

**APPLICATION OF PERFLUOROPOLYMETHYLISOPROPYLETHER  
TO HAND CARE CREAM USING ADSORPTION AND DISPERSION**

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**ABSTRACT**

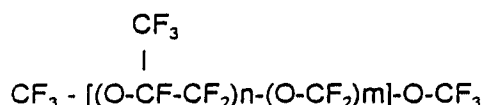
It has been used that fluorinated compounds could be applied to cosmetic products. It is that fluorinated compounds are hydrophobicity and lipophobicity. These fluorinated compounds are reported to form a highly protective and effective film against most aggressive chemical and physical agents. PerfluoropolymethylisopropylEther(PFPE) has homophobicity and are colorless, odorless, tasteless and non-greasy. In this we made a success to formulate the new type of hand care cream using PFPE. PFPE are suitable thickness and chemical inertness to skin. The reason that we select PFPE for this investigation. We developed the new type hand care cream by adsorption and dispersion of PFPE. There are very stable dispersion and highly moisture diffusion control. And these characteristics were verified by actual consumer test.

**INTRODUCTION**

The following properties should be necessary for the hand cream application;

(1) emollient (2) moisture barrier (3) skin protectant (4) film former

We select PFPE for these effect in hand cream. Chemical formula of PFPE is shown in Fig. 1.



poly(perfluoropropene-oxide-perfluoromethylene-oxide) where n/m=20/40  
INCI(CTFA)name: perfluoropolymethylisopropylether

**Figure 1.** Chemical structure of PerfluoropolymethylisopropylEther obtained by photopolymerisation of hexafluoropropene, and the related more specific chemical name.

The absence of hydrogen atoms in the structure, the presence of strong covalent bond-such as C-O and C-F, the chain ending with perfluoroalkyl group, endure excellent chemical and thermal stability, with other useful physical properties due to the extreme flexibility of the perfluorinated polyether backbone and to the very high content of fluorine atoms (around 70%).

The most evident function of PFPE is protection a function of primary importance for almost any cosmetic preparation, especially in the context of topical application[1-91].

PFPE has seen investigated not only as an ingredient of protective creams-of both W/O and O/W types, protective foam with different concentrations of PFPE(1.0% and 3.0%) were also evaluated in the protection against.[10]

The aim of this study was to examine whether generally available hand cream formulations could protect from external irritant and aggressive agents, which could be used as treatment to hand skin. For this purpose, we product hand cream excellent film former, skin protectant and moisture barrier.

## MATERIALS AND METHODS

### Materials

PFPE used molecule weight 650 and 3200. The following are using materials(Table 1.).

Table 1. Materials

#### Emulsifiers

Glyceryl stearate(and)PEG 100 stearate  
Sorbitan Monooleate  
Polyoxyethylene(20)sorbitan Monooleate  
Caprylic-capric triglyceride

#### Oil and Fats

Propylene glycol  
Stearic acid  
Cetyl alcohol  
Glycerol  
Dimethicone copolyol  
Castor oil  
1,3-Butylene Glycol  
Vaseline

#### Other materials

Adsorption powder  
Preservative  
Fragrance  
Tocopheryl acetate  
Carbomer

## **METHODS**

### **Moisture diffusion restraint capability test**

The measurement of moisture diffusion restraint capability was carried out by Corneometer.

The samples were chitin, sodium hyalunate, glycerin, glycerin+PFPE and PFPE+adsorption powder+glycerin.

### **Volatility restraint test of PerfluoropolymethylisopropylEthe by adsorption powder**

A PFPE+adsorption powder system, which contained constant PFPE and various amount adsorption powder, was used for this study. Mixture of adsorption powder and PFPE were homogenized with stand mixer. Adsorption powder used ultrafine powder for good adsorption. After homogenization with various concentrations, these were measured at 60°C with moisture analyzer.

### **Viscosity of Hand cream in various concentrations Adsorption powder+PerfluoropolymethylisopropylEther+Glycerin.**

After cream containing oil, water and wax were emulsified at 80°C, PFPE+adsorption powder+glycerin phase slowly poured into cream phase at 50°C, then they were stirred by a mixing rod (T.K Homo mixer) for 5 min, and subsequently cooled down 35°C. The Viscosity at various concentrations was measured with a Brookfield viscosimeter (Brookfield Engineering Lab. INC.).

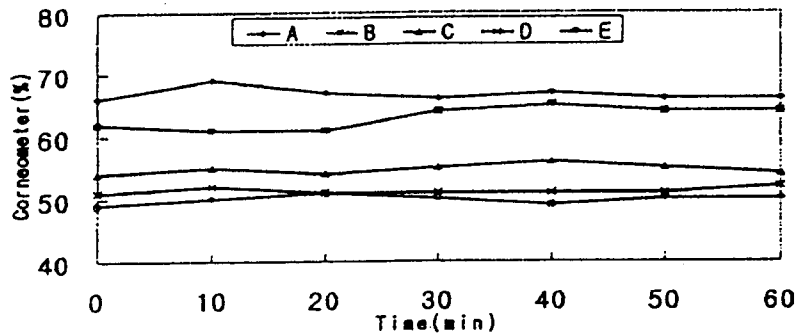
### **User test**

In this study, a cream containing PFPE+adsorption powder+glycerin(mixing rate=1:2:4.) was applied on 24 workers with chronic irritant dermatitis of the hands, detergents and organic solvent. The application was made on the affected sites one a day, for 3 to 10 weeks. The tested sites were evaluated by means of physician's visual judgment and photographed, both before and after the application. The visual judgment was made on basis of four items including rough, desquamation, chappes and erythema, and each item was given five scores. The efficacy of PFPE was judged from the overall improvement by comparing the condition before and after the application. The formulation of the used cream is the materials in Table 1.

## **RESULTS AND DISCUSSION**

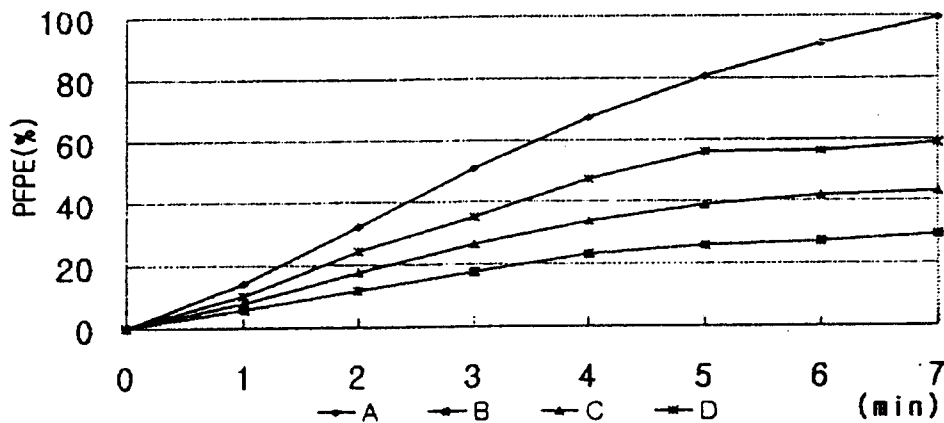
### **Moisture diffusion restraint capability test.**

The PFPE+glycerin was stable at centrifugation for 10 minutes at 3000 rpm and at 55°C for 10 days. That was prepared very simply without heat by addition of a PFPE to glycerin. In the PFPE+adsorption powder+glycerin predisersion, glycerin is the external phase. It has been shown that PFPE+adsorption powder+glycerin has a superior effect increasing the moisture diffuse restraint capability in skin. Therefore, wlien the PFPE+adsorption powder+glycerin is applied to hand cream on the skin, it is assumed to diffuse restraint capability of moisture.



**Figure 2.** A) Fresh skin, B) Chitin, C) Sodium Hyalunate, D) Glycerin, E) Glycerin+PFPE+Adsorption powder.  
 (Courage+Khazaka electronic GmbH : Comemete)

**Volatility restraint test of PerfluoropolymethylisopropylEther by adsorption powder**



**Figure 3.** A) PFPE, B) Adsorption powder: PFPE=2:1, C) Adsorption powder: PFPE=1:1, D) Adsorption powder: PFPE=0.5:1 (PFPE: molecule weight 650, T 60°C). (METTLE TOLEDO: HR73 Halogen Moisture Analyzer)

This experiment result, a volatility of PFPE was changed with adsorption powder amount. A volatility of PFPE was decreased with increase adsorption powder amount. Thus, this powder could adsorb PFPE.

**Viscosity of Hand cream in various concentrations of Adsorption powder+PerfluoropolymethylisopropylEther+Glycerin.**

As shown in Fig. 4., the yield of the cream increased as its viscosity greatened severely as

addition amount in relativity. The separation of pure PFPE never occurs to 10 %.

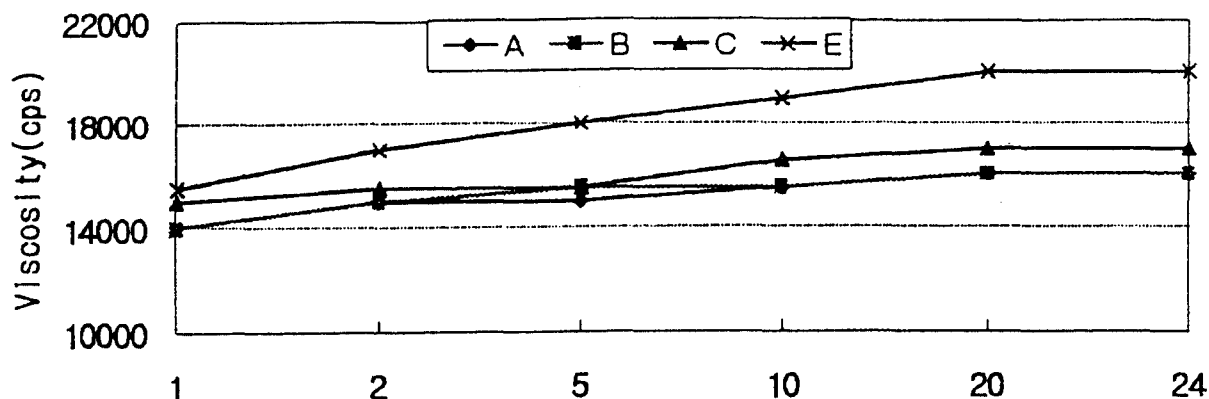


Figure 4. Viscosity of hand cream with concentration of PFPE+adsorption powder+glycerin. A) 1%, B) 2%, C) 5%, D) 10%.. (Brookfield viscosimeter : Helipath spindle E, T 20°C)

#### USER TEST

Over Molecule weight 1500, the availability of PFPE fluids was dramatically increased the potential of products for protection and barrier of the skin. User test result was observed as shown in Table 2. The result of usefulness was 75% in all of the "extremely useful" and "useful" cases. Users improved the appearance, smoothness and softness of the skin. The improved cases, illustrated in Fig. 5, respectively, show that cream is effective for hand skin.

Table 2. Results of the user tests of a cream containing 5% PFPE+adsorption powder+glycein

Usefulness	Number of cases(%)	
Extremely useful	12	(50.0)
Useful	6	(25.0)
Slightly useful	5	(20.8)
Not useful	1	(4.2)
Total	24/24	(100.0)

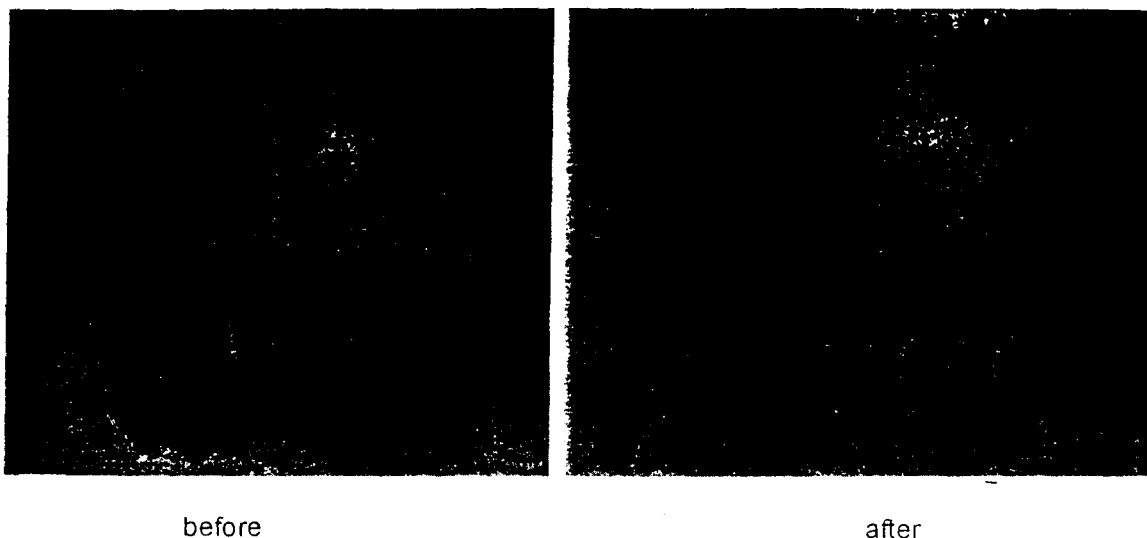


Figure 5. Photographs showing improvement on hand skin after using hand cream.

## CONCLUSIONS

In this studies, we tried to mix PFPE that had hand care effect without separation of PFPE. It is evident that PFPE not only skin protection and barrier, but also moisture diffusion restraint capability by film on skin. Thus, PFPE has been proved to act both skin protect and barrier.

Under the experimental result attained in user test, we known that the usefulness was 75% in all of the "extremely useful" and "useful" case.

From these results, our study suggests that PFPE is not only a very useful protecting and barrier agent for skin, it is also an effective hand care agent for use in the manufacture of hand cream.

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