product in combination with another material, part of the coloring agent used to color the leather can migrate to this other material, thus deteriorating the initial aesthetic appearance of the product. Poor lightfastness of certain coloring agents has also been observed. We also sometimes observe unwanted yellowing of the finished leather when it has been fatliquored with agents containing fatty acids: the destruction of these fatty acids over time causes this yellowing which is damaging to the initial aesthetic appearance of the product.

Thus, it appears that with the conventional leather preparation methods, at least part of the treatment agents added to the leather during the ennobling steps may be caused to be separated from the finished leather during the lifespan of a leather object made with such finished leather. This phenomenon is not desirable.

Document CN 111 500 799 A1 describes a method for tanning and retanning buffalo hides using a macromolecule which is a silane coupling agent.

There therefore remains a need for a method for preparing finished leather which would make it possible to provide the leather with one or several ennobling properties by means of one or several treatment agents, such that this or these treatment agent(s) would remain fixed to the leather in an optimal manner during the lifespan of the finished leather and independently of the circumstances in which this finished leather is used.

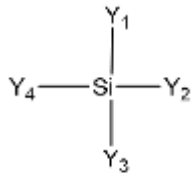
The applicant has developed a new method for preparing a finished leather making it possible to fix one or several treatment agents on the leather in an optimal and durable manner. For this, the preparation method according to the disclosure comprises the use of at least one silylated treatment agent during the tanning step and/or during a subsequent ennobling step, the tanning step comprising the use of a silicic acid precursor of ($Si(OH)_4$).

In one aspect, the present disclosure refers to a finished leather comprising at least one ennobling property provided by at least one silylated treatment agent, said silylated treatment agent being fixed to a three-dimensional Si-O-Si network by a covalent bond, said three-dimensional Si-O-Si network being linked by hydrogen, ionic, or covalent bonds to the collagen constituting the finished leather.

In another aspect, there is provided a method for preparing a finished leather as defined above, from raw hides, said method comprising at least the following steps:

- i) preparing raw hides in order to obtain hides ready for tanning,
- ii) tanning the hides from step i) using a tanning composition comprising at least one tanning agent of formula (I):

[Chem 1]



(I)

in which Y^1, Y^2, Y^3 and Y^4, identical or different, are selected independently of one another as being a halogen atom, a $-[OSiO_uR^1{}_{3-u}]_v$ group, a $-O-[SiO_uH_{u-1}R^1{}_{3-u}]_v-H$ group or a $-OR^2$ group, two or more of the $-[OSiO_uR^1{}_{3-u}]_v$, $O-[SiO_uH_{u-1}R^1{}_{3-u}]_v-H$ and $-OR^2$ groups being able to be connected to each other by a covalent bond, in which:

- u is an integer ranging from 0 to 3, v is an integer greater than or equal to one, and R^1 is selected as a hydrogen atom, a C_1-C_{10} alkyl group, an aryl group, a C_2-C_{10} alkenyl group, a C_2-C_{10} alkynyl group, a polyalkylene oxide group or its derivatives, R^1 including optionally one or several amine, ammonium, amide, ketone, ester, aldehyde, thiol or thioethers groups,
- R^2 is selected as a hydrogen atom, a C_1-C_{10} alkyl group, an aryl group, a C_2-C_{10} alkenyl group, a C_2-C_{10} alkynyl group, a polyalkylene oxide group or its derivatives, R^2 including optionally one or several amine, ammonium, amide, ketone, ester, aldehyde, thiol or thioether groups,

said method being characterized in that said at least one silylated treatment agent is implemented during the tanning step ii) and/or during an ennobling step iii) subsequent to the tanning step ii).

In another aspect, there is provided a method for preparing a finished leather as defined above, from raw hides, said method comprising at least the following steps:

- a) preparing the raw hides in order to obtain hides ready for tanning,
- b) tanning and ennobling the hides resulting from step a) using a treatment composition comprising at least said silylated treatment agent.

In another aspect, the disclosure refers to a finished leather having at least one ennobling property, capable of being obtained by the method as defined above.

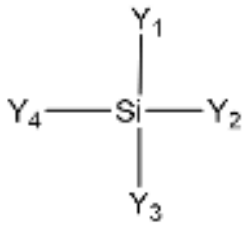
In another aspect, there is provided a method for disennobling a finished leather as defined above, or obtained by the method as defined above, comprising at least one step during which said finished leather is soaked in a basic solution in order to bring the pH of the leather to a value greater than or equal to 10.5, preferably to a value ranging from 11.5 to 13.0.

An object of the present disclosure relates to a finished leather comprising at least one ennobling property provided by at least one silylated treatment agent, said silylated treatment agent being fixed to a three-dimensional Si-O-Si network by a covalent bond, said three-dimensional Si-O-Si network being linked by hydrogen, ionic or covalent bonds to the collagen constituting the finished leather.

Another object of the present disclosure relates to a method for preparing a finished leather according to the disclosure, from raw hides, said method comprising at least the following steps of:

- i) preparing raw hides in order to obtain hides ready for tanning,
- ii) tanning the hides from step i) by means of a tanning composition comprising at least one tanning agent of formula (I):

[Chem 1]



(I)

in which Y^1, Y^2, Y^3 and Y^4, which may be identical or different, are selected independently of each other as a halogen atom, a $-[OSiO_uR^1_{3-u}]_v$ group, a $-O-[SiO_uH_{u-1}R^1_{3-u}]_v-H$ group or a $-OR^2$ group, two or more of the $-[OSiO_uR^1_{3-u}]_v$, $-O-[SiO_uH_{u-1}R^1_{3-u}]_v-H$ and $-OR^2$ groups which can be connected to each other by a covalent bond, in which:

- u is an integer ranging from 0 to 3, v is an integer greater than or equal to one, and R^1 is selected as a hydrogen atom, a C_1-C_{10} alkyl group, an aryl group, a C_2-C_{10} alkenyl group, a C_2-C_{10} alkynyl group, a polyalkylene oxide group or its derivatives, R^1 including optionally one or several amine, ammonium, amide, ketone, ester, aldehyde, thiol or thioethers groups,
- R^2 is selected as a hydrogen atom, a C_1-C_{10} alkyl group, an aryl group, a C_2-C_{10} alkenyl group, a C_2-C_{10} alkynyl group, a polyalkylene oxide group or its derivatives, R^2 including optionally one or several amine, ammonium, amide, ketone, ester, aldehyde, thiol or thioether groups,

said method being characterized in that said at least one silylated treatment agent is implemented during the tanning step ii) and/or during an ennobling step iii) subsequent to the tanning step ii).

Preferably, Y^1, Y^2, Y^3 and Y^4, which may be identical or different, are selected independently of each other as a halogen atom, a $-O-[SiO_uH_{u-1}R^1_{3-u}]_v-H$ group or a $-OR^2$ group. Preferably, Y^1, Y^2, Y^3 and Y^4, which may be identical or different, are selected independently of each other as a halogen atom, or a $-OR^2$ group.

Another object of the present disclosure relates to a method for preparing a finished leather according to the disclosure, from raw hides, said method comprising at least the following steps of:

- a) preparing raw hides in order to obtain hides ready for tanning,
- b) tanning and ennobling the hides from step a) by means of a treating composition comprising at least said silylated treatment agent.

The present disclosure also relates to a finished leather having at least one ennobling property, likely to be obtained by these methods.

The present disclosure also relates to a method for disennobling a finished leather obtained by the methods according to the disclosure comprising at least one

step during which said finished leather is soaked in a basic solution in order to bring the pH of the leather to a value greater than or equal to 10.5, preferably to a value ranging from 11.5 to 13.0.

The methods according to the disclosure make it possible to obtain finished leathers having ennobling properties that are particularly stable over time and during use. Indeed, the hides ready to be tanned comprise collagen fibers. The compounds used during step ii) or step a) of tanning of the methods according to the disclosure are precursors of $Si(OH)_4$. The polymerization of the $Si(OH)_4$ during the tanning step will create a three-dimensional Si-O-Si network linked to the collagen constituting the hides. This three-dimensional network will make it possible to stabilize the hides and thus tan them. The advantage of these methods is that, during the tanning step, part of the silicon of the $Si(OH)_4$ does not react and remains present in this three-dimensional network. The three-dimensional network thus formed has a residue of groups, in the form of silanol functions (Si-OH) on the surface. These groups will allow a modification of the leather in a covalent and controlled manner.

Thus, the use of a silylated treatment agent during the tanning step and/or during a subsequent ennobling step will make it possible to fix the silyl group of the treatment agent to the three-dimensional Si-O-Si network created during the tanning step, by creating a new Si-O-Si bond resulting from the condensation reaction of at least one silanol group of this three-dimensional network and of at least one silanol group of the silylated treatment agent. This Si-O-Si siloxane bond, covalent in nature, is particularly stable and durable over time. Thus, the silyl group of the treatment agent will find itself nested within the three-dimensional Si-O-Si network formed during the tanning step and thus strongly fixed to the collagen of the hide, and therefore to the finished leather. Due to the nesting of the silyl group of the silylated treatment agent within the three-dimensional Si-O-Si network linked to the collagen of the hides, the property provided to the finished leather by the silylated treatment agent is particularly stable: in fact, according to the methods according to the disclosure, the silylated treatment agent is linked to the three-dimensional Si-O-Si network by means of its silyl functional group which is covalently linked to the three-dimensional Si-O-Si network, itself linked by hydrogen, ionic or covalent bonds to the collagen constituting the hides and therefore the finished leather.

Definitions

In the present application, the following terms:

- “raw hides” means synthetic hides or hides of animal origin containing collagen, but which have not yet undergone the hide preparation steps described above, making these hides ready to be tanned;