A hair treatment method where hair is treated with a reducing material which is a reducing polymer film. A protective layer is attached to at least one side of the layer of the polymer film in order to protect the user or hair. In the treatment a reducing component, thioglycolic acid, is released from the reducing polymer film and made to affect the hair.
Hair treatment method

The invention relates to a new hair treatment method, defined more precisely as a hair perming method, which is faster than the methods presently used.

The international publication WO 00/27349 discloses a hair perming method, in which an elastic carrier material impregnated with a reducing agent is placed over hair, which is wrapped around perming rollers and the carrier material is heated with a heating element placed over it. The carrier material can be a non-woven fabric containing fibers rich in silicic acid.

In addition, US patent 5,776,474 (WO 95/33438) discloses a method, in which a reducing agent, thioglycolic acid, is impregnated together with ammonia to a non-woven fabric, which contains fibers rich in silicic acid, and thus a ready-to-use product is achieved for perming hair.

US patent 4,134,412 discloses a hair spray based on the salt of chitosan, which spray is manufactured by neutralizing chitosan with an acid. The publication mentions thioglycolic acid as one of the acids, although formic, acetic and lactic acid are preferred. The product is in a solution form that forms a film after spraying to hair and drying.

US patent 3,257,361 discloses a hair treatment agent based on mercaptoethylamine salt of polyacrylic acid, which agent is spread as an aqueous solution to hair for perming. Similarly, US patent 3,741,723 discloses the use of polysulphhydrylated polymer as an aqueous solution in the same purpose.

The problem in the prior art publications is the possible exposure to the perming agent when handling the aqueous solution or the non-woven fabric impregnated with the solution, for which reason the use of protective gloves is recommended.

The aim of the invention is to provide a new method and material which do not have the drawbacks of prior art.
To achieve this aim, the invention is characterized in that a reducing polymer film is used as a reducing material. The reducing material exists as a dry polymer film, which is formed of a mixture of a reducing component and a carrier polymer. The reducing component is thioglycolic acid (TGA), thioglycolate or some other reducing agent able to reduce the sulphur bridges of keratin. The polymer film is thin and not necessarily very cohesive as such, so as a carrier material supporting the film a specific protective layer can be used to help place the polymer film in contact with the hair. Advantageously the protective layer is used on the both sides of the above-mentioned layer consisting of the polymer film wherein a sandwich structure is achieved which protects the film during storage. The protective layer on the side of the hair can be, for example, removed before using the film and the protective layer on the other side can be left in place to protect the user from direct contact with the reducing agent. The protective layer on the side of the hair can also be of such a nature that the effective agent can pass through it from the polymer film onto the hair. Compared to the methods commonly in use at present, the new method provides the following advantages:

- the reducing agent is bound to the polymer which prevents the premature release of the agent and facilitates the handling of the material but is removable from the polymer with physical measures (heat and moisture),

- the method is considerably faster which is illustrated later,

- the method is biofriendly because the perming agent does not end up anywhere else but in the treated hair,

- the method can be applied to dry hair, in other words the hair does not have to be washed or moistened before application,

- in the method the reduction can also be directed so that, for example, only a small part of the hair is curled, and the method is used to add lift and volume to hair,

- the odour problems of the method are considerably smaller than, for example, in the prior art methods because the method enables keeping the ammonium ion opening the hair cuticles and the actual reducing chemical separated up to the moment when they are stimulated by steam, wherein amounts are very small, and when the fiber film
structure is removed, there is no need for washing in the between but the oxidation step can be performed immediately to bind the sulphur bridges into a new position,

- when in prior art methods the hands of the hairdresser are exposed to the perming agent, in which case the use of protective gloves is recommended which in turn complicates working, so now in the present method there is no need for gloves because no other solutions than water are used in the method.

The difference to present perming methods is significant but also very clear compared to the method according US patent 5,776,474 in which a perming agent is used and the non-woven fabric is wetted, which requires a hair wash before an oxidation step. The use of perming agent also causes odour problems almost as extensive as the ones in conventional perming treatments.

The present method is also characterized in that the necessary steam used in heating is directed only to the hair, not skin, and with the structure of the heating element the right direction of the heat and steam can be effected.

In the following, the invention will be described in more detail with reference to the appended drawings, in which

Fig. 1 shows the material in a cross-section, and

Fig. 2 shows the principle of the method according to the invention.

According to the invention, a layered structure 1, which comprises the reducing component of the perming agent (in its own layer 2) and as one protective layer 3, a non-woven fabric to which ammonium salt has been impregnated. A sandwich structure 1 (Fig. 1), formed of the layer 2 containing the reducing component, which layer is a polymer film, and the protective layers 3 made of non-woven fabric, is placed onto the hair as shown in Fig. 2. The layer 2 of the reducing material is also protected with a layer on the side that is placed onto the hair, which
layer is advantageously non-woven fabric through which the reducing agent and ammonium ions can pass onto the hair.

If the polymer film is of such a nature that there is no danger of the film adhering to the hair, the protective layer 3 on the side of the hair can be removed before usage and the film can be placed in a direct contact with the hair. In this case, the protective layer does not have to be porous.

With the help of a heating device (Fig. 2) steam is formed which releases the ammonium ion from the uppermost protective layer 3 to open the hair cuticles and the reducing chemical from the middle layer 2 to break the sulphur bridges in the hair.

The necessary steam can be formed in a number of ways but it is advantageous to form the steam with an element shown in Fig. 2. A suitable amount of water is placed in the element, which water heats when the element is heated, and the element releases the steam and directs it at the multilayer structure. The element structure is of such a nature that the other parts do not become heated.

The advantages of the method are that the necessary chemical amounts are substantially smaller that in the perming methods of prior art. A conventional method uses an average of 80 ml of perming agent containing about 11% of ammonium thioglycolate, the method according to the US patent 5,776,474 can use an average of 110 ml of agent containing about 8% of ammonium thioglycolate (due to the fact that the fibrous structure used in the method absorbs a part of the agent). In the new method, thioglycolic acid is present in the middle film in the amount of 15 g/m² and ammonium is present in the uppermost layer in the amount of about 0.5 g/m². Depending on the amount of hair and the intended curls, one square metre of the material can provide 3 to 10 perms and as a result the amount of the chemical decreases substantially.

As a result of what is mentioned above, the environmental effects are also considerably different. In a conventional perm all the perming
solutions are washed away into water. In the method according to the US patent 5,776,474, large chemical residues form a problem and disposing of the residue by burning forms harmful gases and ashes due to the silicic acid. In the present invention the polymer film containing the reducing agent can be regenerated and used again or disposed suitably by composting.

The polymers in the middle polymer film can be water-soluble polymers such as CMC, PVOH (polyvinyl alcohol), polylactide or chitosan. Of these, chitosan works as a reducing agent as such so there is no absolute need to add a reducing component. A reducing component, such as thioglycolic acid, can be blended with the others. During the use, the reducing component is released from the polymer film and affects the hair in a reducing manner.

In the following table different methods are compared.

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In the following examples, the invention will be described more in detail by means of some examples, which do not restrict the invention.

Examples of the manufacturing of the film and examples of the manufacturing of the sandwich:
Example 1

TGA-Ch -solution:

85% thioglycolic acid is diluted to 1%. A desired amount of chitosan is dissolved, in these tests about 1% solution was made at first. Chitosan is dissolved with magnet agitation and it dissolves very well in thioglycolic acid.

The solution is then filtered and a d.m. is determined. After determining d.m., the possible dilution factor is then calculated (for example, if 0.5% solution is desired). The pH of the TGA-Ch -solution (0.5%) is about 3. The solution is kept in a refrigerator.

A film can be formed of the solution by evaporating the water. In the final stage of forming the film, it is advantageous to keep the film blank in tension wherein the strength improves substantially. On the film the ratio of chitosan to TGA is about 1:1 (corresponding to about 1,08 equivalent/100 g on the basis of the TGA's molecular weight 92). The grammage of the film is advantageously about 10-50g/m².

Example 2

Neutralizing the TGA-Ch -solution with ammonia:

400 ml of 0.5% TGA-Ch is used which has the initial pH of 2.7. About 15 ml of strong ammonia solution is added to the solution by titrating wherein the pH rises to over 9. The solution is mixed to as homogeneous as possible with a blender. The solution is neutralized by boiling it in a double-boiler and monitoring its pH. The boiling is stopped when the pH is 7-7.5. The solution is homogenized again with a blender, cooled to room temperature and the pH is checked. The resulted solution is kept in the refrigerator.

A film is formed like above. The film can be used as such for perming with the device shown in Figure 1 using heat and steam. It is advantageous to protect the film with a synthetic non-woven fabric on
one side or both sides in order to prevent the polymer from adhering to the hair or the heating device.

Example 3

Proceed as in the Example 1. A non-woven fabric or paper impregnated with ammonium bicarbonate about 1 to 5% of the amount of fiber is attached to the film. With the help of the structure, perming is possible with the help of heat and steam. The film is protected on the other side like in the Example 2.

Example 4

Like Example 3 except that the polymer is CMC and the ratio of the polymer to the TGA is advantageously 2:1 or higher corresponding at the most about 0.54 equivalent/100 g of polymer. The amount/m² of TGA in the film is advantageously about 5 to 25 g/m².

Example 5

Like Example 3 except that the polymer is polyvinyl alcohol.

Example 6

Like Example 5 except that the polymer is polylactide.

In one embodiment it is advantageous to use layered structure wherein the lowermost layer is a non-woven fabric or paper, which contains about 2 to 8 g/m² of ammonium released by the effect of heat, and on top of the film a non-woven fabric, which prevents the polymer from adhering to the device or the hair depending on which side of the fabric is placed onto the hair. The structure works in both ways but it is advantageous to place the side containing ammonium against the hair wherein a smaller amount of ammonium is enough compared to the other embodiment. In this case, the other non-woven fabric acts as a mere protective layer towards the user without any functionality in view of perming.
The amount of the reducing component can be adjusted in connection with the manufacturing of the product. The odour problems can be reduced by replacing a part of the TGA by another, advantageously neutral or reducing acid, such as HCl, formic acid or acetic acid. Thus, the polymer is dissolved into a dilute 1 to 3 M acid, the pH is adjusted to over 4 and TGA is added. The film to which TGA or any other reducing agent comprising a thiol group is blended can be placed directly into contact with hair.

The ratio of polymer to TGA can in the above-mentioned examples be 2.5:1 or higher corresponding to the amount of reducing agent 0.43 equivalent/100g polymer or less. It has been observed that if the TGA concentration is small, the perm is naturally volumous but not very curly. By adjusting the proportion of TGA, film types having different reducing capability can be manufactured, of which types the client can choose the appropriate curliness.

So called thiomers, i.e. thiolated polymers, known from drug administration forms can be used as a reducing polymer. The thiol groups of said polymers cause the reducing reaction in keratin. This kind of polymer film is placed into direct contact with the hair.

A non-woven fabric containing fibers having good absorption to ammonium ions can be used as a material for the protective layer. Known viscose fibers rich in silicic acid (for example, fibers marketed under the trade name "VISIL") can be used as a starting material, from which fibers the silicic acid is extracted with alkali, for example with NaOH. Alkali treatment can be performed to the non-woven fabric and thus raise its pore quantity. The ammonium ion can be impregnated to this non-woven fabric for example as a carbonate or dilute ammonia.
Claims:

1. Hair treatment method wherein the hair is treated with a reducing material, characterized in that a reducing polymer film is used as the reducing material.

2. The method according to claim 1, characterized in that in the treatment, a reducing component is released from the reducing polymer film and the component and is made to affect the hair.

3. The method according to claim 2, characterized in that the reducing component is released with the help of steam.

4. The method according to any of the preceding claims, characterized in that a reducing agent, for example thioglycolic acid or any other reducing agent containing thiol group, is blended into the polymer.

5. The method according to any of the preceding claims, characterized in that during the treatment the polymer film is protected with a protective layer (3) on at least one side.

6. The method according to claim 5, characterized in that the protective layer (3) is a porous material, for example a non-woven fabric.

7. The method according to claim 6, characterized in that the protective layer (3) comprises ammonium ions which are made to affect the hair in the treatment.

8. The method according to any of the preceding claims, characterized in that the basic polymer of the polymer film is CMC, PVOH, polylactide or chitosan.

9. A hair treatment product to be used in the method according to any of the preceding claims, characterized in that it is a layered product (1), which comprises a layer (2) of a reducing polymer film and a protective layer (3) attached to at least one side of the layer.
10. The method according to claim 9, characterized in that the protective layer (3) is porous, for example a non-woven fabric, and it comprises advantageously ammonium ions.
Figure 1

non-woven including ammonium ions
polymer film including thioglycol acid
protective non-woven

hair

Figure 2

heating device
perm roller

warm steam
composite sheet

cool areas

hair

scalp
### A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: A61K, A61Q, A45D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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* Further special categories of cited documents:
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  * "P" document published prior to the international filing date but later than the priority date claimed
  * "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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  * "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
  * "&" document member of the same patent family

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Date of mailing of the international search report: 14 October 2009 (14.10.2009)

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Form PCT/ISA/210 (second sheet) (July 2008)
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## INTERNATIONAL SEARCH REPORT

### Classification of Subject Matter

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