

Palmitoyl Pentapeptide-4 (Matrixyl)

棕榈酰五肽-4

Inventory of Existing Cosmetic Ingredients in China (IECIC 2021), No. 8759

B

Evigrade evidence level: B. Limited evidence. One RCT or several controlled studies with limitations

Palmitoyl pentapeptide-4 (pal-KTTKS) has one placebo-controlled human trial behind an anti-wrinkle effect: a 12-week split-face RCT in 93 women with 3 ppm in a moisturizer, run by Procter & Gamble, with no effect sizes in the abstract [S1]. A small pilot RCT without links to P&G points the same way but reports no numbers [S2]. For firmness and hydration there are only unreported measurements and laboratory work, so the data are moderate for fine lines and weak for the other claims.

Claims and what the data support

Claim	NMPA norms	Data
Anti-wrinkle 抗皱	Test required, literature supplements	Supported
Firming 紧致	Test required, literature supplements	Partly supported
Moisturizing 保湿	Literature can be enough	Not supported
Ingredient efficacy claim: contains palmitoyl pentapeptide-4, which helps reduce the appearance of fine lines 特定宣称（原料功效）	Literature can be enough	Supported

Anti-wrinkle

In a double-blind split-face RCT (n=93, women aged 35–55, 12 weeks), a moisturizer with 3 ppm pal-KTTKS reduced wrinkles and fine lines more than the same moisturizer without the peptide, by quantitative image analysis and by expert grading; participants also reported improvement [S1]. The abstract gives no effect sizes, and the trial was run by a finished-product manufacturer. A pilot RCT on crow's feet (n=21 across three arms, 8 weeks) reported better results for the peptide cream than for placebo, without numbers or p values [S2]. P&G split-face studies of multi-ingredient products improved periorbital roughness, but the peptide's share of the effect cannot be separated [S3]. Under the NMPA claim evaluation norms an anti-wrinkle claim needs a test of the product; this literature can only supplement it.

Firming

No controlled human study reports a firmness or elasticity result for this peptide. The pilot RCT measured elasticity with a Cutometer, but the abstract gives no values for it [S2]; in the abstract of the 93-person trial the only significant outcomes are wrinkles and fine lines [S1]. The rest is laboratory

work: KTTKS without palmitoyl increased collagen I, collagen III and fibronectin synthesis in cell culture [S6], and pal-KTTKS reached the epidermis and dermis of mouse skin in vitro [S4]. This is mechanism, not a firming effect measured in people. The claim needs a test of the product; literature can only supplement it.

Moisturizing

No published study reports a hydration result for this peptide. The pilot RCT measured skin hydration (Corneometer) and water loss (Tewameter), but the abstract gives no values [S2]. In the 93-person trial both sides of the face received the same moisturizer base, so any hydration from the base is the same on both sides [S1]. Literature is enough for a moisturizing claim under the norms, but the literature on palmitoyl pentapeptide-4 does not cover hydration and cannot back this claim; the product's moisturizing ingredients would need their own data.

Ingredient efficacy claim: contains palmitoyl pentapeptide-4, which helps reduce the appearance of fine lines

The wording matches what the 93-person RCT tested: 3 ppm pal-KTTKS in a leave-on moisturizer, used for 12 weeks, gave fewer visible wrinkles and fine lines than the same base [S1]. Under the norms, literature is enough for an ingredient claim, but the ingredient's action must be linked to the claim made for the product (Art. 11). Two conditions follow from the data. The product should contain at least 3 ppm of the peptide: below that, the trial does not apply to the product directly. The raw material should carry the tested KTTKS sequence, because the same INCI name also covers the KTSKS sequence [S1, S9]. All of this rests on one trial run by a manufacturer.

Tested concentrations

The only concentration tested in a placebo-controlled human trial is 3 ppm (0.0003%) pal-KTTKS in a moisturizer [S1]. The pilot RCT and the multi-ingredient studies do not state the peptide concentration in their abstracts [S2, S3]. Dose-response in humans has not been studied, so nothing shows that more than 3 ppm works better. Use levels reported to CIR are of the same order: the highest reported maximum in 2013 was 0.00061% (6.1 ppm) in eye lotions and face and neck products, and the 2023 draft cites 0.0012% (12 ppm) as the maximum reported for non-spray face and neck products [S8]. Raw materials sold under trade names are dilute solutions, so the peptide content of the finished product equals the percentage of raw material multiplied by the peptide content in the supplier's specification. If the result is below 3 ppm, the trial [S1] does not apply to the product directly. Human safety data reach higher levels: an HRIPT with 0.01% (100 ppm) [S8].

Studies

S1 Greater reduction in wrinkles and fine lines than the same moisturizer without peptide, by image analysis and expert grading; self-assessed improvement; well tolerated

Limitations: Single trial run by Procter & Gamble; no effect sizes in the abstract; Caucasian women aged 35–55 only; firmness and hydration not reported

S2 Peptide cream did better than acetyl hexapeptide-3 cream and placebo on photos, instrument data and self-assessment, according to the authors

Limitations: Pilot study, about 7 women per arm; no numbers or p values in the abstract; concentration not stated; funded by a cosmetics company

S3 Multi-ingredient products improved periorbital roughness (Ra, Rz) after 4 weeks compared with the untreated side

Limitations: Products also contained niacinamide, Pal-KT, carnosine and other actives, so the peptide's contribution cannot be separated; untreated side instead of vehicle control; P&G study

S4 Pal-KTTKS found in stratum corneum ($4.2 \pm 0.7 \mu\text{g}/\text{cm}^2$), epidermis ($2.8 \pm 0.5 \mu\text{g}/\text{cm}^2$) and dermis ($0.3 \pm 0.1 \mu\text{g}/\text{cm}^2$), not in receptor fluid; KTTKS without palmitoyl not detected in skin; both degraded quickly by skin proteases

Limitations: Mouse skin in vitro; concentration not stated in the abstract; no clinical outcome

S5 Passive delivery of pal-KTTKS into excised human skin was limited; microneedle pretreatment raised it 2–22-fold by fluorescence signal

Limitations: Ex vivo; fluorescent-labelled peptide; no clinical outcome

S6 KTTKS was the minimal sequence that stimulated collagen I, collagen III and fibronectin synthesis in mesenchymal cells

Limitations: Cell culture; peptide without palmitoyl; not a skin study

S7 Review of controlled ex vivo and in vivo studies of topical peptides against skin ageing; no pooled estimate in the abstract

Limitations: Narrative, not systematic; published in 2009, before the pilot RCT

S8 HRIPT without irritation or sensitization: 0.01% Pal-KTTKS in 51 subjects and a 0.12% Pal-KTSKS formulation diluted to 15% in 106 subjects; maximum use concentration in 2013 was 0.00061%

Limitations: Draft for panel review marked Do Not Cite or Quote; unpublished data submitted by industry

S9 Final report: safe in cosmetics in the present practices of use and concentration, for the KTTKS and KTSKS sequences

Limitations: Conclusion read in the panel's meeting announcement, full final report not opened; no reproductive or carcinogenicity data, judged mitigated by low exposure

Wording the data support

✓ Helps reduce the appearance of fine lines and wrinkles

Anti-wrinkle claim about the product: under the NMPA norms the product itself needs an efficacy test, this literature only supplements it

✓ Contains palmitoyl pentapeptide-4, which helps reduce the appearance of fine lines

Ingredient claim: only if the product contains at least 3 ppm of the peptide and the raw material carries the tested KTTKS sequence [S1]

✓ In a 12-week study, a moisturizer with 3 ppm of this peptide reduced visible wrinkles more than the same moisturizer without it

For the evidence summary in the claim file, not for the label: the study tested a different formula [S1]

Wording the data do not support

✗ Clinically proven to reduce wrinkles

One trial, run by a finished-product manufacturer, with no effect sizes in the abstract [S1]

✗ Boosts collagen by 350%

No data on skin collagen in people; collagen synthesis was shown only in cell culture, for the peptide without palmitoyl [S6]

✗ Reduces wrinkle depth by [X]% in 12 weeks

The trial abstract reports statistical significance but no percentages [S1]; a number needs a test of the product itself

✗ Firms and lifts the skin

No controlled human study reports a firmness or elasticity result [S1, S2]

✗ Palmitoyl pentapeptide–4 hydrates the skin

No hydration result has been reported for this peptide [S2]

✗ Penetrates into the dermis to rebuild collagen

Only small amounts reached the dermis of mouse skin in vitro, and passive delivery into human skin ex vivo was limited [S4, S5]; collagen in people was not measured

✗ Works like retinol, without irritation

None of the sources compares the peptide with retinoids; a no-irritation claim needs a test

✗ Matrixyl reduces wrinkles

The Matrixyl name is also used for other peptide blends, such as Matrixyl 3000 with different peptides; name the INCI and the tested sequence (Pal-KTTKS)

✗ Safe during pregnancy

Reproductive and developmental toxicity data are missing [S9]

Safety

The CIR Expert Panel issued a final report in 2024: palmitoyl pentapeptide–4 (KTTKS and KTSKS sequences) is safe in cosmetics in the present practices of use and concentration [S9]. The panel noted that developmental, reproductive and carcinogenicity data are missing and considered the gap mitigated by low use concentrations, limited dermal absorption in vitro, negative genotoxicity tests and a negative estrogen agonist assay of a 0.12% Pal-KTSKS formulation [S9]. Human data from the 2023 draft: a trade-name mixture with 0.01% Pal-KTTKS caused no irritation or sensitization in an HRIPT with 51 subjects, and a 0.12% Pal-KTSKS formulation diluted to 15% in water caused none in an HRIPT with 106 subjects [S8]. At 3 ppm the peptide was well tolerated in the 12-week RCT [S1]. We did not open the full final report; the conclusion comes from the panel's meeting announcement. The draft is marked Do Not Cite or Quote, so its figures should be checked against the final report before submission.

What the literature does not cover

There is no independent replication of the 93-person trial with reported effect sizes and no systematic review or meta-analysis. Dose-response in humans has not been studied, so concentrations other than 3 ppm are untested. No controlled human study reports results for firmness, elasticity or hydration. Collagen in human skin after topical use has not been measured; collagen synthesis was shown in cell culture, for the peptide without palmitoyl. The efficacy data come from the KTTKS sequence; there are none for the KTSKS sequence that the same INCI name covers. Reproductive, developmental and carcinogenicity data are missing. The trials enrolled Caucasian women [S1] and Indonesian women [S2]; there are no data in men. A PubMed search for October 2024 to October 2026 found no new human efficacy study of this ingredient.

Sources

S1 Robinson LR, Fitzgerald NC, Doughty DG et al. Int J Cosmet Sci 2005;27(3):155–160
PMID 18492182 · DOI 10.1111/j.1467-2494.2005.00261.x · RCT, split-face, double-blind, placebo-controlled, n=93, 12 weeks · Funding: Procter & Gamble

S2 Aruan RR, Hutabarat H, Widodo AA et al. J Clin Aesthet Dermatol 2023;16(2):37–43
PMID 36909866 · RCT, double-blind, three parallel arms, pilot, n=21, 8 weeks · Funding: Paragon Technology and Innovation (Indonesian cosmetics company)

- S3** Kaczvinsky JR, Griffiths CE, Schnicker MS, Li J. J Cosmet Dermatol 2009;8(3):228–233
PMID 19735523 · DOI 10.1111/j.1473–2165.2009.00444.x · two RCTs, split-face, double-blind, multi-ingredient products, n=77, 4 weeks · Funding: Procter & Gamble
- S4** Choi YL, Park EJ, Kim E et al. Biomol Ther (Seoul) 2014;22(4):321–327
PMID 25143811 · DOI 10.4062/biomolther.2014.053 · in vitro, Franz cells, hairless mouse skin · Funding: not manufacturer-funded
- S5** Mohammed YH, Yamada M, Lin LL et al. PLoS One 2014;9(7):e101956
PMID 25033398 · DOI 10.1371/journal.pone.0101956 · ex vivo, excised human skin, 1 and 24 hours · Funding: not manufacturer-funded
- S6** Katayama K, Armendariz-Borunda J, Raghow R et al. J Biol Chem 1993;268(14):9941–9944
PMID 8486721 · in vitro, cell culture · Funding: U.S. government grants
- S7** Gorouhi F, Maibach HI. Int J Cosmet Sci 2009;31(5):327–345
PMID 19570099 · DOI 10.1111/j.1468–2494.2009.00490.x · narrative review · Funding: not manufacturer-funded
- S8** Cosmetic Ingredient Review. Safety Assessment of Myristoyl Pentapeptide–4, Palmitoyl Pentapeptide–4, and Pentapeptide–4 as Used in Cosmetics. Draft Report for Panel Review, released August 18, 2023
<https://www.cir-safety.org/sites/default/files/Pentapeptides.pdf> · safety assessment, draft
- S9** Cosmetic Ingredient Review. Post Meeting Announcement, 170th Expert Panel Meeting (September 30 – October 1, 2024). Final Safety Assessment: Pentapeptide Ingredients
https://www.cir-safety.org/sites/default/files/PostMeetingAnnouncement_102024_0.pdf · safety assessment, final conclusion

PMID checked in PubMed on 2026–10–13

An evidence summary you can use when you prepare your efficacy claim file for NMPA. We do not check compliance. The claim decision stays with your team.

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棕榈酰五肽-4

Palmitoyl Pentapeptide-4 (Matrixyl)

《已使用化妆品原料目录（2021年版）》第 8759 号

B Evigrade 证据等级：B。证据有限：一项随机对照试验，或数项有局限的对照研究

棕榈酰五肽-4（pal-KTTKS）的抗皱作用有一项安慰剂对照人体试验支持：93 名女性参加的 12 周随机半脸对照试验，保湿霜中含 3 ppm 该肽，由宝洁公司开展，摘要中没有效应量[s1]。一项与宝洁公司无关的小型随机对照预试验结果方向一致，但没有报告数值[s2]。紧致和保湿方面只有未报告结果的测量和实验室研究，因此细纹方面的证据为中等，其他宣称的证据较弱。

功效宣称与数据支持情况

宣称	规范要求	数据
抗皱	须做试验，文献作补充	数据支持
紧致	须做试验，文献作补充	部分支持
保湿	可仅用文献资料	数据不支持
原料功效宣称：含有棕榈酰五肽-4，有助于改善细纹外观	可仅用文献资料	数据支持

抗皱

在一项双盲半脸随机对照试验（n=93，35 至 55 岁女性，12 周）中，含 3 ppm pal-KTTKS 的保湿霜与不含该肽的同一保湿霜相比，经图像定量分析和专家评估，皱纹和细纹的改善幅度更大；受试者自评也有改善[s1]。摘要没有给出效应量，试验由成品化妆品企业开展。一项针对鱼尾纹的随机对照预试验（三组共 21 人，8 周）报告含肽乳霜的结果优于安慰剂，但没有数值和 p 值[s2]。宝洁公司对多成分产品的半脸研究显示眼周皮肤粗糙度改善，但无法区分该肽的贡献[s3]。按照《化妆品功效宣称评价规范》，产品的抗皱宣称须进行功效宣称评价试验，文献资料只能作为补充。

紧致

目前没有对照人体研究报告该肽对紧致度或弹性的结果。随机对照预试验用 Cutometer 测量了弹性，但摘要没有给出相应数值[s2]；93 人试验的摘要中，有统计学意义的结局只有皱纹和细纹[s1]。其余都是实验室研究：未棕榈酰化的 KTTKS 在细胞培养中增加了 I 型胶原、III 型胶原和纤连蛋白的合成[s6]；体外实验中 pal-KTTKS 到达了小鼠皮肤的表皮和真皮[s4]。这些属于作用机制数据，不是在人体上测得的紧致效果。该宣称须进行功效宣称评价试验，文献资料只能作为补充。

保湿

没有已发表的研究报告该肽的保湿结果。随机对照预试验测量了皮肤含水量（Corneometer）和经皮水分流失（Tewameter），但摘要没有给出数值[s2]。在 93 人试验中，两侧面部使用同一保湿霜基质，基质带来的保湿作用两侧相同[s1]。按照规范，保湿宣称可以依据文献资料，但棕榈酰五肽-4 的现有文献不涉及保湿，无法支持这一宣称；产品中的保湿成分需要各自的数据。

原料功效宣称：含有棕榈酰五肽-4，有助于改善细纹外观

这一表述与 93 人随机对照试验的测试内容一致：免洗保湿霜中含 3 ppm pal-KTTKS，使用 12 周后，可见皱纹和细纹少于同一基质[s1]。按照规范，原料功效宣称可以依据文献资料，但原料的功效须与产品的功效宣称相关（第十一条）。根据现有数据有两个前提。产品中该肽的含量应不低于 3 ppm，低于这一含量时，该试验不直接适用于产品。原料中的肽应为试验所用的 KTTKS 序列，因为同一 INCI 名称也涵盖 KTSKS 序列[s1, s9]。以上依据只有一项由企业开展的试验。

研究中的浓度

在安慰剂对照人体试验中，唯一测试过的浓度是保湿霜中 3 ppm (0.0003%) pal-KTTKS[s1]。随机对照预试验和多成分研究的摘要没有说明该肽浓度[s2, s3]。人体剂量反应关系未经研究，没有数据表明高于 3 ppm 效果更好。CIR 收到的实际使用浓度处于同一数量级：2013 年报告的最高使用浓度为 0.00061% (6.1 ppm)，用于眼部乳液和面颈部产品；2023 年草案引用的非喷雾面颈部产品最高报告浓度为 0.0012% (12 ppm) [s8]。以商品名销售的原料是稀释溶液，成品中的肽含量等于原料添加比例乘以供应商规格中标明的肽含量。计算结果低于 3 ppm 时，试验[s1]不直接适用于该产品。人体安全性数据覆盖更高浓度：0.01% (100 ppm) 的 HRIPT[s8]。

研究

S1 经图像分析和专家评估，皱纹和细纹的减少幅度大于不含肽的同一保湿霜；受试者自评有改善；耐受良好
局限性：只有一项试验，由宝洁公司开展；摘要中没有效应量；受试者仅为 35 至 55 岁白人女性；未报告紧致和保湿结果

S2 作者报告，含肽乳霜在照片、仪器数据和自评问卷上的结果优于 Acetyl Hexapeptide-3 乳霜和安慰剂
局限性：预试验，每集约 7 名女性；摘要中没有数值和 p 值；未说明浓度；由化妆品企业资助

S3 多成分产品使用 4 周后，眼周皮肤粗糙度（Ra、Rz）较未处理侧改善

局限性：产品还含 Niacinamide、Pal-KT、Carnosine 等活性成分，无法区分该肽的贡献；对照为未处理侧而非基质；宝洁公司研究

S4 角质层中检出 pal-KTTKS $4.2 \pm 0.7 \mu\text{g}/\text{cm}^2$ ，表皮 $2.8 \pm 0.5 \mu\text{g}/\text{cm}^2$ ，真皮 $0.3 \pm 0.1 \mu\text{g}/\text{cm}^2$ ，接收液中未检出；未棕榈酰化的 KTTKS 在皮肤中未检出；两者均被皮肤蛋白酶迅速降解

局限性：体外小鼠皮肤；摘要未说明浓度；没有临床结局

S5 pal-KTTKS 被动递送进入离体人体皮肤的量有限；按荧光信号计算，微针预处理使递送量提高 2 至 22 倍
局限性：离体研究；荧光标记肽；没有临床结局

S6 KTTKS 是在间充质细胞中刺激 I 型胶原、III 型胶原和纤连蛋白合成的最短序列

局限性：细胞培养；使用的是未棕榈酰化的肽；不是皮肤研究

S7 综述了外用肽抗皮肤老化的离体和在体对照研究；摘要中没有合并估计值

局限性：叙述性综述，非系统综述；发表于 2009 年，早于上述随机对照预试验

S8 HRIPT 未见刺激或致敏：0.01% Pal-KTTKS，51 名受试者；含 0.12% Pal-KTSKS 的配方稀释至 15%，106 名受试者；2013 年最高使用浓度为 0.00061%

局限性：供专家小组审阅的草案，标注 Do Not Cite or Quote；数据由行业提交，未发表

S9 最终报告：KTTKS 和 KTSKS 序列在目前的使用方式和浓度下用于化妆品是安全的

局限性：结论取自专家小组会议公告，最终报告全文未打开；缺少生殖毒性和致癌性数据，专家小组认为暴露量低可以弥补

数据能支持的措辞

✓ 有助于改善细纹和皱纹的外观

这是产品的抗皱宣称：按照规范，产品本身须进行功效宣称评价试验，上述文献只能作为补充

✓ 含有棕榈酰五肽-4，有助于改善细纹外观

原料功效宣称：仅当产品中该肽含量不低于 3 ppm，且原料中的肽为试验所用的 KTTKS 序列时适用[S1]

✓ 一项 12 周研究中，含 3 ppm 该肽的保湿霜减少可见皱纹的效果优于不含该肽的同一保湿霜

用于功效宣称依据的文献摘要，不用于产品标签：该研究测试的是另一配方[S1]

数据不能支持的措辞

✗ 经临床证明可减少皱纹

只有一项试验，由成品企业开展，摘要中没有效应量[S1]

✗ 胶原蛋白提升 350%

没有人体皮肤胶原数据；胶原合成只在细胞培养中、用未棕榈酰化的肽观察到[S6]

✗ 12 周皱纹深度减少 [X]%

试验摘要只报告了统计学意义，没有百分比[S1]；具体数字需要产品本身的试验

✗ 紧致提拉肌肤

没有对照人体研究报告紧致度或弹性结果[S1, S2]

✗ 棕榈酰五肽-4 为肌肤补水

没有该肽保湿结果的报告[S2]

✗ 深入真皮层重建胶原

体外小鼠皮肤中只有少量到达真皮，离体人体皮肤中被动递送有限[S4, S5]；人体胶原未经测量

✗ 效果如视黄醇且无刺激

所列文献中没有该肽与视黄醇类的对比研究；无刺激宣称需要试验

✗ Matrixyl 可减少皱纹

Matrixyl 这一名称也用于其他肽组合，例如含不同肽的 Matrixyl 3000；应写 INCI 名称和试验所用序列（Pal-KTTKS）

✗ 孕期可安全使用

缺少生殖和发育毒性数据[S9]

安全性

CIR 专家小组于 2024 年发布最终报告，结论是棕榈酰五肽-4（KTTKS 和 KTSKS 序列）在目前的使用方式和浓度下用于化妆品是安全的[S9]。专家小组指出缺少发育毒性、生殖毒性和致癌性数据，并认为使用浓度低、体外经皮吸收有限、遗传毒性试验阴性以及含 0.12% Pal-KTSKS 配方的雌激素激动剂试验阴性，可以弥补这一缺口[S9]。2023 年草案中的人体数据：含 0.01% Pal-KTTKS 的商品名混合物在 51 名受试者的 HRIPT 中未引起

刺激或致敏；含 0.12% Pal-KTSKS 的配方用水稀释至 15% 后，在 106 名受试者的 HRIPT 中也未引起反应 [s8]。12 周随机对照试验中使用 3 ppm 该肽，耐受良好[s1]。最终报告全文我们没有打开，结论来自专家小组会议公告。草案标注 Do Not Cite or Quote，提交前应将其中数据与最终报告核对。

文献中缺少的内容

93 人试验没有报告效应量的独立重复研究，也没有系统综述或荟萃分析。人体剂量反应关系未经研究，3 ppm 以外的浓度未经测试。没有对照人体研究报告紧致度、弹性或保湿结果。外用后人体皮肤中的胶原未经测量；胶原合成只在细胞培养中、用未棕榈酰化的肽观察到。功效数据来自 KTTKS 序列，同一 INCI 名称涵盖的 KTSKS 序列没有功效数据。缺少生殖、发育毒性和致癌性数据。试验受试者为白人女性[s1]和印度尼西亚女性[s2]，没有男性数据。在 PubMed 检索 2024 年 10 月至 2026 年 10 月的文献，未发现该成分新的人体功效研究。

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S9 Cosmetic Ingredient Review. Post Meeting Announcement, 170th Expert Panel Meeting (September 30 – October 1, 2024). Final Safety Assessment: Pentapeptide Ingredients
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PMID 已于 2026-10-13 在 PubMed 核对

这是一份文献证据摘要，供贵方准备向 NMPA 提交的功效宣称评价资料时参考。我们不做合规审核，是否宣称由贵方团队决定。