surface with water in step S4-2;
and/or
- of the cleaned solid surface and the dried cleaned solid surface during drying the cleaned solid surface in step S5;
and/or
- of the pre-cleaned solid surface during pre-cleaning the solid surface with water or with an aqueous solution in step S2a;
never exceeds a temperature of 80 °C, preferably 60 °C, more preferably 40 °C, even more preferably 35 °C, yet more preferably 30 °C;
especially preferred the temperature of solid surface and of the aqueous solution containing dissolved ferrate (VI) ions never exceeds a temperature of 80 °C, preferably 60 °C, more preferably 40 °C, even more preferably 35 °C, yet more preferably 30 °C whilst carrying out the method;
and/or

- wherein

  - the cleaned solid surface
  and/or
  - the dried cleaned solid surface
  is a disinfected solid surface;
  and/or

- wherein

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,

    - additionally comprise surfactants, independently selected from:

      - anionic surfactants, preferably soaps, amine oxides, alkylbenzene sulfonates, alkane sulfonates, alkyl sulfates and alkylethersulfates;
      and/or
      - non-ionic surfactants, preferably fatty alcohol ethoxylates, alkylphenol ethoxylates, sorbitan fatty acid esters, alkylpolyglucosides, and N-methylglucamides;
      and/or
      - cationic surfactants, preferably quaternary ammonium compounds and salts of C_{10} to C_{22} primary amines;
      and/or
      - amphoteric surfactants, preferably amidoalkyl betaines;
      or

    - wherein

      - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
      and/or
      - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,

    are essentially free of surfactants, preferably completely free of surfactants;
    and/or

- wherein the pH of

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,

is never below pH 7, preferably never below pH 8, more preferably never below pH 8.5, even more preferably never below pH 9, most preferably never bellow pH 9.5;
and/or

- wherein

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,
  is

    - essentially free of chlorine bleach, preferably completely free of chlorine bleach;
    and/or
    - essentially free of hydrochloric acid, preferably completely free of hydrochloric acid;
    and/or
    - essentially free of sulfuric acid, preferably completely free of sulfuric acid;
    and/or
    - essentially free of nitric acid, preferably completely free of nitric acid;
    and/or
    - essentially free of ethylenediaminetetraacetic acid (EDTA) and salts thereof, preferably completely free of ethylenediaminetetraacetic acid (EDTA) and salts thereof;
    and/or
    - essentially free of nitrilotriacetic acid (NTA) and salts thereof, preferably completely free of nitrilotriacetic acid (NTA) and salts thereof;
    and/or
    - essentially free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof, preferably completely free of diethylenetriaminepentaacetic acid (DTPA) and salts thereof;
    and/or
    - essentially free of methylglycinediacetic acid (MGDA) and salts thereof, preferably completely free of methylglycinediacetic acid (MGDA) and salts thereof;
    and/or
    - essentially free of ß-alanine diacetic acid (ß-ADA) and salts thereof, preferably completely free of ß-alanine diacetic acid (ß-ADA) and salts thereof.

10. Method according to any of the preceding claims 5 to 9,

- wherein

  - the aqueous solution containing dissolved ferrate (VI) ions, prepared or provided in step S1,
  and/or
  - the diluted aqueous solution containing dissolved ferrate (VI) ions resulting in step S1-2,

  contains ferrate (VI) ions in an amount in the range from 0.0002 wt.-% to 1.10 wt.-%, preferably in the range from 0.0006 wt.-% to 0.07 wt.-%, more preferably in the range from 0.0008 wt.-% to 0.034 wt.-%, with regard to the total mass of the respective solution;
  and/or
  - wherein during the contacting in step S3

    - at least a fraction of dissolved ferrate (VI) ions
    reacts with
    - at least a fraction of soil
    so that dissolved ferrate (III) ions result;
    and/or

- wherein the aqueous solution containing dissolved ferrate (VI) ions is provided as predefined quantity of an aqueous solution containing dissolved ferrate (VI) ions by means of automated dosing, preferably automated dosing utilizing conductivity.

11. Use of an aqueous solution containing dissolved ferrate (VI) ions as a demulsifier, preferably in a method for cleaning a solid surface, more preferably in a method for cleaning a solid surface as defined in any of claims 5 to 10.

12. Washing agent and/or cleaning agent comprising an aqueous solution containing dissolved ferrate (VI) ions and

- having a pH of pH 7 or more, preferably of pH 8 or more, more preferably of pH 8.5 or more, even more preferably of pH 9 or more, most preferably of pH 9.5 or more.

13. Method for producing a cleaning agent, preferably a cleaning agent according to the preceding claim 12, comprising the following step:

- preparing or providing an aqueous solution comprising dissolved ferrate (VI) ions and preferred additionally comprising an aqueous solution of alkali ions, preferably K(I) ions and/or Na(I) ions, more preferred Na (I) ions and even more preferred additionally having a pH of pH 7 or more, preferably of pH 8 or more, more preferably of pH 8.5 or more, even more preferably of pH 9 or more, most preferably of pH 9.5 or more.

14. Solution and/or suspension, preferably washing fleet and/or wastewater, more preferably washing fleet, comprising

- dissolved ferrate (VI) ions, preferably in an amount of 0.0002 wt.-% to 1.2 wt.-%, more preferably from 0.0006 wt.-% to 1.1 wt.-%, even more preferably from 0.0034 wt.-% to 1.02 wt.-% with regard to the total mass of the solution and/or suspension;
and
- one two or more substances selected from the group consisting of:

  - plant cell
  - animal cell
  - lipid
  - protein
  - starch
  and
  - sugar.

15. Cleaning machine,

- comprising one, two or more a storage tanks containing an aqueous solution comprising dissolved ferrate (VI) ions
and/or
- comprising one, two or more tubings containing an aqueous solution comprising dissolved ferrate (VI) ions
and/or
- comprising one, two or more dosing devices containing an aqueous solution comprising dissolved ferrate (VI) ions
and/or
- comprising one, two or more cleaning chambers

  - for cleaning with an aqueous solution comprising dissolved ferrate (VI) ions
  and/or
  - containing an aqueous solution comprising dissolved ferrate (VI) ions
  and/or

- containing an aqueous solution comprising dissolved ferrate (VI) ions
and/or
- suitable for cleaning at least one, preferably at least ten, more preferably all, of the objects selected from the group consisting of:

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,

- cutlery,
- drinking glasses
- cookware,
- cars,
- workwear;
- personal protective equipment
and
- pallets;
preferably selected from group consisting of:

  - boxes,
  - cutlery,
  - cookware,
  - cars,
  - workwear,
  - personal protective equipment,
  and
  - pallets;

more preferably the solid surfaces are surfaces of boxes;
and/or

- for industrial use.

16. Kit of parts
comprising:

- ferrate (VI) ions
- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide
- water,
and
- a soiled object selected from the group consisting of:

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment
  and
  - pallets;
  preferably selected from group consisting of:

    - boxes,
    - cutlery,
    - cookware,
    - cars,
    - workwear;
    - personal protective equipment
    and
    - pallets;

  more preferably the solid surfaces are surfaces of boxes;

preferably comprising

- ferrate (VI) ions
- alkali hydroxide, preferably sodium hydroxide and/or potassium hydroxide, more preferably sodium hydroxide
- water,
- a soiled object selected from the group consisting of:

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment

  and
  - pallets;

  preferably selected from group consisting of:

    - boxes,
    - cutlery,
    - cookware,
    - cars,
    - workwear;
    - personal protective equipment

    and
    - pallets;

  more preferably the solid surfaces are surfaces of boxes;

  and

- a cleaning machine and/or washing machine, suitable for washing and/or cleaning at least one of the objects selected from the group consisting of:

  - boxes,
  - glass bottles and non-glass bottles,
  - crockery, especially bowls, cups, plates, and serving dishes,
  - cutlery,
  - drinking glasses
  - cookware,
  - cars,
  - workwear;
  - personal protective equipment

  and
  - pallets

  preferably selected from group consisting of:

    - boxes,
    - cutlery,
    - cookware,
    - cars,
    - workwear;
    - personal protective equipment

    and
    - pallets;

  more preferably the solid surfaces are surfaces of boxes.

17. Use of a kit according to claim 16 for cleaning hard surfaces, selected from the group consisting of:

- boxes,
- glass bottles and non-glass bottles,
- crockery, especially bowls, cups, plates, and serving dishes,
- cutlery,
- drinking glasses
- cookware,
- cars,
- workwear;
- personal protective equipment

and

- pallets

preferably for cleaning hard surfaces, selected from the group consisting of:

- boxes,
- glass bottles and non-glass bottles,
- crockery, especially bowls, cups, plates, and serving dishes,
- cutlery,
- drinking glasses
- cookware,
- cars,
- workwear;
- personal protective equipment

and

- pallets;

preferably selected from group consisting of:

- boxes,
- cutlery,
- cookware,
- cars,
- workwear;
- personal protective equipment

and

- pallets;

more preferably the solid surfaces are surfaces of boxes;

from a soil

- selected from the group consisting of:

  - alcoholic beverages, animal excrement, ash, baby food, balsamic vinegar, berries, beverages containing coffee, bird droppings, blood, butter, cane, canned milk, chalk, chocolate, cocoa, coffee, cola, cream, curd, edible fat, edible oil, flyspeck, fruit, grass, grease, ice cream, iodine, jam, juice, preferable fruit juice and/or vegetable juice, ketchup, lemonade, liquorice, margarine, marmalade, mayonnaise, milk, mould, mustard, nut nougat cream, nuts, oil, pesto, pollen, porridge, pudding, pus, red wine, salad sauces, salad dressings, saliva, sauces, slaughterhouse waste, sperm, spices, starch, syrup, tomato, tomato sauce, tsatsiki, urine, vaseline, vegetables, vomit, wax, and yoghurt;
    and/or

- selected from the group consisting of:

  - for cleaning a surface soiled with a soiling selected from the group consisting of:

    - soiling containing protein, preferably one, two, three or more soiling containing protein selected from the group consisting of soiling by:

      - blood,

- animal meat, preferably animal meat originating from animals selected from the group consisting of: poultry, pig and cattle,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish and/or fishbone
- slaughterhouse waste,
- mayonnaise,
- salad sauces,
- salad dressings,
- sauces and/or dips,
- vegetables,
- yoghurt;

- soiling containing edible fats and/or edible oils preferably one, two, three or more soiling containing edible fats and/or edible oils selected form the group consisting of soiling by:

- edible plant oils,
- animal fat, preferably animal fat originating from animals selected from the group consisting of: poultry, pig, cattle and fish,
- animal bones, preferably animal bones originating from animals selected from the group consisting of: poultry, pig and cattle,
- fish bone,
- marinades,
- butter,
- milk,
- egg, preferably egg white and/or egg yolk
- chocolate,
- margarine,
- slaughterhouse waste,
- salad sauces,
- salad dressings,
- sauces,
and
- yoghurt;

- soiling containing carbohydrates,
preferably soiling containing carbohydrates selected from the group consisting of soiling by:

- cane,
- fruit,
- ice cream,
- jam,
- dough
- juice, preferable fruit juice and/or vegetable juice,
- ketchup,
- lemonade,
- sauces and dips, preferably selected from: salad sauces, salad dressings, and dips;
- vegetables,
- starch,
- syrup,
and
- sugar;
and

- mixtures thereof.

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 3271

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2008/112657 A1 (BATTELLE MEMORIAL INSTITUTE [US]; MONZYK BRUCE F [US] ET AL.) 18 September 2008 (2008-09-18) * example 2 * * page 36, line 22 - line 34 * * claims 1, 2 *	1-17	INV. C11D3/04 C11D7/10 C11D3/39
X	CN 103 756 802 A (ZHONGSHAN TORCH POLYTECHNIC; LIU YINGCHUN; HUANG YONG) 30 April 2014 (2014-04-30) * example 1 * * paragraph [0047] *	1-14,16, 17	
X	Anonymous: "Cleaning trial at virus-filled greenhouses shows strength of new cleaning agent", , 13 July 2023 (2023-07-13), pages 1-3, XP093165534, Retrieved from the Internet: URL:https://www.floraldaily.com/article/9544293/cleaning-trial-at-virus-filled-greenhouses-shows-strength-of-new-cleaning-agent/ * page 2 - page 3 *	1-14,16, 17	
A	CN 115 975 735 A (NINGBO TOPCENTRAL NEW MAT CO LTD) 18 April 2023 (2023-04-18) * the whole document *	1-17	

TECHNICAL FIELDS SEARCHED (IPC)
C11D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	4 February 2025	Placke, Daniel

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 24 20 3271

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04-02-2025

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