

# Water-Based Manicure Formulation Showing Equivalent Properties to Those of Solvent-Based Manicure Formulations

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## 1. Introduction

Generally, there are two types of manicure formulations, which are based on organic solvent or water. One is solvent-based manicure formulations, which contain nitrocellulose as a film former. Solvent-based manicure formulations show excellent glossy appearance and high film hardness, which provide a long-lasting effect on nails. However, there are several concerns about solvent-based manicure formulations, such as the associated ecological problems, safety risks for human nails and inhalation, and characteristic odor during application of volatile organic compounds (VOCs). In this study, a water-based manicure formulation containing copolyester as a film former was developed. This formulation is eco-friendly because of its water base. This water-based manicure formulation shows equivalent appearance and lasting properties to those of solvent-based manicure formulations.

## 2. Materials and Methods

The copolyester (INCI Name: Terephthalic Acid/Isophthalic Acid/Sodium Isophthalic Acid Sulfonate/Glycol Copolymer (and) Neopentyl Glycol) was developed as a dispersion in water (F1). Additionally, two conventional film formers were prepared for comparison, conventional copolymer (INCI Name: Acrylates Copolymer) dispersion in water (F2) and nitrocellulose solution in solvent (F3).

### 2.1. Gloss appearance

Each film formulation was applied on a polyethylene terephthalate (PET) film with an applicator to form a film with a thickness of 0.1 mm. After complete drying, the gloss of the film was measured with a gloss checker (Horiba Ltd. IG-410).

### 2.2. Evaluation of manicure formulation

The following three manicure formulations were prepared: M1: with copolyester dispersion in water (F1), M2: with conventional acrylates copolymer dispersion in water (F2), and M3: with nitrocellulose in solvent (F3).

### 2.3. Film hardness

The hardness of each manicure film on a PET substrate was evaluated by the scratch hardness pencil method according to JIS K5600-5-4(ISO/DIN 15184). Pencils of varying hardness (from 6B to 6H) were used for this evaluation, and the grade of pencil that showed no scratch trace on the film was considered as the hardness index.

## 3. Results

### 3.1. Gloss appearance

The results of the film gloss are shown in Table 1. The film with copolyester (F1) showed the highest gloss of the films.

### 3.2. Film hardness

The results of the pencil hardness test of the films is shown in Table 2. The manicure with copolyester showed the highest hardness (greatest resistance against scratching), which was the same as that of the manicure with nitrocellulose

(solvent).

Table 1. Comparison of the gloss of the films

	Gloss appearance
F1: copolyester (water)	171
F2: acrylates copolymer (water)	164
F3: nitrocellulose (solvent)	170

Table 2. Comparison of the hardness of the films

	Scratch hardness (pencil method)
M1 with copolyester (water)	3B
M2 with acrylates copolymer (water)	Less than 6B
M3 with nitrocellulose (solvent)	3B

#### 4. Discussion and Conclusion

An aqueous manicure formulation was developed. This formulation consists of a copolyester dispersion in water and shows equivalent appearance and lasting properties to those of conventional solvent-based manicure formulations. This aqueous manicure formulation is VOC-free, eco-friendly, and safe for human use.