

## REINOLWAX PF

In trichology, hydrogen peroxide is used for de-coloration and for oxidation in hair colour products and perms. In order to improve their performance, rheological ingredients are added that improve the texture of the product so that when applied to the hair, colour tints and perms do not drip or run onto the face or scalp. In fact, it is necessary that oxidizing products containing H<sub>2</sub>O<sub>2</sub> have a certain "body" and viscosity that allows optimum application and minimises the loss of product caused by excessive running or dripping.

When developing an oxidizing emulsion formula, as well as obtaining a product with the appropriate chemical-physical properties, it is necessary to consider 2 other important factors: the stability and the maintenance of the assay of H<sub>2</sub>O<sub>2</sub> in time. Hydrogen peroxide is difficult to stabilise because of its marked reactivity. Therefore, in order to guarantee physical and chemical stability in a product that contains hydrogen peroxide, the emulsifier and other ingredients for the formula should be chosen with great care. The same care should be used in the choice of material and equipment used for the production. The decline of the original assay of H<sub>2</sub>O<sub>2</sub> not only limits the efficiency of the product itself, but also causes a dangerous swelling of the container that could eventually explode.

REINOL has created a product that is particularly suitable for the formulation of acid emulsions that contain hydrogen peroxide. This new emulsifier, called **REINOLWAX PF**, can be used in two ways:

### 1. As an emulsifier.

The acid and liquid form of this new emulsifier allows the creation of very stable products with excellent organoleptic characteristics in one single production cycle, without having to heat the two phases. The resulting emulsions are also much more tolerable for the skin than those products produced with traditional emulsifying systems.

### 2. As a co-emulsifier.

Using a small percentage of **REINOLWAX PF** allows a reduction in quantity of primary emulsifier, but improves the stability of the product, maintaining the assay of hydrogen peroxide in time. The production process is faster and the emulsion is of better appearance and

organoleptic characteristics. The skin tolerance of the product is also notably improved.

### **The application of REINOLWAX PF**

A series of emulsions were created with this new emulsifier with the intention of evaluating their stability and ability to maintain the initial assay of hydrogen peroxide over a period of time. The following are three simple examples of emulsions with different quantities of hydrogen peroxide created by placing all the components into the mixer in one unique solution and proceeding with a combined mixing/emulsifying action.

We recommend completing this operation under vacuum as the speed of the homogenising equipment necessary to disperse the emulsifier and form an emulsion, creates a great quantity of air which tends to remain trapped within the product.

#### *Fluid emulsion with hydrogen peroxide*

	A	B	C
<b>REINOLWAX PF</b>	3.00	2.50	2.00
Cetrimonium Chloride	1.40	1.40	1.40
PVP	0.50	0.50	0.50
Oxyquinoline	0.05	0.05	0.05
Disodium pyrophosphate	0.30	0.30	0.30
Hydrogen peroxide 36 %.	34.00	18.00	10.00
Aqua (demineralized)	60.75	77.25	85.75

A=40 vol.

B=20 vol.

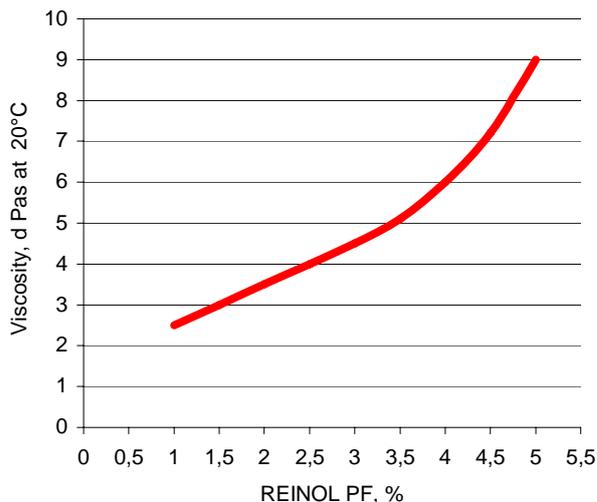
C=12 vol.

As previously mentioned, in order to create an emulsion you simply put the components into the mixer, place under vacuum and proceed to turbo-mix the emulsion. Mixing for 10/15 minutes at a medium speed should be enough to create the finished emulsion. The pH of the emulsion will be around 2.5 and can be adjusted to the required pH with traditional methods.

The viscosity of the emulsion can be increased by increasing the quantity of emulsifier or by adding a cationic substance to the formula.

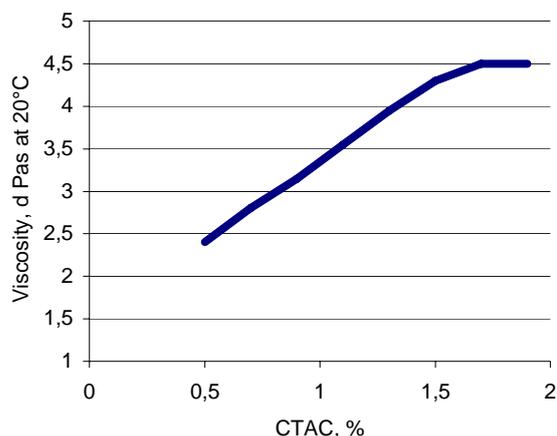
In the following graph we describe the variation in viscosity that occurs to an emulsion with 20 volumes of hydrogen peroxide as the quantity of **REINOLWAX PF** is increased.

Cetrimonium Chloride is particularly suitable because of its thickening, stabilising and conditioning properties. Even modest quantities



of a cationic substance cause an increase in viscosity of the emulsion created with **REINOLWAX PF** and they become more full bodied, creamy and shiny. Furthermore, the presence of a cationic substance makes the hair shiny, soft and less vulnerable to static electricity.

The addition of greater quantities of Cetyltrimethylammonium Chloride (CTAC 30% solution) will continue to increase the viscosity of the emulsion only to a certain point. In the following graph, we describe the rheological behaviour of the previously mentioned emulsion with 20 vol. with increasing quantities of CTAC.



**REINOL®PF** also allows the production of oxidizing emulsions through cold processing with just a simple mixer. In this case however, in order to facilitate the dispersion of the emulsifier in the cold water phase, it is necessary to prepare an emulsifier/Paraffinum Liquidum pre-mix and to use a high speed mixer in order to obtain comparable results with those obtained with a vacuum turbo emulsifier.

### ***Dermal impact***

Oxidizing emulsions prepared with **REINOLWAX PF** have another important advantage: they are considerably less irritant than emulsions normally found on the market. The emulsions potential irritancy is determined according to “in vitro” tests. The test simulates the effects caused by the application of irritating components onto a proteinic structure similar to that of the skin modified for this purpose, comparandoli ad una calibration curve that correlates directly with the results obtained with a Patch test. Tests to predict the potential onset of skin irritation were performed on samples of emulsions containing 12 and 20 volumes of hydrogen peroxide. The 20 vol. emulsion produced with **REINOLWAX PF** can be considered **non irritating**. An excellent result for a product of this type.

### ***The use of REINOLWAX PF as a co-emulsifier***

**REINOLWAX PF** may be used in association with a primary emulsifier Using even tiny quantities permits the use of much smaller quantities of primary emulsifier, making the emulsifying process much faster and making interventions on the final characteristics of a product much easier. In fact, notable improvements in the end product including:

- ❖ **Skin toleration.**
- ❖ **The stability and maintenance of the assay.**
- ❖ **The appearance.**

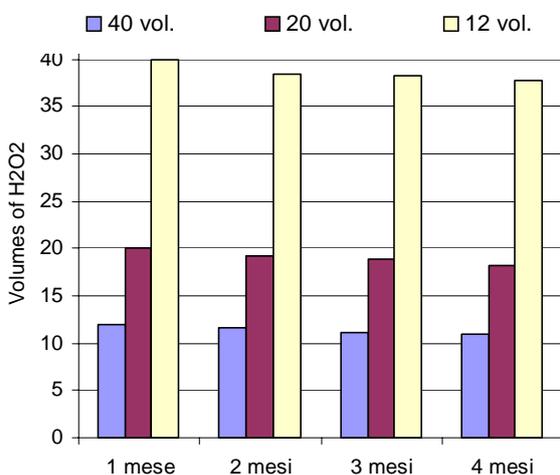
### ***Emulsion stability***

The various stability tests carried out on emulsions created with **REINOLWAX PF** have given more than satisfactory results. Tests were performed in a centrifuge 24 hours after the preparation, when the product is sufficiently stabilised.

Samples were centrifuged at 3000 rpm for 15 and 30 minutes, and non showed signs of separation. Heat stability tests were also performed. The emulsions were placed in transparent glass containers and exposed to temperatures of 37° to 45°C for 3 months. Following these stability and heat stability tests the viscosity of the emulsions A, B and C were tested after allowing them to cool to room temperature. The values recorded before and after the exposure to these tests did not show significant variations.

### Assay stability

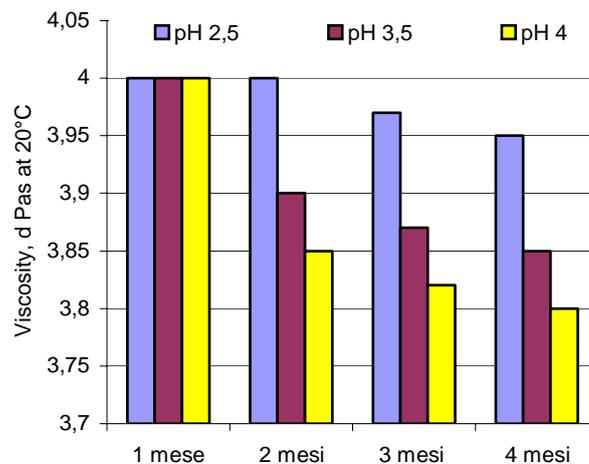
In an oxidizing emulsion, the decline of the assay of hydrogen peroxide is generally caused by UV rays, a high pH value, contamination produced by transition metals like copper, magnesium and iron, and by many common organic composites. However, these are dangers that can be avoided by using a correct formulation, respecting rigorous production methods and adhering to a series of precautions during the production, transfer and packing phases.



The assay of H<sub>2</sub>O<sub>2</sub> in the emulsions manufactured with **REINOLWAX PF** did not show significant variations over time. In fact, the following graph shows the conservation of hydrogen peroxide over a period of 4 months of the 3 emulsions A, B e C previously described.

### Stability of viscosity

The pH value has a determining influence on the maintenance of the assay of H<sub>2</sub>O<sub>2</sub> and also effects the viscosity of the emulsion. Using the previously described emulsion with 20 volumes of hydrogen peroxide, the following graph shows how the viscosity decreases after one, two, three and four months of its preparation if the pH value is increased.



An emulsion with a pH of 2,5 offers an ideal compromise between the maintenance of the assay of H<sub>2</sub>O<sub>2</sub> and the optimum conservation of viscosity.

### Practical applications

The next step in this series of experiments is that of verifying the practical use of emulsions produced with **REINOLWAX PF**. We therefore performed some tests to evaluate their application with permanent trichological dies with 2 phases. These products are normally made up of a colour phase with a high pH and an acid phase containing H<sub>2</sub>O<sub>2</sub>. In order to activate the hydrogen peroxide the 2 phases are mixed just before use. Using an experimental formulation, similar to a hair die, we evaluated the application properties of emulsions prepared with this new emulsifier.

The test performed in order to verify the thickening properties of emulsions prepared with **REINOLWAX PF** involves mixing into equal parts of the “developer” with a pH of 2,5, and the “die” with a pH of 12 containing 8% of ammonium hydroxide. After 3 minutes of mixing, the viscosity of the preparation was suitable for application and the pH was 10.

After the positive results of this first evaluation, we wanted to verify if the emulsions prepared during this experiment were also able to thicken the trichological dies normally found on the market. For this purpose, we mixed four two phase dies produced by leading manufactures, both with their own “developer” and with an emulsion with equivalent assay of H<sub>2</sub>O<sub>2</sub> produced with this new emulsifier.

In each case, the viscosity obtained with the “developer” formulated with **REINOLWAX PF** was equivalent to that obtained with the original.

A cosmetic expert then performed some practical experiments, examining the behaviour during mixing and application of the products obtained with the original “developer” supplied with the die and those obtained with the “developer” formulated with the new emulsifier. In comparing the results, the colour, tone and reflection of the hair, as well as the overall quality of the application, proved in each case to be equivalent, confirming the success of products formulated with **REINOLWAX PF**. Hair treated with the “developer” formulated with the new emulsifier appears to be particularly soft, easy to comb and, in the case of dark coloured dies, extremely shiny.

This simple test highlights the benefits that can be obtained when using **REINOLWAX PF** for preparing acid emulsions with hydrogen peroxide. In such applications this product is easy to use and considerably reduces the work cycle time. Its enough to simply place the water, the hydrogen peroxide, the emulsifier and all the other ingredients into a mixer, create a vacuum, and proceed with a combined mixing – turbo emulsifying action. Just a few minutes of emulsification are necessary to produce a finished emulsion. Oxidizing products produced with the new emulsifier are extremely stable, have optimum organoleptic properties and are particularly suitable for trichological applications. During application, they also reduce the aggressiveness to the scalp and have interesting functional and conditioning characteristics.

**REINOLWAX PF** is also used in the formulation of hair conditioners. With this new emulsifier it is possible to realise, with a simple cold process stable products, with very good organoleptic features and with excellent functional properties. Shown below there is a clear example of a formulation of hair conditioner realised by putting, in a unique solution, all the components in the

mixer and proceeding with the combined action of mixer and turbo-emulsifier.

<b>REINOLWAX PF</b>	3.50
Cetrimonium Chloride (25%)	3.00
PVP/DMAPA Acrylates Copolymer	2.50
Polyquaternium-7	1.30
Arctium Lappa	1.20

Aqua	q.s. at 100
PVM/MA Decadiene Crosspolymer	q.s.
Neutralising agent	q.s.
Preservatives and perfume	q.s.

As in the previous application, the creation of the vacuum is a necessary condition in this kind of production. The rapid homogenisation necessary for the realisation of the emulsion, actually produces an abundant formation of air which, because of the rapid thickening process, would remain in the product.

#### **Technical Characteristics**

**REINOLWAX PF** is an emulsifier in acid form for O/W systems. In small quantities (2-4%) it can be used to create emulsions of pleasant appearance, very stable in time and at any pH value, even in the presence of electrolites with strong ionic dissociation.

Chemically, it is formed of fatty alcohols of vegetal origin that have been ethoxylated and phosphated. Its formula is: R-(C<sub>2</sub>H<sub>4</sub>O)<sub>2</sub>H<sub>2</sub>O<sub>4</sub>P where R=C12-14. The INCI name is LAURETH-2 PHOSPHATE and the product is liquid, clear and colourless with a light odour. It has a pH of around 3 and an average acidity of 16. It is soluble in mineral oils, in many vegetal oils and it is dispersible in water.

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