# FORMULATION AND PHYSICAL CHARACTERISTICS OF EMULGEL CONTAINING CARROT EXTRACT (Daucus carota L.)

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## ABSTRACT

Carrots, scientifically known as *Daucus carota L.*, are tuberous plants widely consumed for their numerous benefits, particularly in skin care. They help maintain skin moisture, soften the skin, and reduce the appearance of wrinkles caused by free radicals, acting as antioxidants. Carrots are rich in vitamin A, beta-carotene, vitamin C, and vitamin K. This study employs an experimental approach to formulate carrot extract into an emulgel—a preparation that combines the benefits of emulsions and gels, using various concentrations of gelling agents. The emulgel was then subjected to physicochemical tests, including organoleptic evaluation, homogeneity assessment, pH testing, spreadability, phase separation, and irritation testing.

**Keywords:** *Formulation, Physical Characteristics, Carrot Extract (Daucus carota L), Emulgel*

## Introduction

The current social trend of using natural ingredients in personal care (“back to nature”) is gaining popularity these days, so people are once again resorting to using various natural ingredients. Long before formal healthcare services and modern medicines reached the society level, effective plants had greater economic value and fewer side effects than synthetic drugs. Therefore, using natural medicines with proper formulation is very important and naturally safe and effective. One plant that is nutritious and offers many benefits is carrot (Daucus carota L) which contains vitamins A, C and vitamin K as well as beta-carotene. The beta-carotene in carrot (Daucus carota L.) tubers is useful in maintaining skin moisture, softening the skin and preventing the formation of wrinkles on the face, so that the face always looks radiant. Carrot (Daucus carota L) is not only rich in vitamins but also easy to obtain and available at a price that is affordable for all sections of society. For this reason, carrot (Daucus carota L) is gaining huge popularity. The development of cosmetics

for personal care is progressing very rapidly these days. Cosmetics are a mixture of several ingredients formulated in such a way that they can be used for the care and beautification of body parts depending on the purpose of the cosmetics.

To achieve local effects, different formulations of therapeutics and cosmeceuticals are applied on the skin surface. However, the main obstacle is the permeability of chemical substances in the formulation to pass through the permeable skin membrane (Shashi, 2012). The outermost layer of the skin, namely the multilayered stratum corneum, provides a strong barrier to the penetration of chemical substances into the skin, especially since most medicinal chemicals are unable to penetrate the stratum corneum (Raut SV, 2014). . The development of drug delivery systems has led to new formula modifications that can increase the bioavailability of drugs in the skin. New drug delivery systems resulting from the combination of two pharmaceutical dosage forms such as Emulgel which combines two dosage forms namely an emulsion preparation and a gel preparation have been shown to increase the percutaneous absorption of drugs especially for fat soluble types of drug molecules (Shashi, 2012). Also, the use of penetration enhancers is being considered to increase the penetration of the drug into the skin (Raut SV, 2014). This proves that aspects of the formulation and properties of the active ingredient are very important factors determining the penetration of drugs into the skin as the properties of the active ingredients and excipients each have different influences on the penetration and absorption profile of drugs through the skin membrane (Shashi, 2012). In addition, anatomical and physiological factors of the patient also influence the permeation and absorption of drugs through the skin such as skin texture, lipid profile, and skin lipid profile. B. the condition of the injury, the pH of the skin, the thickness of the skin and the age of the patient.

Cosmetic preparations containing extracts can be produced more easily and stably when they are processed into emulgel preparations, as this system is a form of an emulsion in a gel, which ensures an elegant appearance and high stability. And all this with high effectiveness. Emulgel is a form of stable emulsion and gel preparation with addition of gelling agent, where the gel capacity of the emulgel preparation makes the emulsion formulation more stable

Emulgel preparations can be characterized by physical and chemical properties in the form of organoleptic observations, pH, viscosity, spreadability, adhesion and stability tests (Garg et al., 2017; L. Kumar & Utreja, 2019)

The aim of this research is to obtain the most optimal formula by satisfying all the physicochemical properties that are still within the range included in the specified range of requirements.

The active ingredients in the emulgel can be chemical or natural active ingredients NTr Lin dPt obtained from plants. To obtain the properties of a plant, a process called

extraction is carried out, i.e. the extraction of the desired nutrients from a plant by various extraction methods and assisted by various suitable solvents for the desired active substance, the end result being a thick extract which can then be processed into a dry extract or added to the selected preparation

## Methodology

### Tools and materials

The tools used are glassware, analytical balances, micropipettes, magnetic stirrer, pH meter and materials used for emulgel formulation namely carrot tubers (Daucus carota L.), Span 20 (Brataco Chemical), Tween 20 (Brataco Chemical), Parrafin liquidum (Brataco Chemical), Propylene glycol (Brataco Chemical), Methyl and propyl paraben (Brataco Chemical), Triethanolamine (Brataco Chemical), HPMC (Brataco Chemical), Phosphate buffer pH 7.4, Aquamineralisata (Brataco Chemical).

Research Methods

Method of preparing carrot (Daucus carota L) extract

Material collection

The material used for the research was carrot (Daucus carota L) obtained from Lembang market in Bandung district, West Java province.

Creating simplicity

Carrot tubers are cleaned, then washed and cut into small pieces with a knife. Chopped carrots are dried in air without direct sunlight for up to 7 days. The maximum water content in simplicity is not more than 10%. Dry sorting is then carried out to remove unnecessary foreign matter.

### Preparation of carrot extract (Daucus carota L)

Prepare 500 grams of dried carrot simplicia, add 2,200 ml of 95% ethanol solvent, put it in a closed bottle and add filter liquid or solvent, namely ethanol, cover and leave for five days protected from light and stir regularly for three days up to four times for about five minutes. After 5 days, the mixture was filtered, the macerate was then thickened using a rotary evaporator at a pressure of 70 rpm and a temperature of 70 °C (Voigt, 1997).

## Formula design

The Emulgel base preparation is manufactured in 3 formulas with different concentrations of HPMC as gelling agent, with a volume of 100 ml in each formula. The Emulgel base formula is shown in Table 1.

**Tabel 1. Rancangan Formula Basis Emulgel**

| Komposisi | Prosentase (%) | | |
|---|---|---|---|
| | F1 | F2 | F3 |
| HPMC | 0.5 | 1.00 | 1.50 |
| Liquid Paraffin | 7.5 | 7.5 | 7.5 |
| Tween 20 | 1 | 1 | 1 |
| Span 20 | 1.5 | 1.5 | 1.5 |
| Propylene Glycol | 10 | 10 | 10 |
| Nipagin | 0.03 | 0.03 | 0.03 |
| Nipasol | 0.01 | 0.01 | 0.01 |
| TEA | 2 | 2 | 2 |
| Aqua ad. | 100 | 100 | 100 |

## Method for preparing carrot (Daucus carota L) emulgel.

The working procedure for preparing carrot (Daucus carota L) extract emulgel is as follows:

Prepare emulgel by dispersing HPMC in distilled water (75 °C) with constant stirring at medium speed with a mechanical stirrer and adjust the pH to 5.5-6.5 with triethanolamine (TEA). The oil phase is prepared by dissolving Span 20 in liquid paraffin. The water phase was prepared by dissolving Tween 20 in distilled water. 0.03 g of methyl paraben and 0.01 g of propyl paraben dissolved in 10 g of propylene glycol and vitamin C mixed with the water phase. The oil and water phases are heated separately to 70-80 °C. Then the oil phase was added to the water phase with continuous stirring until it cooled to room temperature. The emulsion is poured into the gel with gentle stirring until a homogeneous emulsion is obtained (V. Naga Sravan et al, 2014)

Methylparaben and other preservatives are greatly reduced in the presence of non-ionic surfactants due to micellization. However, propylene glycol (10%) has been shown to enhance antimicrobial activity in the presence of non-ionic surfactants (Rowe, 2006).

## Evaluation of Emulgel

Test of physical properties of Emulgel

a) Organoleptic examination

The organoleptic examination included visual observation of shape, color and odor, which was carried out by observing changes in shape, odor and color of the Emulgel preparation during four weeks of storage.

b) Homogeneity test

Apply the preparation on a piece of transparent glass. The preparation has a homogeneous composition.

c) pH test

Place the preparation in a container with a pH meter and then immerse the electrode in the container. The value indicated by the pH meter is the pH of the Emulgel.

d) Spreadability test

Spreadability on the skin depends on the concentration and viscosity of the Emulgel. This spreadability is very important when applying the preparation on the skin, as a preparation with good spreadability ensures uniform distribution of the dose on the skin. The test was carried out using the extensometry method. The principle is to calculate the increase in surface area that the preparation offers when loaded with a certain weight and within a certain time interval.

e) Viscosity

The viscosity of each formulation was determined at ambient temperature using a Brookfield digital viscometer with spindle no. 5 at 50 rpm (V. Naga Sravan et al, 2014).

f) Irritation test

The aim of the irritation test is to find out whether the preparation prepared by the author can cause irritation or not. Irritation to the skin is characterized by a reddish discoloration of the skin and the appearance of red spots on the skin. After conducting the organoleptic test, pH test, homogeneity test and viscosity test, an irritation test is conducted to determine whether the preparation has an irritating effect.

Test the irritation on the sample using the open patch test method. Namely, by conducting direct irritation tests on 10 panelists aged between 17 and 25 years. A sample was administered to each panelist by applying it thinly on the panelist's forearm and covering it with a bandage for up to 1 hour for 5 consecutive days. Subsequently, skin reactions were observed which occurred after 1 hour or after 5 consecutive days of application. Signs of irritation may include local itching and redness of the local skin. If irritation of the testers' skin occurs, the preparation does not meet the requirements of the irritation test.

## Results and Discussion

Preparation of carrot extract (Daucus carota L)

Carrot extract was prepared from 6 kg of carrots and 2200 ml of 95% ethanol. With a soaking time of 7 days, 63 grams of extract were obtained. The obtained carrot extract is used as an antioxidant.

The characteristics of the physical properties of carrot extract after filtering in the form of organoleptics (consistency, smell, color) are shown in Table 2.

**Table 2. Physical properties of carrot extract (Daucus carota L)**

| Sediaan | Organoleptis | | |
|---|---|---|---|
| | Konsistensi | Bau | Warna |
| Ekstrak Wortel | Kental | Khas wortel | Coklat Tua |

From the data in the table, it is known that the prepared carrot (Daucus carota L) extract has a thick consistency because it undergoes a separation process between the solvent and the extract during the rotation process. The smell of the resulting extract is typical of carrot and has a dark brown color, the color change in the extract occurs because oxidation takes place from the crushing process to the extraction process.

### Method of preparing carrot extract (Daucus carota L) emulgel

To prepare the emulgel from carrot extract (Daucus carota L), all the ingredients of the oil phase (stearicum acid, aleicum acid, paraffin, nipasol, cetil alcohol) are melted in an evaporating cup over a water bath. The water phase is prepared by dissolving nipagin in hot water, using hot water depending on the solubility of nipagin and then adding TEA. Place the oil phase in a mortar, grind until homogeneous, gradually add the water phase, then add carrot extract (Daucus carota L) and finally add alcohol to taste.

**Test results of physical properties of Emulgel**

**Emulgel-based orientation results**

Based on the results in Table 3 and Table 4, formulas F1, F2 and F3 show good results in consistency, phase separation and freeze-thaw tests

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Table 3. Physical Evaluation Results of Emulgel Base

| Formula | Warna | Bau | Konsistensi | Phase Separation |
|---|---|---|---|---|
| F1 | Putih | Tidak Berbau | Kental, mudah disebar | Tidak terjadi pemisahan fasa |
| F2 | Putih | Tidak Berbau | Kental, mudah disebar | Tidak terjadi pemisahan fasa |
| F3 | Putih | Tidak Berbau | Kental, mudah disebar | Tidak terjadi pemisahan fasa |

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Table 4 Freeze Thaw Test Results

| Formula | Pemisaha Fasa pada siklus- | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| F1 | (-) | (-) | (-) | (-) | (-) | (-) |
| F2 | (-) | (-) | (-) | (-) | (-) | (-) |
| F3 | (-) | (-) | (-) | (-) | (-) | (-) |

Description:

(-) No phase separation

(+) Phase separation occurs

**Vitamin E emulgel formulation**

The freeze-thaw test shows that F1, F2 and F3 have good stability, so all three can be combined with carrot extract. All formulations can be seen in Table 5.

Table 5. Formulasi Emulgel Ekstrak Wortel

| Komponen | Prosentase (%) | | |
|---|---|---|---|
| | F1 | F2 | F3 |
| Ekstrak wortel | 5 | 5 | 5 |
| HPMC | 0.5 | 1.00 | 1.50 |
| Liquid Paraffin | 7.5 | 7.5 | 7.5 |
| Tween 20 | 1 | 1 | 1 |
| Span 20 | 1.5 | 1.5 | 1.5 |
| Propylene Glycol | 10 | 10 | 10 |
| Nipagin | 0.03 | 0.03 | 0.03 |
| Nipasol | 0.01 | 0.01 | 0.01 |
| TEA | 2 | 2 | 2 |
| Aqua ad. | 100 | 100 | 100 |

**Physical stability study of Emulgel (Carrot Extract)**

Table 6 and Figure 1 show the physical properties of Emulgel in F1, F2 and F3. The research results show that F1 has a better formula based on parameters such as pH measurements and dispersion tests followed by stability tests. Figure 1 shows the stability study data of F1 formula.

Table 6. Results of Physical Characteristics of Carrot Extract Emulgel

| Formula | Karakteristik Organoleptik | Waktu Penyimpanan (Hari) | | | | |
|---|---|---|---|---|---|---|
| | | 0 | 7 | 14 | 21 | 28 |
| F1 | Pemisahan fasa | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih |
| | Warna | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau |
| | Bau | Licin | Licin | Licin | Licin | Licin |
| | Tekstur | Kental | Kental | Kental | Kental | Kental |
| | Konsistensi | Homogen | Homogen | Homogen | Homogen | Homogen |
| | Homogenitas | | | | | |
| F2 | Pemisahan fasa | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih |
| | Warna | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau |
| | Bau | Licin | Licin | Licin | Licin | Licin |
| | Tekstur | Kental | Kental | Kental | Kental | Kental |
| | Konsistensi | Homogen | Homogen | Homogen | Homogen | Homogen |
| | Homogenitas | | | | | |
| F3 | Pemisahan fasa | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih | Tidak Putih |
| | Warna | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau | Tidak Berbau |
| | Bau | Licin | Licin | Licin | Licin | Licin |
| | Tekstur | Kental | Kental | Kental | Kental | Kental |
| | Konsistensi | Homogen | Homogen | Homogen | Homogen | Homogen |
| | Homogenitas | | | | | |

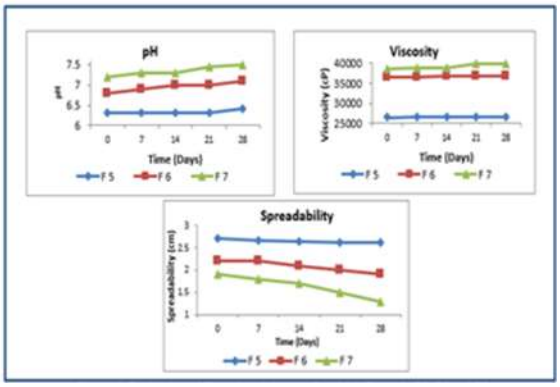


Figure 1. Results of pH, Viscosity and Spreadability Evaluation

**Hasil Uji Iritasi**

Uji Iritasi dilakukan pada semua Formula yaitu formula F1, F2, dan F3 karena dinilai ketiga formuula tersebut memenuhi persyaratan batasan dari setiap parameter uji, sehingaa ketiganya diujikan melalui uji iritasi ini. 2. The Influence of the Effectiveness of the Online Registration System for Outpatients on the Queue System at XYZ Hospital, Bandung

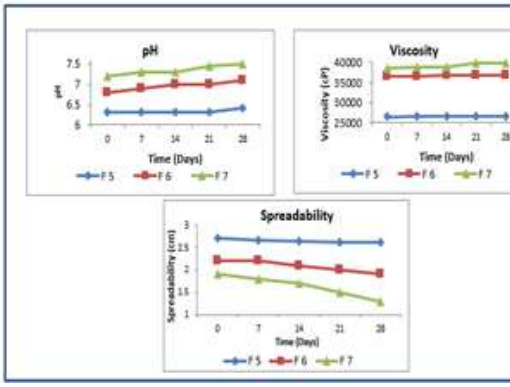
Table 7. Results of the irritation test of carrot extract emulgel (Daucus carota L)

| Formula | Hasil pemeriksaan uji iritasi pada 10 panelis | | | | | prosentase iritasi (%) |
|---|---|---|---|---|---|---|
| | Hari 1 | Hari 2 | Hari 3 | Hari 4 | Hari 5 | |
| F1 | (-) | (-) | (-) | (-) | (-) | 0 |
| F2 | (-) | (-) | (-) | (-) | (-) | 0 |
| F3 | (-) | (-) | (-) | (-) | (-) | 0 |

Description = (-) There is no brightness

(+) Redness, itching and burning

From the table it can be seen that the results of skin irritatior with 10 test subjects show that all preparations do not cause percentage of skin irritation reactions carried out is 0% 1 h This shows that there are no irritating substances in eacl formula (F1, F2 and F3).




## Conclusion

From the research results, it can be concluded that:

A. Carrot extract (Daucus carota L) can be formulated in emulgel dosage form with a concentration range between 0.5 and 1.5 for HPMC as a gelling agent.

B. The results of the irritation test on the three formulas showed that no allergic reaction in the form of redness, itching, red spots or swelling occurred.

**SUGGESTTION**

For further research, it is recommended to add drug testing parameters, assays, and in vitro and in vivo efficacy tests.

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