GATTEFOSSÉ

# Transcutol® P

## For efficient drug solubilization and skin penetration

People make our name

## ABBREVIATIONS

**API:** Active Pharmaceutical Ingredient; **DEGEE:** Diethylene glycol monoethyl ether; **DMF:** Drug Master File; **DMSO:** Dimethyl sulfoxide; **FDA:** US Food and Drug Administration; **INCI:** International Nomenclature of Cosmetic Ingredients; **PG:** Propylene glycol; **Ph. Eur.:** European Pharmacopœia; **SC:** Stratum corneum; **UNII:** Unique Ingredient Identifier; **USP-NF:** US Pharmacopoeia National Formulary; **W/W:** Weight / Weight

# Contents

# Product description: a safe solvent

Transcutol® P is a high purity grade of diethylene glycol monoethyl ether (DEGEE) (Figure 1) manufactured by the condensation of ethylene oxide and ethanol, followed by distillation. The presence of an ether and an alcohol function explains the exceptional solubilizing capacity of this solvent.

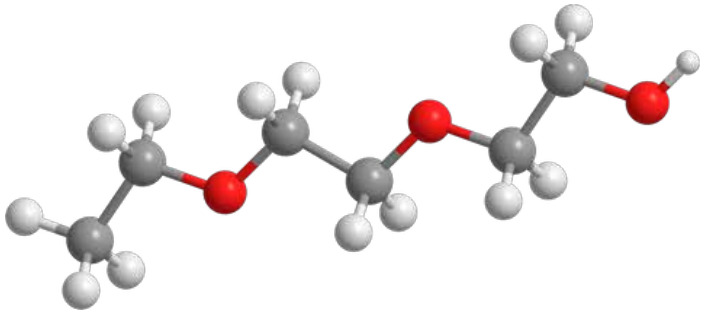


Figure 1: DEGEE molecular structure

Transcutol® is the highest purity pharmaceutical grade DEGEE available. Gattefossé implements a proprietary distillation process to ensure the lowest level of impurities in all Transcutol® grades, well below the Pharmacopoeia limits. For topical formulations Gattefossé recommends the use of Transcutol® P grade for human medicines and Transcutol® V for veterinary medicines. Note that Transcutol® HP is the highest purity grade and is preferred for oral medicines and for highly sensitive APIs.

Transcutol® P is a protic solvent; a colorless limpid liquid (viscosity = 4.1 mPa.s at 25°C), with a faint odor. It is miscible in most of the excipients commonly used in topical formulations (Table 1).
In standard laboratory conditions (20 - 25°C; 35 - 50% RH), Transcutol® P is relatively stable to humidity. However, above 60% RH, Transcutol® P is hygroscopic (Figure 2).

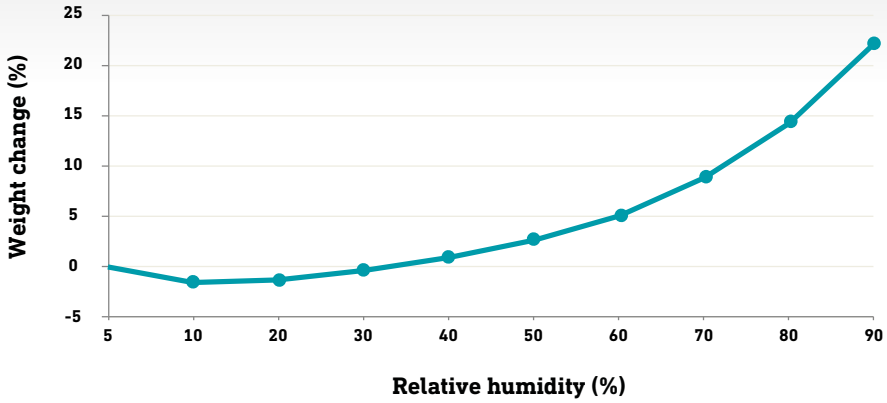



Figure 2: Transcutol® P water sorption isotherm at 25°C

Table 1: Main physicochemical properties of Transcutol® P compared to common topical solvents

| | Transcutol® P | Propylene glycol | Ethanol | PEG 400 | Water |
|---|---|---|---|---|---|
| | $C_6H_{14}O_3$ | $C_3H_8O_2$ | $C_2H_6O$ | $C_{2n}H_{4n+2}O_{n+1}$ n = 8.2 to 9.1 | $H_2O$ |
| Molar mass (g/mol) | 134.175 | 76.1 | 46.07 | 380 - 420 | 18 |
| Density (g/cm³ at 20°C) | 0.989 | 1.038 | 0.789 | 1.128 | 0.998 |
| Viscosity (mPa.s at 20°C) | 4.8 | 58 | 1.2 | 120 | 1 |
| Log P (Octanol:Water) | -0.43 | -0.92 | -0.18 | -4.8 | -0.5 |
| Melting point (°C) | -76 | -59 | -114 | 4-8 | 0 |
| Boiling point (°C) | 196 - 200 | 187 - 188.2 | 78.5 | 290 | 100 |
| Vapor pressure (Pa) | 16 | 9 | 5950 | 1.33 | 3130 |
| Flash point (°C) | 96 | 99 | 13 | 238 | NA |
| Dielectric constant (25°C) | 14.1 | 32.1 | 24.3 | NA | 80.4 |
| Surface tension (mN/m at 25°C) | 31.3 | 40.1 | 21.8 | NA | 72.8 |
| **Miscibility at 25°C of solvents (above) in main topical excipients (below)** | | | | | |
| Capryol® 90 | Miscible | Miscible | Miscible | Miscible | Immiscible |
| Capryol® PGMC | Miscible | 60% | Miscible | Miscible | Immiscible |
| Isopropyl myristate | Miscible | Immiscible | Miscible | Immiscible | Immiscible |
| Labrafil® M 1944 CS | Miscible | Immiscible | 50% | 10% | Immiscible |
| Labrasol® | Miscible | Miscible | Miscible | Miscible | Miscible |
| Lauroglycol™ 90 | Miscible | Miscible | Miscible | Miscible | Immiscible |
| Lauroglycol™ FCC | Miscible | 20% | Miscible | 30% | Immiscible |
| Mineral oil | Immiscible | Immiscible | Immiscible | 50% | Immiscible |
| Sweet almond oil | 30 90 | Immiscible | Immiscible | Immiscible | Immiscible |
| Plurol® Oleique CC 497 | Miscible | 20% | Miscible | Immiscible | Immiscible |

*Examples to explain how to read the miscibility table:*
*Transcutol® P is miscible with sweet almond oil up to 30% and above 90% solvent in oil. From 40 to 80% it is immiscible.*
*10% PEG 400 are miscible in 90% Labrafil® M 1944 CS.*

# Handling:
# measures to ensure product integrity

Transcutol® P is sensitive to oxidation and hydrolysis; exposure to oxygen and humidity should be limited during handling and storage.

**Control exposure to oxygen**

- Minimize aeration of the excipient
- Minimize and control the degree of exposure to heat and light
- Use $N_2$ blanket

**Control exposure to humidity**

- Minimize and control relative humidity when opening the packaging
- Seal the container tightly after use

## A safe solvent to handle

Transcutol® P evaporation is reduced compared to ethanol due to a higher boiling point and a lower vapor pressure.

Transcutol® P has a flash point of 96°C, therefore exposure to external (or potential) sources of ignition at or above this temperature should be avoided. Gattefossé recommends avoiding heating above 85°C.

Detailed information is available in the Handling Sheet and the Material Safety Datasheet

# Product functionality

## A powerful solubilizer

A key feature of Transcutol® P is its solubilization capacity for both lipophilic and hydrophilic APIs. Figure 3 gives saturation solubility data of a wide set of APIs used in topical drug delivery.

Increasing drug solubility in the vehicle, and thereby the thermodynamic driving force, provides higher diffusion and better skin permeation. Formulating with Transcutol® P ensures sufficient drug solubilization and subsequent delivery of an adequate concentration at the target site.

## An efficient penetration and permeation enhancer

The mechanism of action of Transcutol® P for penetration and permeation enhancement can be explained as follows:

- Increasing drug solubility in the vehicle
- Decreasing drug charge by a solvent effect
- Increasing drug solubility and partitioning in the stratum corneum
- Maintaining hydrated dynamics in the stratum corneum without disturbing the lipid bilayer structures

The effect of chemical permeation enhancers on skin structure and how they interact with the lipid bilayer is well characterized (Gwak, 2002; Hirata, 2014; Moghadam, 2013; Salimi, 2015; Trommer, 2006).

A qualitative ranking of the common permeation enhancers can be established (Figure 4). With no effect on lamellar structure, Transcutol® P appears to be as gentle as water on the skin.

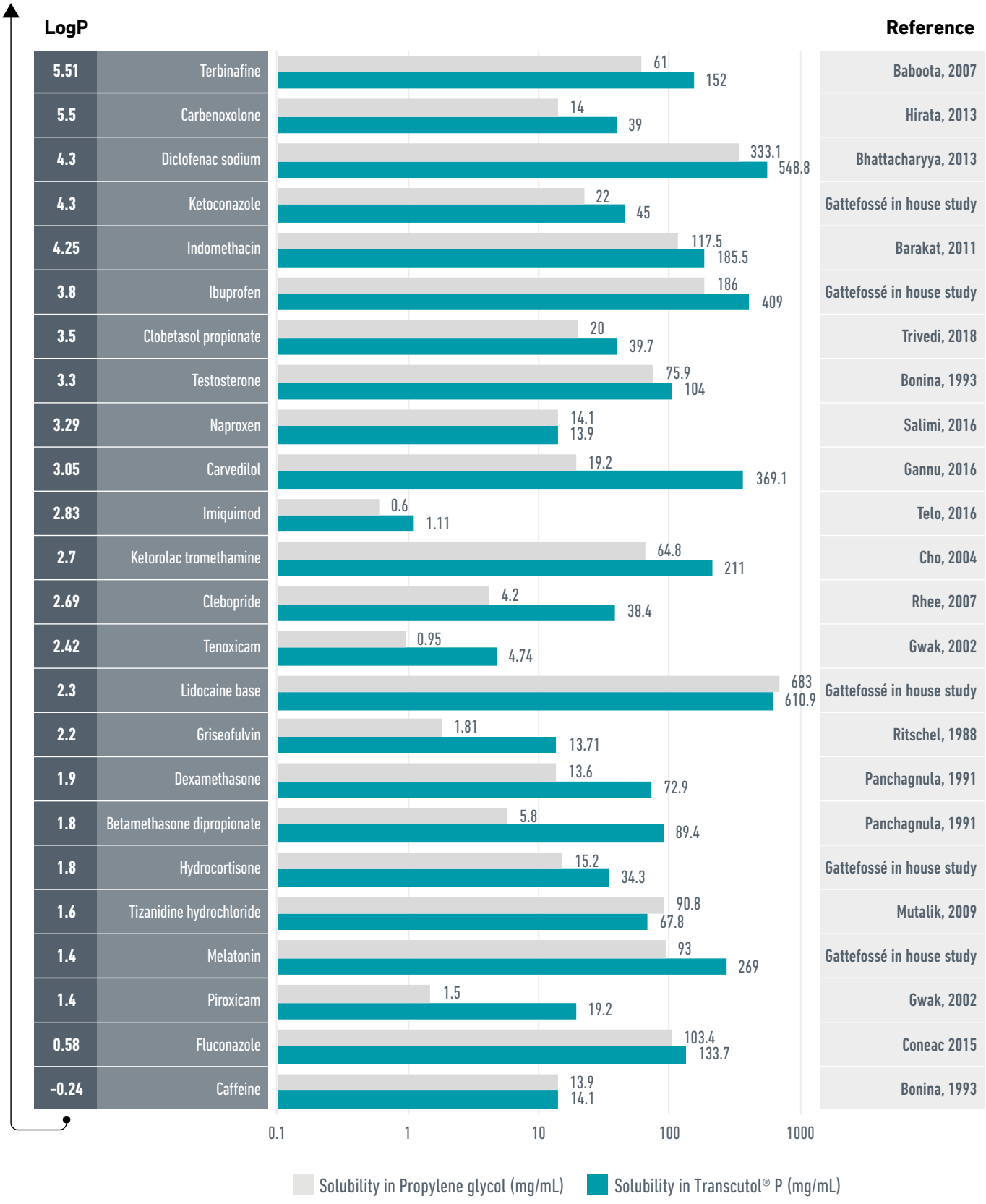



Figure 3: Solubility data in Transcutol® P and propylene glycol for selected APIs

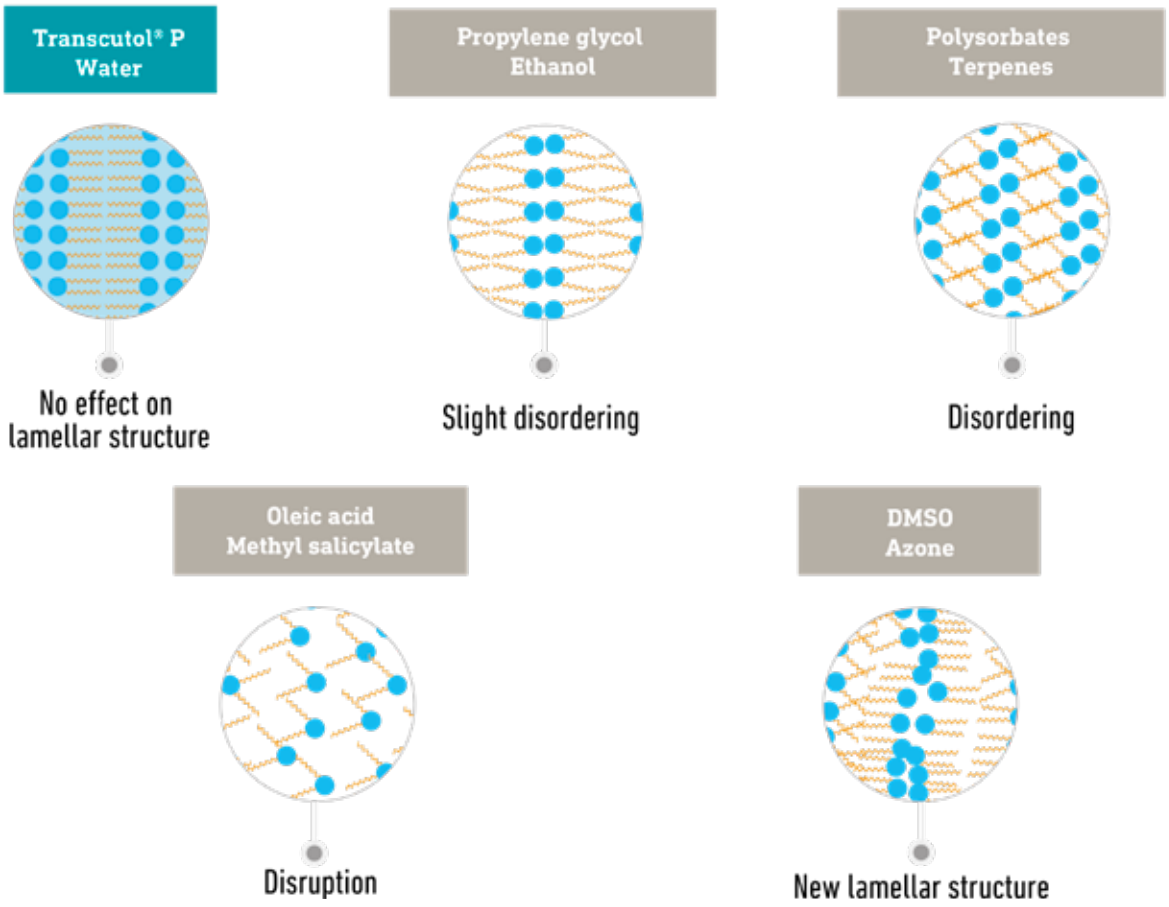



Figure 4: Qualitative ranking of the effect of permeation enhancers on skin lamellar structure

## Translating functionality into practical tips

- A good solubilization of API in a solvent does not necessarily correlate with good permeation.
- Screening of various solvents for solubility and permeation capacity is a compulsory step in formulation development to determine the most appropriate solvents and their ratio as a function of the target (topical or transdermal) and the drug properties.
- Water is a key solvent. Formulated with Transcutol® P, good solubilization and permeation are obtained, while maintaining skin hydration dynamics.
- Enhanced permeation resulting from the combination of Transcutol® P with different permeation enhancers i.e. a synergistic effect has been reported, notably with Capryol® and Lauroglycol™.

# Formulating with Transcutol® P

Transcutol® P has been referenced in all types of dosage forms, including creams, emulgels, foams, and gels. Moreover, it is a widely used enhancer in the preparation of micro/nano emulsions and vesicular / liposomal drug delivery systems for transdermal delivery.

## General recommendations

In most cases, the API is dissolved in Transcutol® P at ambient temperature, although if necessary, heating to 50 - 60°C is possible.
Addition of common antioxidant for topical formulation is recommended.

## Emulsions

Transcutol® P may be included in the aqueous or oily phase. Typically, it is gradually added after emulsification during the cooling step when the temperature is around 40°C to avoid API degradation.
Stable anhydrous and hydrous creams containing as high as 40% Transcutol® P can be obtained (Dave, 2018).
Stable emulgels have been formulated with up to 25% Transcutol® P.

## Gels

Transcutol® P can be used in aqueous and hydro-alcoholic gels. High levels of Transcutol® P are achievable without altering the clear gel structure or its stability, whatever the gelling agent (carbomers, hydroxyethylcellulose and hydroxypropylcellulose).

Stable, clear gels (viscosity ≈ 5000 mPa.s) are obtained with:

- 2% hydroxyethylcellulose and up to 40% Transcutol® P
- 0.5% carbomer and up to 30% Transcutol® P
- 2.5% hydroxylpropylcellulose and up to 25% Transcutol® P

## Microemulsions

Transcutol® P has been extensively studied in microemulsion systems where it acts as a solubilizer (Kreilgaard, 2002). A comprehensive review summarizes the main microemulsion compositions with Transcutol® P (Ha, 2019).

## Foams

Foams result from the conversion of a microemulsion or an emulsion with the use of a propellant-free or propellant device. In both cases, Transcutol® P is used as a solubilizer.

## Patches

Transcutol® P is used as a permeation enhancer with the API in the pressure-sensitive-adhesive layer (Shen et al, 2018).

# Case studies

Three main steps govern drug diffusion from the formulation to the skin:

- Solubility: the formulation must solubilize a sufficient amount of drug to deliver an effective concentration at the target site
- Partition: the drug must partition out of the delivery vehicle into the upper layers of the SC
- Diffusion: the drug molecule diffuses through the SC mainly via the intercellular path

Fick's law applies for passive diffusion, meaning it is driven by drug concentration and that maximum flux is obtained at saturation solubility.

The different processes for a drug to solubilize, partition and diffuse through the different layers of the skin are dependent on API intrinsic properties (molecular weight, melting point, solubility, ....) and on the formulation (Figure 5). As such, the choice of excipients is critical.

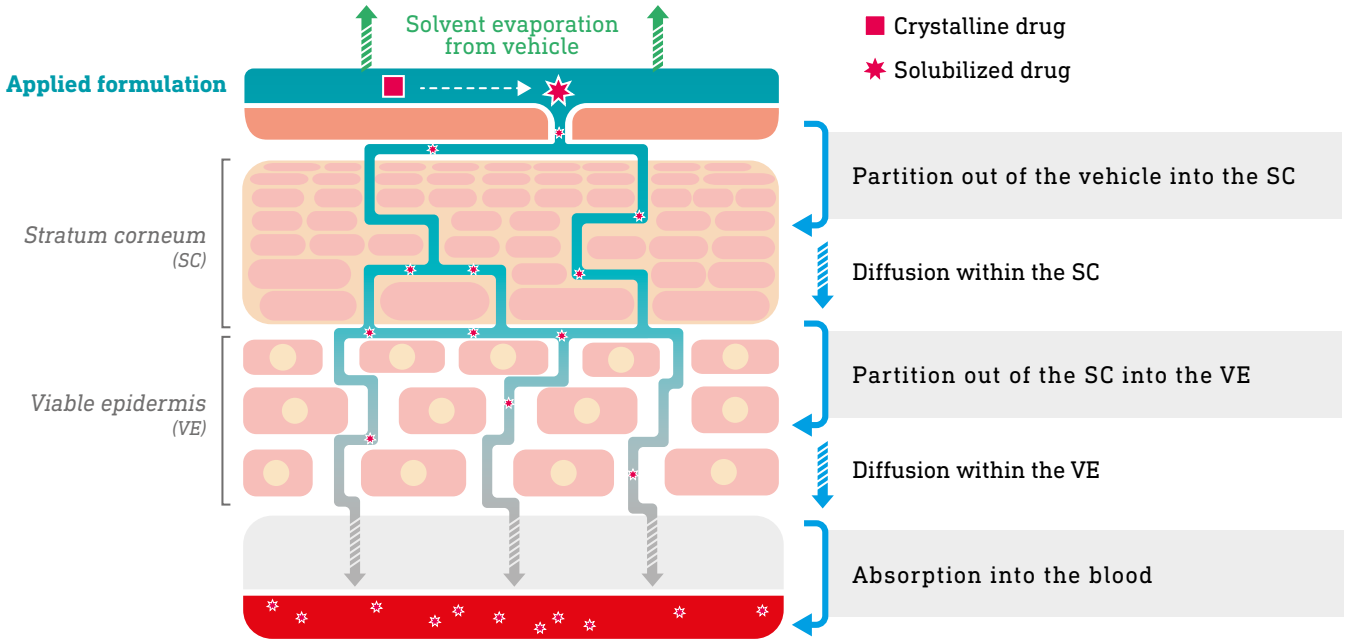



Figure 5: Schematic representation of skin delivery (adapted from Lane, 2013)

To illustrate the role of Transcutol® P and the importance of formulation, several case studies are described.

**CS #1: Achieving the right balance between solubility and thermodynamic force**

**CS #2: Transcutol® P is suitable for a wide range of active ingredients**

**CS #3: Benefiting from synergy between Transcutol® P and Lauroglycol™ FCC**

**CS #4: Leveraging solvent evaporation for increased efficacy**

## CS #1: Achieving the right balance between solubility and thermodynamic force

The art of the formulator consists in choosing the appropriate vehicles and determining their correct ratio to maximize drug solubility in the formulation and partition in the skin. Since no general rule can be established, screening of the API in different vehicles is a necessary step.

Two examples are provided below to show how different APIs behave in Transcutol® P and the importance of using a mixture of solvents, keeping in mind water is an essential solvent in topical formulations.

**Clonazepam**

| Drug properties | Impact on skin penetration |
|---|---|
| Molecular weight: 316 g/mol → | Suitable for topical delivery |
| Log P ≈ 2.4 → | Low lipophilicity |
| Water solubility: 0.1 mg/mL → | A major hurdle for drug partitioning in the hydrophilic regions past the SC |
| Solubility in Transcutol® P: 38.7 mg/mL → | Soluble |

The gel formulation consisted of 1.5% of clonazepam, 1% Carbopol 934 as gelling agent, 97% vehicle (different Transcutol® P:water ratios) and 0.5% triethanolamine as neutralizer. Two hundred milligrams of the gel formulation were applied on rabbit ear skin and permeation of the drug was assessed *in vitro* (Figure 6).

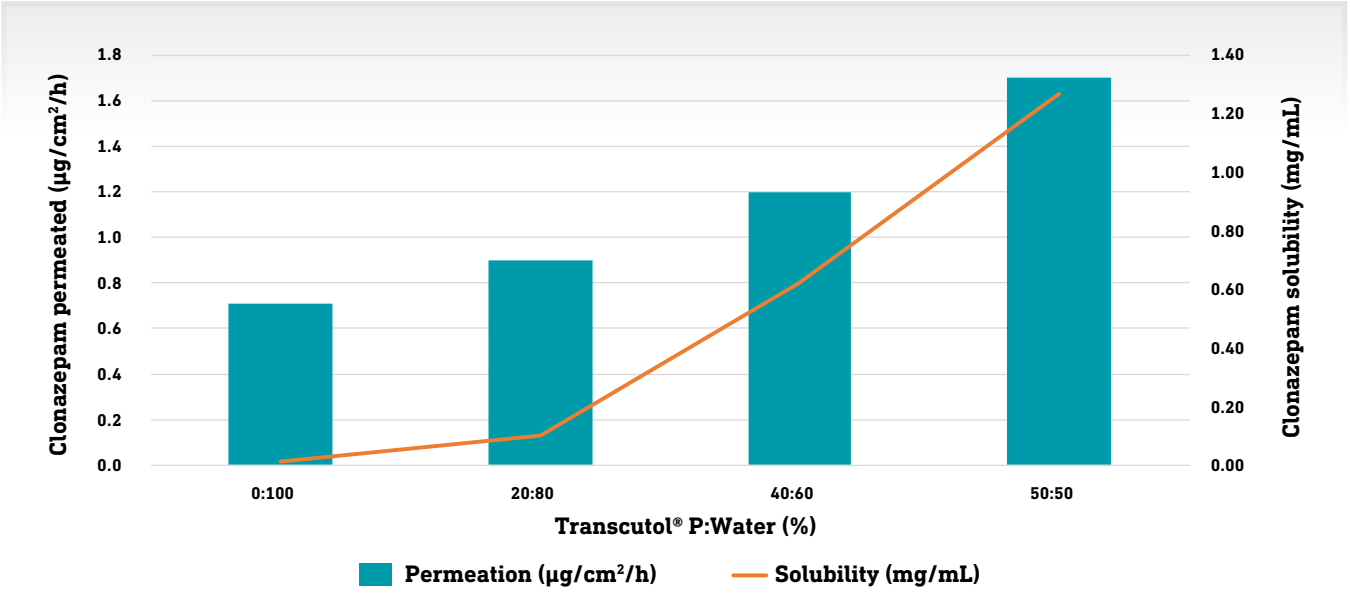



Figure 6: Clonazepam permeation for different ratios Transcutol® P:water solutions (adapted from Mura, 2000)

With rising Transcutol® P concentration both the flux and solubility of clonazepam increase. At 50% Transcutol® P concentration, the right balance between solubility and permeation is achieved.

## Ibuprofen

| Drug properties | Impact on skin penetration |
|---|---|
| Molecular weight: 206 g/mol | Suitable for topical delivery |
| LogP≈ 4 | Medium lipophilicity |
| Water solubility: 0.021 mg/mL | A major hurdle for drug partitioning in the hydrophilic regions past the SC |
| Solubility in Transcutol® P: 400 mg/mL | Freely soluble. Ibuprofen has a strong affinity for Transcutol® P |

Ibuprofen formulations (50 mg/mL) were prepared at different ratios of Transcutol® P:water and the permeation rate through human skin was assessed *in vitro* (Bialik, 1993). Comparing solubility and permeation rates of ibuprofen (Figure 7) suggests that there is an inverse relationship between flux and solubility.

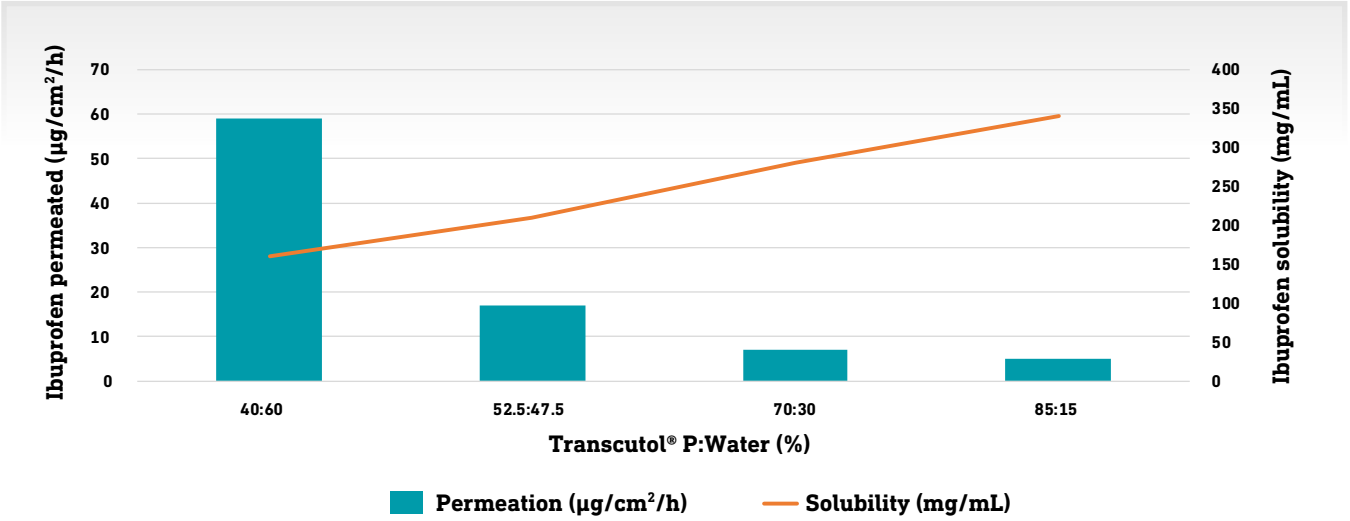



Figure 7: Ibuprofen permeation from Transcutol® P:water solutions (adapted from Bialik, 1993)

At 85:15 Transcutol® P:water ratio, limited permeation is observed, whereas at 40:60 ratio highest permeability is obtained. Due to its strong affinity for Transcutol® P, ibuprofen has little tendency to partition out when the vehicle contains more than 50% Transcutol® P.

The addition of water, in which ibuprofen is less soluble, increases the thermodynamic activity of ibuprofen, thus increasing its rate of permeation. The presence of water in the mixture maintains the skin hydration levels needed for a faster permeation rate. In this example, 40% Transcutol® P in water provides adequate solubility with the highest flux ratio.

### Conclusion

For hydrophilic or low lipophilic API, the SC is the sole barrier to the API. Therefore, good solubilization of the API is necessary to facilitate skin penetration. For API with medium or high lipophilicity, the barriers are the SC and the difficulty to partition into the hydrophilic layers beneath the SC.

Hydration capacity of the skin and the vehicle impact skin permeation. Thus, the relationship between solubility and permeation may be linear or inverse, depending on the quantity of solvent as well as water in the formulation.

# CS #2: Transcutol® P is suitable for a wide range of active ingredients

Lipophilic, hydrophilic, cationic or anionic... whatever the API, Transcutol® P is a powerful solubilizer and penetration/permeation enhancer.

## Highly lipophilic drug: tetrahydrocannabinol (LogP ≈ 7 )

Fabin et al (1991) measured the penetration of tetrahydrocannabinol in rat skin from three different formulations: neat Transcutol® P, PEG 400 and a 7:3 blend of propylene glycol:ethanol. Among the different solvents tested, the highest cumulative permeation was observed for Transcutol® P (Figure 8).

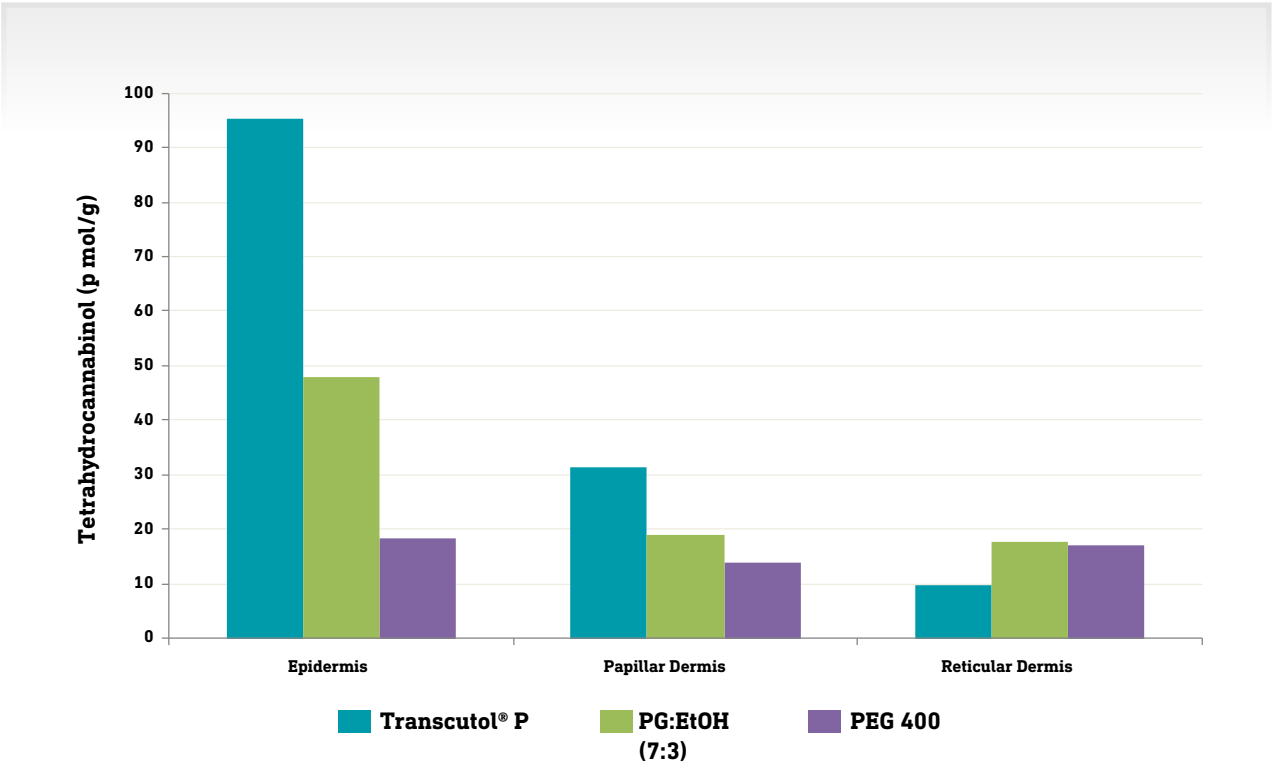



Figure 8: Distribution of tetrahydrocannabinol across rat skin (adapted from Fabin et al, 1991)

## Low lipophilic drug: dexamethasone (LogP ≈ 1.8)

Panchagnula et al (1991) observed a marked increase in dexamethasone solubility in Transcutol® P compared to other solvents: 0.445 mg/mL in water, 13.60 mg/mL in propylene glycol and 72.9 mg/mL in Transcutol® P.

The penetration of dexamethasone as a function of skin depth for the tested solvents showed a tremendous increase in permeation with Transcutol® P (Figure 9).

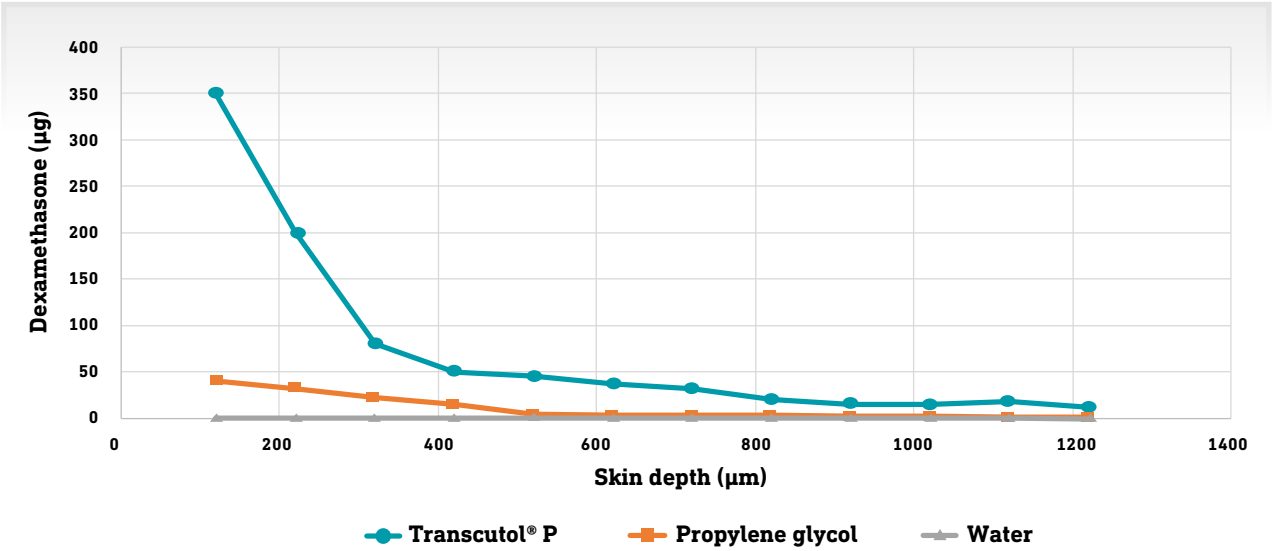
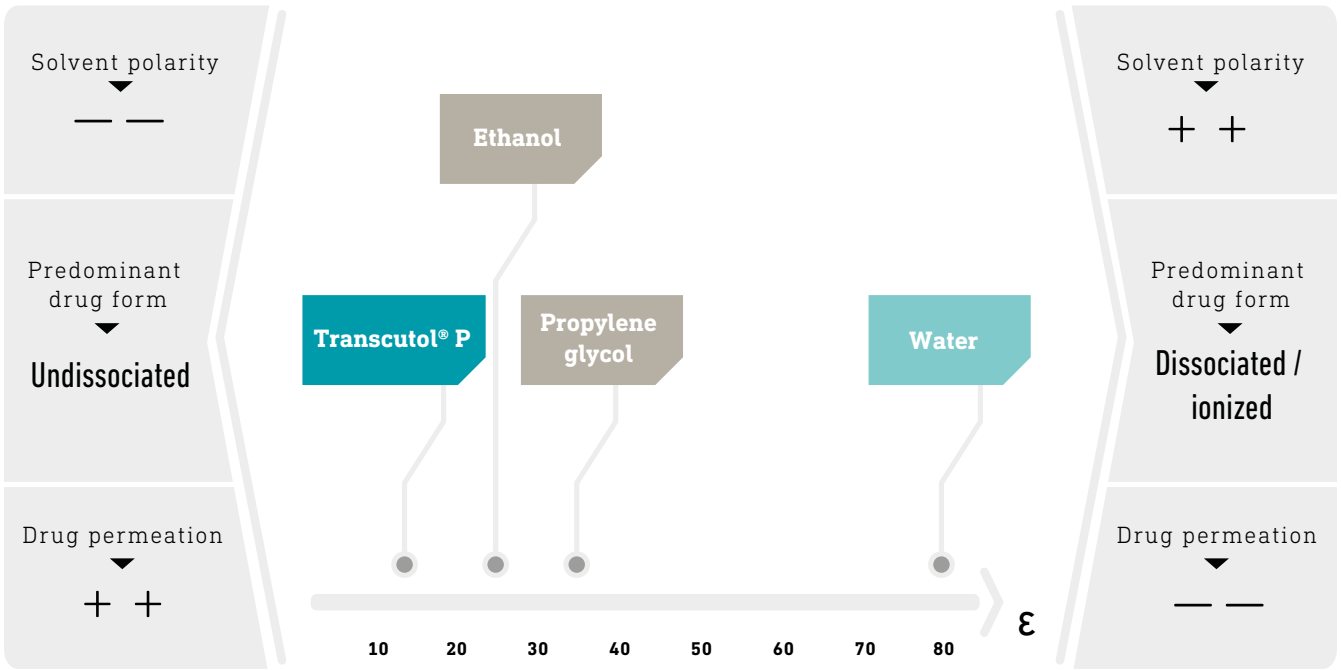



Figure 9: Distribution of dexamethasone in rat skin layers (adapted from Panchagnula, 1991)

## Ionizable drugs

Ionized, drug molecules are poorly absorbed across the skin barrier. Moreover, slight changes in pH in the formulation or in the skin can cause large variations in permeability (Cázares -Delgadillo, 2005).

Owing to a lower dielectric constant (ε), Transcutol® P is much less polar than water. Therefore, ionizable drugs will dissociate to a lower extent in Transcutol® P than in water, which favors increased permeation.



## CS #3: Benefiting from synergy between Transcutol® P and Lauroglycol™ FCC

The synergistic use of penetration enhancers to increase skin delivery is a well-established practice, abundantly described in the literature (Dragicevic, 2015; Karande, 2009; Lane, 2013). The synergy of Transcutol® P with penetration enhancers has been more specifically reviewed (Osborne, 2018) and its association with Lauroglycol™ FCC highlighted (Morin, 2019; Dauphin-Chanard, 2019).

Lauroglycol™ FCC is a propylene glycol monolaurate (Type I, >45% monoesters), with ≥95% lauric acid ($C_{12}$), a fatty acid known to enhance skin permeation (Aungst, 1986).

Lidocaine hydrochloride solubility was assessed in various solvents and penetration enhancers, either alone or in combination (Table 2). In neat excipients, highest solubility was obtained for water, followed by Transcutol® P, whereas Lauroglycol™ FCC exhibited a limited solubility.

Table 2: Solubility of lidocaine HCl in various penetration enhancers (adapted from Dauphin-Chanard et al. 2019)

| Permeation enhancer | Solubility at 32°C (mg/mL) |
|---|---|
| Water | 796.2 ± 16.7 |
| Transcutol® P | 379.0 ± 14.8 |
| Transcutol® P / Lauroglycol™ FCC (7/3) | 271.0 ± 8.4 |
| Transcutol® P / Lauroglycol™ FCC (5/5) | 143.4 ± 9.6 |
| Lauroglycol™ FCC | 5.4 ± 0.3 |

Permeation of lidocaine hydrochloride was assessed in Franz cells (Strat-M membrane) for Transcutol® P and Lauroglycol™ FCC, alone or in combination (Figure 10).

In neat excipient, highest permeation rate was obtained for Transcutol® P, followed by water and Lauroglycol™ FCC. This shows that although water is the best solubilizer for lidocaine hydrochloride, it is not the best permeation enhancer.

When combining Lauroglycol™ FCC and Transcutol® P at different ratios, a faster onset of drug diffusion was observed demonstrating a synergistic effect. Transcutol® P increased drug solubility in the formulation, whereas Lauroglycol™ FCC pushed the drug to partition into the membrane.

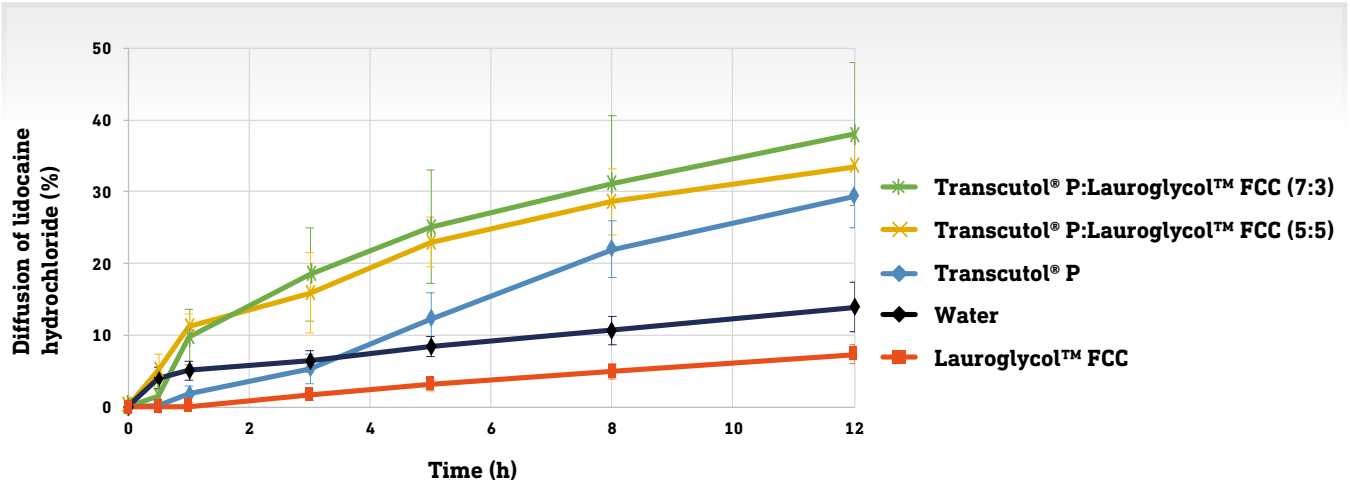



Figure 10: Diffusion of lidocaine HCl in Transcutol® P and Lauroglycol™ FCC (adapted from Dauphin-Chanard et al. 2019)

## CS #4: Leveraging solvent evaporation for increased efficacy

Aczone® gel was first approved by the FDA in 2005. The original commercial product contained 5% dapsone and 25% DEGEE.

Dapsone has poor aqueous solubility and high solubility in DEGEE (Figure 11). Therefore, about 25% of the API is dissolved in the gel, the remaining being suspended in the gel.

Interestingly, the efficacy of the product relies on the subtle equilibrium between solubilized and crystalline API, which is driven by water evaporation after application of the gel.

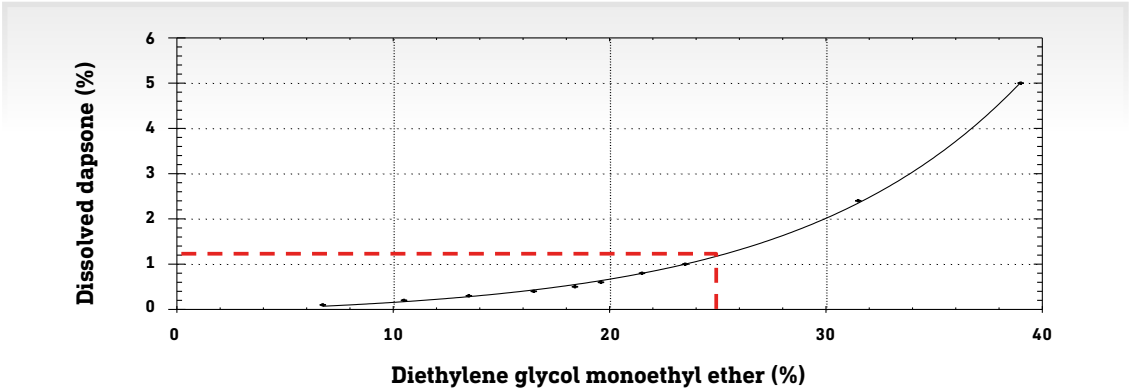



Figure 11: Dapsone solubility as a function of DEGEE concentration (adapted from Osborne, 2011)

Dapsone is used to treat acne due to its dual efficacy as anti-microbial and anti-inflammatory agent:

- The anti-microbial activity is targeted in the pilosebaceous follicle in the upper part of the stratum corneum where sebum accumulates and bacteria can develop.
- To reach the systemic circulation and reduce inflammation, dapsone must be solubilized and penetrate through the stratum corneum.

During rub-in, dapsone penetrates and accumulates in the hair follicle openings, where it acts as anti-microbial. Rubbing in the gel onto the skin also helps deposit any suspended drug particles into the pilosebaceous units, creating a reservoir for subsequent dissolution in sebum over time, becoming a secondary formulation.

Another factor significantly impacting the efficacy of the formulation is the relative volatility of water compared to Transcutol® P. The evaporation of water after application of the gel translates to a higher ratio of Transcutol® P in the dose, helping to further solubilize the undissolved dapsone. The relative increase in DEGEE concentration in the gel enables a higher drug solubilization and penetration across the skin, providing a higher efficiency. Since DEGEE is the stronger solvent and less volatile there is no drug precipitation on the surface of the skin, and consequently no residue after application.

In this gel formulation, DEGEE and water act as solvent partners, enabling optimization of the ratio of crystallized /solubilized drug to obtain an efficient formulation for acne.

# Regulatory information, precedence of use and safety

Transcutol® P is a well-identified, safe excipient which conforms to the EP and USP-NF pharmacopoeias (Table 3). Diethylene glycol monoethyl ether is registered in the FDA Inactive Ingredient Database and its use level in topical and transdermal skin delivery is provided in Table 4.

Diethylene glycol monoethyl ether safety is established via numerous toxicological studies reviewed by Sullivan et al, 2014. Gattefossé main studies on Transcutol® P in dermal route are listed in Table 5, all demonstrate the safety of Transcutol® P. For further information about the extensive toxicological and safety data available to support the use of Transcutol® P please contact Gattefossé.

DEGEE has been used for decades in numerous market references for topical and transdermal deliveries, some examples are listed in Table 6.

Table 3: Transcutol® P regulatory summary

| | |
|---|---|
| USP-NF Name | Diethylene glycol monoethyl ether |
| Ph. Eur. name | Diethylene glycol monoethyl ether |
| CAS number | 111-90-0 |
| UNII Code (FDA) | A1A1I8X02B |
| INCI name | Ethoxydiglycol |
| Handbook of Pharmaceutical Excipients | Diethylene glycol monoethyl ether |
| Drug master file | US DMF 5718; Canada MF 2005 - 108 |

Table 4: US FDA inactive ingredient database references for diethylene glycol monoethyl ether

| Route | Dosage form | Use level |
|---|---|---|
| Topical | Cream | 15% |
| Topical | Gel | 49.91% |
| Topical | Lotion | 1% |
| Topical | Ointment | 5% |
| Transdermal | Gel | 5% |
| Transdermal | Patch | 430 mg |

Table 5: Safety studies for the dermal route performed by Gattefossé on Transcutol® P

| Study type | Species | Transcutol® P concentration | Conclusion |
|---|---|---|---|
| Acute Irritation (JORF) | Rabbit | 50% in water | Non-irritant |
| Acute Irritation (Patch test) | Human | Pure | Well tolerated |
| Sensitization (HRIPT) | Human | Pure | Non-irritant<br>Non-sensitizing |

Detailed information is available in our Regulatory Datasheet

Table 6: Market references using diethylene glycol monoethyl ether in topical dosage forms

| Dosage form | Indication | API | Country |
|---|---|---|---|
| Cream | Anesthetics | Lidocaine | South Korea |
| | Anti-acne | Erythromycin | Ghana |
| | | Tretinoin | Ghana |
| | Antibiotics | Fusidic acid | Pakistan |
| | Antibiotics; Antifungals | Mupirocin; Clotrimazole | Columbia |
| | Antibiotics; Cicatrizants; Antihistaminic | Sulfadiazine; Zinc oxide; Diphenhydramine | Taiwan |
| | Antifungals | Terbinafine | Taiwan |
| | Anti-inflammatory; Anesthetics; Analgesics and antipyretics | Diclofenac; Menthol; Methyl salicylate | India |
| | Antivirals | Aciclovir | South Korea |
| | Cicatrizants | Dexpanthenol | Syria |
| | Corticosteroids | Fluocinonide | USA |
| | | Halobetasol | Brazil; India |
| | Corticosteroids; Hyperpigmentation; Anti-acne | Fluocinolone acetonide; Hydroquinone; Tretinoin | Pakistan |
| | Hyperpigmentation; Anti-acne; Corticosteroids | Hydroquinone; Tretinoin; Mometasone | India |
| | Vitamins; Emollients and protectives | 7-Dehydrocholesterol; Saccharide isomerate | Malaysia |
| | Vitamins | Vitamin C | Indonesia |
| Gel | Analgesics and antipyretics; Anesthetics | Diethylamine; Myrtecaine | Germany |
| | Anesthetics | Lidocaine, Lidocaine hydrochloride | South Korea |
| | | Tetracaine | USA |
| | Anti-acne | Dapsone | Canada; USA |
| | Anti-inflammatory | Diclofenac | Argentina; Morocco; Uruguay |
| | | Ibuprofen | Spain |
| | | Ketoprofen | South Korea |
| | | Naproxen | Italy |
| | | Nimesulide | Brazil; Italy; Turkey |
| | | Piroxicam | South Korea; Taiwan |
| | Anti-inflammatory; Analgesics and antipyretics; Anesthetics | Nimesulide; Methyl salicylate; Menthol; Capsaicin | India |
| | Anti-neoplastics | Mechlorethamine | USA |
| | Anti-varicose | Organo-heparinoid | Brazil |
| | Drugs for urinary frequency and incontinence | Oxybutynin | USA |
| | Improves the microcirculation; Analgesics and antipyretics | Escin; Diethylamine salicylate | Italy |
| | Hormones | Estradiol | Europe; Tunisia; Chile, USA |

| Dosage form | Indication | API | Country |
|---|---|---|---|
| Lotion | Anti-inflammatory | Piroxicam | South Korea |
| | Antiseptics and disinfectants | Menthol | USA |
| | Corticosteroids | Desoximethasone | South Korea |
| Ointment | Blood substitutes; Anti-inflammatory | Dextran; Phenylbutazone | France |
| Patch | Analgesics and antipyretics; Anti-inflammatory | Paracetamol; Diclofenac | Taiwan |
| | Anesthetics | Capsaicin | USA; Europe |
| | Anti-inflammatory | Piroxicam | South Korea |
| | Antiseptics and disinfectants | Menthol | South Korea |
| | Hormones | Estradiol; Levonorgestrel | UK |
| Solution | Anesthetics; Antiseptics and disinfectants | Benzocaine; Butoforme; Oxyquinoleine | France |
| | Antifungals | Terbinafine | South Korea |
| | Antiseptics and disinfectants | Benzalkonium | Italy |
| | | Triclosan | France |
| | Antiseptics and disinfectants | Benzalkonium; Chlorhexidine | France |
| | Corticosteroids | Hydrocortisone | France |
| | Corticosteroids; Antifungals; Antibiotics | Clobetasol; Clotrimazole; Neomycin | India |
| | Erectile dysfunction | Alprostadil | Brazil |
| | Insecticides and repellents | Esdepallethrine; Piperonyle butoxyde | France; Germany; Eastern Europe; Morocco; Tunisia |
| | Peripheral vasodilators | Minoxidil | South Korea |
| | Expectorants | Guethol nicotinate; Guaifenesin; Eucalyptol; Pinus | France |

# Technical support

Gattefossé range of excipients for topical drug delivery include solubilizers, emulsifiers and viscosity modifying agents. Emulsifiers are designed for challenging formulations and deliver excellent texture and sensorial properties. Solubilizers provide skin penetration enhancement and viscosity agents stabilize formulations. Our excipients are used in creams, emulgels, lotions, foams, microemulsions and gels. Gattefossé can provide technical support to help you with the selection of excipients for topical drug delivery.

Please contact your local Gattefossé representative

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