Betulin Lab
Latvijas Finieris Group

Birch Bark Extract Oleogel for Cosmetics

Natural triterpene-based oleogels for next-generation cosmetic emulsions

Birch bark extract oleogels combine naturally occurring triterpenes with plant oils to create a multifunctional cosmetic ingredient. The system enables the preparation of stable Pickering emulsions without conventional surfactants, allowing simplified and energy-efficient formulation of creams and emulsions.

Our oleogels are produced from birch (Betula pendula, Betula pubescens) bark extract combined with natural oils such as sunflower, jojoba or MCT oil. The product is currently being scaled to production levels to support industrial cosmetic applications. Preliminary content analysis suggests a birch bark extract concentration of approximately 2–6%.

Safety testing has demonstrated no cytotoxic or phototoxic effects, and stability and oxidation studies have been performed. Official technical documentation is currently being prepared.

Key advantages

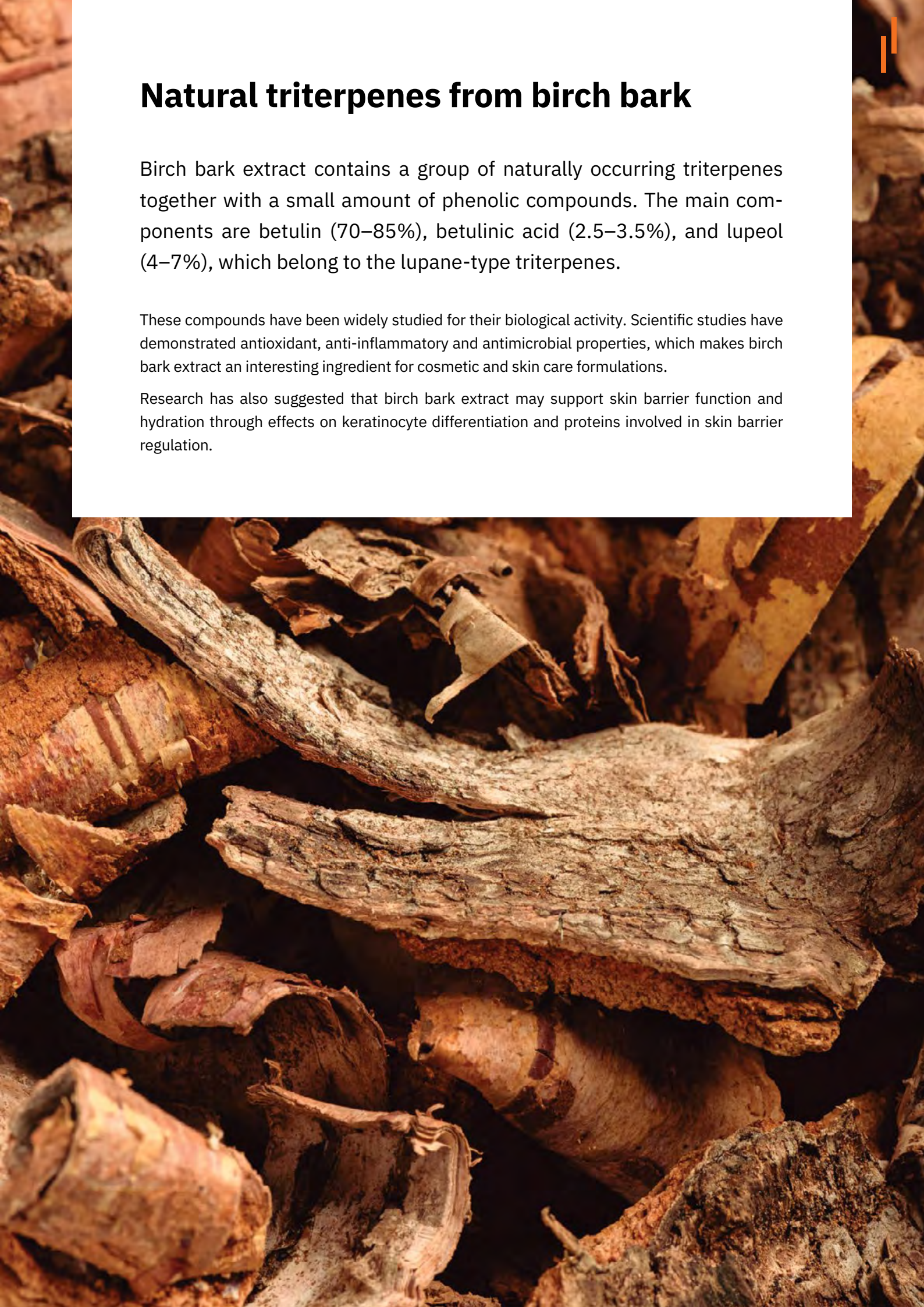
- natural ingredient derived from birch bark
- rich in triterpenes (betulin, betulinic acid, lupeol)
- multifunctional cosmetic ingredient
- enables surfactant-free Pickering emulsions
- suitable for cold-process formulations
- plant-oil based system

Natural triterpenes from birch bark

Birch bark extract contains a group of naturally occurring triterpenes together with a small amount of phenolic compounds. The main components are betulin (70–85%), betulinic acid (2.5–3.5%), and lupeol (4–7%), which belong to the lupane-type triterpenes.

These compounds have been widely studied for their biological activity. Scientific studies have demonstrated antioxidant, anti-inflammatory and antimicrobial properties, which makes birch bark extract an interesting ingredient for cosmetic and skin care formulations.

Research has also suggested that birch bark extract may support skin barrier function and hydration through effects on keratinocyte differentiation and proteins involved in skin barrier regulation.



Cosmetic potential of birch bark extract

Antioxidant activity is an important property for cosmetic ingredients that support skin health. Laboratory studies using DPPH and ABTS assays have demonstrated strong free radical scavenging properties for birch bark extracts.

In addition to antioxidant activity, triterpenes present in birch bark extract have been associated with:

- support of skin barrier function
- antimicrobial activity against certain skin microorganisms
- potential anti-inflammatory effects
- support for skin regeneration processes

These properties create opportunities for the use of birch bark extract in a variety of cosmetic applications.

Oleogel

Birch bark extract consists primarily of highly hydrophobic compounds: betulin, betulinic acid and lupeol naturally have very little bioavailability and are stable in nature.

To obtain the therapeutic benefits these molecules provide, birch bark extract can be dissolved in a lipid phase, making them more accessible and creating an oleogel (Grysko & Daniels, 2013).

Oleogels are made by structuring a lipid to obtain a gel, which is achieved through the noncovalent interactions of hydrophilic molecules dissolved in the lipid. The natural ability of betulin, betulinic acid, lupeol and other minor components of birch bark extract to self-assemble in solution to form large structures (Grysko & Daniels, 2013) can be used in place of traditional emulsifiers, allowing the formation of stable gels with many potential applications.

In practice, oleogels are made by combining plant oils with a defined amount of birch bark extract, either in powder or solution form, heating the mixture and stirring it. To ensure even distribution of the betulin, betulinic acid and lupeol crystals, the mixture is homogenised. As it cools, a gel is formed (Laszczyk et al., 2006).

Oils used in the production of oleogel

Since oleogels are produced using a lipid phase, the choice of oil influences both the gelling process and the pharmacological properties when applied dermally.

Studies have shown that several oils allow efficient release of the active triterpenes (betulin, betulinic acid and lupeol) from the oleogel system. In particular, oils such as almond oil, jojoba oil and sunflower oil have demonstrated favourable behaviour in oleogel systems and may support the release of active compounds when applied to the skin.

For the oleogels described in this brochure, plant oils such as sunflower oil, jojoba oil or MCT oil are used as the lipid phase, providing a stable carrier for the triterpene network.

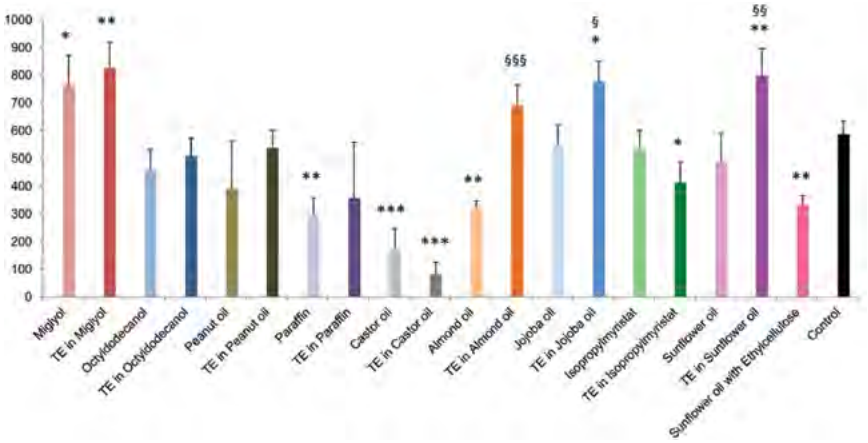


*Figure 1, Influence of different oils on oleogel performance (Steinbrenner et al., 2015). Mean + SEM. * compared to control, § comparison between oil and oleogel. */§. p<0.05, **/§§ p<0.01, ***/§§§ p<0.001. peanut oil, TE in peanut oil, paraffin, TE in paraffin, castor oil, TE in castor oil. n = 4–5; Miglyol (MCT), TE in Miglyol (MCT), octyldodecanol, TE in octyldodecanol, almond oil, TE in almond oil, jojoba oil, TE in jojoba oil, isopropylmyristate, TE in isopropylmyristate, sunflower oil, TE in sunflower oil, sunflower oil with ethylcellulose: n = 9–14, control: n = 14.*

Pickering emulsions

Pickering emulsions are made without surfactants, instead relying on solid particles to stabilise the solution.

The components of birch bark extract, particularly betulin, betulinic acid and lupeol, have been shown to allow the formation of stable emulsions, which positively influence the bioavailability of birch bark extract.

A Pickering emulsion produced using one of the key components of birch bark extract, betulin, oil and water demonstrated strong rheological properties which improved with increased proportions of betulin (Zeng et al., 2024).

It is particularly interesting to produce Pickering emulsions using birch bark extract because it is possible to do so without using heat – a so-called cold emulsion – allowing energy savings during production.

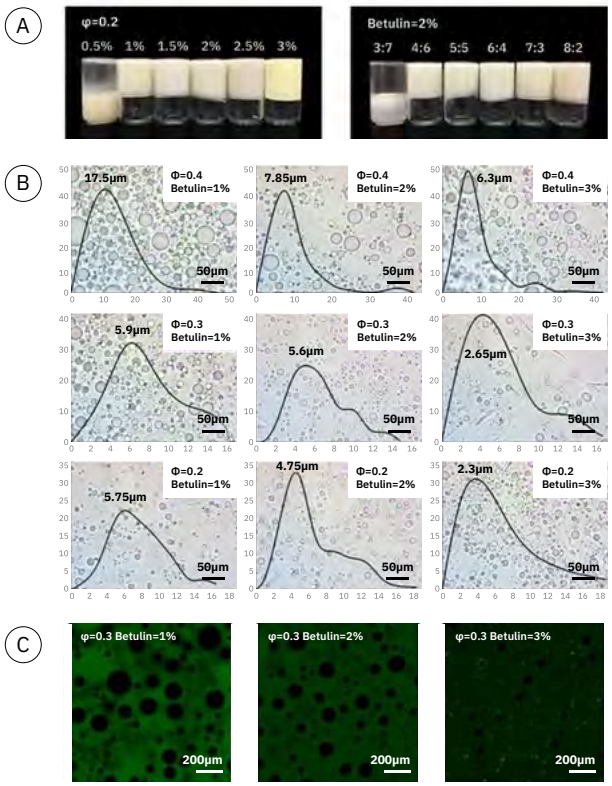


Figure 2, Zeng et al., 2024. Effects of betulin particle concentration and/or water fraction (φ) on (A) visual appearance (B) droplet size and (C) Confocal Laser Scanning Microscopy (CLSM) of the emulsions.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Creams

Using our oleogel, it is possible to produce a cream by combining 40% oleogel and 60% distilled water, without the use of any emulsifiers.

Example formulations using oleogel

Oleogel produced from birch bark extract is a natural emulsifier for Pickering emulsions with antioxidant and antibacterial properties, which encourage skin regeneration. It contains 3-6% triterpenes (mainly betulin, lupeol and betulinic acid) embedded in a plant oil (sunflower, jojoba or MCT). This oleogel is deep gold in colour and has a gentle, particular scent originating from birch outer bark.

Cold pickering emulsions formulas

Formulation 1

40% oleogel + 60% aqua

- Combine ingredients at room temperature: add reverse osmosis water to the oleogel
- Shake the mixture, until it is almost homogeneous (~1 min)
- Homogenise the mixture (10 000 rpm) until homogeneous (1-3 min)
- Homogeniser: IKA T18 Ultra Turrax
- For this formula, small drops of water may appear during storage

Formulation 2

40% oleogel + 58% aqua + 2% glycerine

- Combine ingredients at room temperature: add reverse osmosis water to oleogel
- Shake the mixture, until it is almost homogeneous (~1 min)
- Homogenise the mixture (10 000 rpm) until homogeneous (1-3 min)

Formulation 3

40% oleogel + 57% aqua + 2% glycerine + 0,5% NaCl+ 0,5% MgSO4

- Combine ingredients at room temperature: add reverse osmosis water to oleogel
- Shake the mixture, until it is almost homogeneous (~1 min)
- Homogenise the mixture (10 000 rpm) until homogeneous (1-3 min)

Observations

Glycerine can be used to prevent the extrusion of water from the emulsion.

At the salt (NaCl, MgSO4) concentration used, the emulsion showed resistance to negative effects of electrolytes.

Potential cosmetic applications

Due to the presence of naturally occurring triterpenes and the ability to form stable Pickering emulsions, birch bark extract oleogels may be used in a variety of cosmetic formulations.

The multifunctional character of the oleogel system allows it to act both as a bioactive ingredient and as a structuring component in emulsions, enabling simplified formulation approaches.

Potential cosmetic applications include:

- skin care creams and lotions
- moisturising and barrier-support formulations
- natural and plant-based cosmetic products
- antioxidant skin care formulations
- surfactant-free emulsions
- cold-process cosmetic formulations

The oleogel system may be particularly attractive for formulators seeking simplified formulation processes, reduced surfactant use, and naturally derived ingredients.

References

Abdellaoui, A., Yengo, L., Verweij, K.J.H., Visscher, P.M., 2023. 15 years of GWAS discovery: Realizing the promise. The American Journal of Human Genetics 110, 179–194. https://doi.org/10.1016/j.ajhg.2022.12.011

Chen, H., Xiao, H., & Pang, J., 2020. Parameter Optimization and Potential Bioactivity Evaluation of a Betulin Extract from White Birch Bark. Plants 9(3), 392. https://doi.org/10.3390/plants9030392

Ostapiuk, A., Kurach, L., Strzemski, M., Kurzepa, J., & Hordyjewska, A., 2021. Evaluation of Antioxidative Mechanisms In Vitro and Triterpenes Composition of Extracts from Silver Birch (Betula pendula Roth) and Black Birch (Betula obscura Kotula) Barks by FT-IR and HPLC-PDA. Molecules 26, 4633. https://doi.org/10.3390/molecules26154633

Emrich, S., Schuster, A., Schnabel, T., & Oostingh, G. J., 2022. Antimicrobial Activity and Wound-Healing Capacity of Birch, Beech and Larch Bark Extracts. Molecules 27(9), 2817. https://doi.org/10.3390/molecules27092817

Kletnieks, U. & Kletnieks, K., 2023. Betulin – Candidate for Targeting of Skin Aging. Proceedings of the XXXI International Scientific and Practical Conference. International Science Group.

Smiljanic, S., Messaraa, C., Lafon-Kolb, V., Hrapovic, N., Amini, N., Osterlund, C., & Visdal-Johnsen, L., 2022. Betula alba Bark Extract and Empetrum nigrum Fruit Juice, a Natural Alternative to Niacinamide for Skin Barrier Benefits. Int J Mol Sci 23(20), 12507. https://doi.org/10.3390/ijms232012507

Zeng, C., Wang, Y., Liu, Y., Su, S., Lu, Y., Qin, S., & Shi, M., 2024. Self-constructed water-in-oil Pickering emulsions as a tool for increasing bioaccessibility of betulin. Food Chemistry: X, 21, 101056. https://doi.org/10.1016/j.fochx.2023.101056

Bernard, P., Scior, T., Didier, B., Hibert, M., & Berthon, J., 2001. Ethnopharmacology and bioinformatic combination for leads discovery: application to phospholipase A2 inhibitors. Phytochemistry, 58(6), 865-874. https://doi.org/10.1016/S0031-9422(01)00312-0

Laszczyk, M., Jager, S., Simon-Haarhaus, B., Scheffler, A., & Schempp, C. M., 2006. Physical, Chemical and Pharmacological Characterization of a New Oleogel-Forming Triterpene Extract from the Outer Bark of Birch (Betulae Cortex). Planta Med, 72(15), 1389-1395. doi: 10.1055/s-2006-951723

Murrell, D., Bodemer, C., Bruckner, A. L., Cunningham, T., Davis, C., Fernandez, M. F., Kiritsi, D., Maher, L., Sprecher, E., Torres-Pradilla, M., & Kern, J. S., 2025. Long-term safety and efficacy of Oleogel-S10 (birch bark extract) in epidermolysis bullosa: 24-month results from the phase III EASE study. British Journal of Dermatology, 192(6), 1007-1017. https://doi.org/10.1093/bjd/ljaf022

Grysko, M. & Daniels, R., 2013. Evaluation of the mechanism of gelation of an oleogel based on a triterpene extract from the outer bark of birch. Die Pharmazie - An International Journal of Pharmaceutical Sciences, 68(7), 572-577. https://doi.org/10.1691/ph.2013.6515

Steinbrenner, I., Houdek, P., Pollok, S., Brandner, J. M., & Daniels, R., 2016. Influence of the Oil Phase and Topical Formulation on the Wound Healing Ability of a Birch Bark Dry Extract. PLoS One, 11(5), e0155582. doi: 10.1371/journal.pone.0155582

Su, S., Liu, Y., Li, H., Xia, H., Li, P., Qin, S., Shi, M., Guo, S., & Zeng, C., 2024. Effect of lipid type on betulin-stabilized water-in-oil Pickering emulsion: emulsion properties, in vitro digestion, and betulin bioaccessibility. Journal of the Science of Food and Agriculture, 105(2), 769-779. https://doi.org/10.1002/jsfa.13867

Frew, Q., Rennekampff, H., Dziewulski, P., Moiemen, N., BBW-11 Study Group, Zahn, T. & Hartmann, B., 2019. Betulin wound gel accelerated healing of superficial partial thickness burns: Results of a randomized, intra-individually controlled, phase III trial with 12-months follow-up. Burns, 45, 876-890. https://doi.org/10.1016/j.burns.2018.10.019

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