

## NOVEL LINEAR ALKANES FOR DECORATIVE COSMETICS, SKIN AND HAIR

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### Introduction

A new family of crystal clear, linear alkanes with formulator-friendly properties can fill multiple needs in the Cosmetic and Personal Care markets. The INCI designations for these three new ingredients are: C13-15 ALKANE, C15-19 ALKANE and C18-21 ALKANE. These straight-chained, extremely pure hydrocarbons have proven themselves to be exceptional, non-tacky emollients providing a dry feel and a "cushion" effect in creams and lotions not typically associated with ingredients of such low viscosity. They all have extremely low vapor pressures, and are exempt from the VOC content limits. As the product chain-length increases the emolliency increases, along with the amount of residual shine or gloss. This makes these new alkanes perfect for hair conditioners, hair sheen products, anti-aging products that help to brighten the appearance of the skin, and color cosmetics that need to provide gloss, a wet-look, a moisturizing feel and improved wear characteristics. Emulsions formulated with these new alkanes are noticeably whiter and shinier, have improved opacity and playtime and also give less of a soaping effect. They also provide slip, spreadability, gloss and emolliency, all with low viscosity. These novel alkanes are exceptionally safe, with low vapor pressures and flash points over 100 degrees centigrade.

### Chemistry

"Alkane" is the nomenclature given to the homologous series of saturated hydrocarbons. Saturated hydrocarbons are compounds containing only carbon and hydrogen, bonded by single bonds only, and have the general formula  $C_nH_{2n+2}$ , where the n is a positive whole number. This formula does not indicate structure and when n is greater than three the formula can represent more than one compound, e.g. when n=4 we can have either n-butane  $CH_3-CH_2-CH_2-CH_3$  (linear) or 2-methylpropane- $CH_3-CH_2-CH_3$  (branched).

Therefore, linear alkanes are a homologous series, with ethane and larger linear alkanes represented by the structural formula:  $CH_3(CH_2)_nCH_3$ . The straight chain alkanes are so called because all the carbon atoms of the molecule are linked together in a linear fashion, similar to the links in a chain or to beads on a string. Like a chain, these linear molecules can twist and fold without breaking the bonds between adjacent atoms. Like beads on a string, the carbon atoms can rotate about the carbon-to-carbon single bonds, changing the positions of the attached hydrogen atoms relative to each other.

These novel linear alkanes presented today are highly purified paraffinic oils with chain lengths ranging from  $C_{13}$  to  $C_{21}$ . They contain a high concentration of odd-numbered chain lengths and this may help explain the different properties and functionalities these materials exhibit when compared to other common alkanes, such as squalane, polydecane, and heptane.

The principal source of alkanes is petroleum, together with the accompanying natural gas. Petroleum is separated by distillation into its various fractions. Once petroleum has been refined to remove the aromatic components, the remainder generally consists of saturated hydrocarbons: normal alkanes (paraffinics), isoalkanes (isoparaffinics), and cycloalkanes (naphthenics). These particular linear alkanes described today are synthesized by proprietary methods in an ISO certified plant involving the use of a high performance catalyst and hydrogenation using a hydrogen purity of 99.9% under a pressure of 100 bars. The result is a range of linear alkanes in the form of low viscosity, transparent liquids, very stable to both oxygen and UV changes, with unique properties. This double operation of selection and processing provides such purity that they even conform to European Pharmacopeia standards.

### Applications

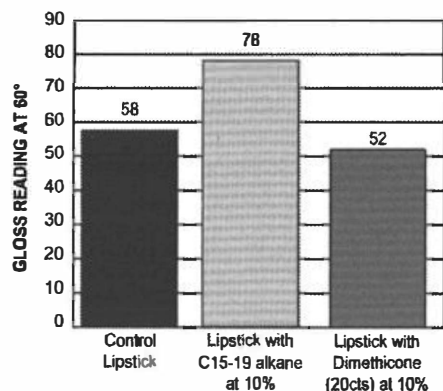
These novel linear alkanes (C13-15, C15-19 and C18-21) have proven in our laboratories to have many desirable properties that will benefit cosmetic products.

Lipstick Formulation (29-56-4)	
INCI Name	% WW
<b>Phase A</b>	
Beeswax	8.00
Euphorbia Cerifera (Candelilla) Wax	3.00
Copernicia Cerifera (Carnauba) Wax	6.50
C18-21 alkane (and) Isohexadecane	10.00
Isopropyl Palmitate	11.00
Tridecyl Trimellitate	10.00
Peg-4 Diheptanoate	4.00
Ricinus Communis (Castor) Seed Oil	35.85
Propylparaben	0.10
BHT	0.05
Calcium Aluminum Borosilicate	1.50
<b>Phase B</b>	
Titanium Dioxide (and) Ricinus Communis (Castor) Seed Oil	4.00
D&C Red #7 Calcium Lake (and) Ricinus Communis (Castor) Seed Oil	6.00

In *Decorative cosmetics* these linear alkanes increase the playtime of pigmented emulsions, plasticize films for mascaras, and act as a moisturizing, wet binder in eye shadows. In lipsticks and lip gloss, they help to bring out truer colors while increasing gloss, moisturization and slip. By combining the different chain length products, you can easily control the extent of the properties. For example, by combining the C13-15 with the C18-21, you can balance the lighter skin feel of the shorter chain-length material with the exceptional gloss provided by the longer chain length.

In *Skin Care*, these products improve slip, spreadability and provide a wonderful moisturizing cushion to emulsions. C13-15 alkane produces a light, moisturizing film after dry-down, which is perfect for daywear products, while the C18-21 alkane exhibits a higher level of slip, emolliency and cushion, which works well with night replenishing formulations or more therapeutic products. As expected, the C15-18 alkane provides properties between these two, combining the lighter feel of the short chains with the more pronounced properties of the longer chain lengths. These novel alkanes also reduce the soaping effects sometimes seen with creams and lotions. Due to their comparatively higher index of refraction, they produce whiter and more opaque emulsions than those containing dimethicones.

In the *Hair Care* area, they provide outstanding shine for spray-on products, with the shorter-chain alkanes feeling light enough to use for leave-in conditioners or detanglers. The other chain lengths provide the additional substantivity that is needed for wash-out conditioners. The additional benefits of manageability and combability follow through with all three products, leaving the hair not only feeling soft, but also looking natural and healthy.



A lipstick with 10% C15-19 alkane was formulated and subjected to glossmeter readings against a control and a lipstick with Dimethicone. The results showed that gloss levels when these linear alkanes were present, reached an unusually high level for lipstick, reflecting up to 78% of the incident light at an angle of 60 degrees. A 5-person panel test showed that the formulas with the novel alkanes were visibly more glossy, and were favored overall for the application properties. These initial test results are very promising, and will lead to further study of the advantages of combination products.

#### Summary

Linear alkanes with chain lengths from C13 to C21 offer a number of advantages over the traditional cosmetic fluids. Their high purity, crystal clarity and low viscosity make them easy to work with in a wide variety of cosmetic forms. The exceptionally high gloss achievable in decorative cosmetics sets these novel ingredients apart, along with their high levels of slip and emolliency. They are colorless, odorless, non-greasy, non-tacky and they leave an elegant, soft, silky end feel on the skin. They are exempt from the VOC content limits for consumer products and our safety testing shows them to be non-irritating, non-allergenic and non-comodogenic. With all these attributes and their potential for functional synergy, the future for these linear alkanes to be used alone or in combination with other ingredients to solve formulation problems, looks very bright indeed.

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