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STUDY ON PETROLEUM DERIVED WAXES AND THEIR USES

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ABSTRACT

These materials represent a significant fraction of petroleum. They are refined by vacuum distillation. Paraffin waxes are mixtures of saturated n- and isoalkanes, naphthenes, and alkyl- and naphthene-substituted aromatic compounds. The degree of branching has an important influence on the properties. Millions of tons of paraffin waxes are produced annually. They are used in foods (such as chewing gum and cheese wrapping), in candles and cosmetics, as non-stick and waterproofing coatings and in polishes. Paraffin wax refers to a white or colorless soft solid that is used as a lubricant and for other applications. It is derived from petroleum and consists of a mixture of hydrocarbon molecules containing between twenty and forty carbon atoms. It is solid at room temperature and begins to melt above approximately 37 °C (99 °F); its boiling point is >370 deg C. In chemistry, ***paraffin*** *is used synonymously with "alkane", indicating hydrocarbons with the general formula C_nH_{2n+2}. The name is derived from Latin parum ("barely") + affinis, meaning "lacking affinity" or "lacking reactivity" indicating paraffin's unreactive nature.*

Paraffin wax is mostly found as a white, odorless, tasteless, waxy solid, with a typical melting point between about 46 and 68 °C (115 and 154 °F), and having a density of around 900 kg/m^3. It is insoluble in water, but soluble in ether, benzene, and certain esters. Paraffin is unaffected by most common chemical reagents but burns readily.

The hydrocarbon $C_{31}H_{64}$ is a typical component of paraffin wax.

Paraffin wax is an excellent electrical insulator, with an electrical resistivity of between 10^{13} and 10^{17} ohm metre. This is better than nearly all other materials except some plastics (notably Teflon). It is an effective neutron moderator and was used in James Chadwick's 1932 experiments to identify the neutron.

Paraffin wax is an excellent material to store heat, having a specific heat capacity of 2.14–2.9 $J\ g^{-1}\ K^{-1}$ (joule per gram kelvin) and a heat of fusion of 200–220 $J\ g^{-1}$. This property is exploited in modified drywall for home building material: a certain type (with the right melting point) of wax is infused in the drywall during manufacture so that, when installed, it melts during the day, absorbing heat, and solidifies again at night, releasing the heat. Paraffin wax phase change cooling coupled with retractable radiators was used to cool the electronics of the Lunar Rover. Wax expands considerably when it melts and this allows its use in wax thermostatic element thermostats for industrial, domestic and, particularly, automobile purposes.

Key words: *Paraffin wax, isoalkanes, naphthenes, odorless, tasteless.*

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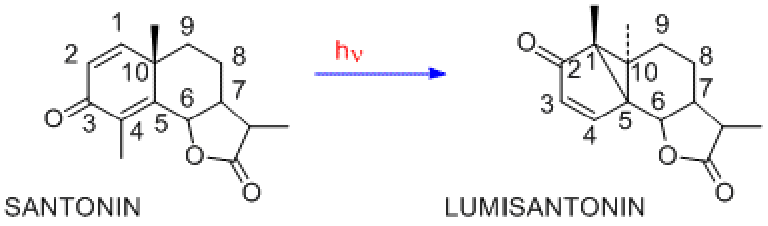
INTRODUCTION

The term biochemistry is derived from two words Bios + Chemistry, a branch of physical science, is the study of the composition, properties and behavior of matter. As it is a fundamental component of matter, the atom is the basic unit of chemistry. Chemistry is concerned with atoms and their interactions with other atoms, with particular focus on the properties of the chemical bonds formed between species. Chemistry is also concerned with the interactions between atoms or molecules and various forms of energy (e.g. photochemical reactions: Mechanistic organic photochemistry is that aspect of photochemical reactions. The absorption of ultraviolet light by organic molecules very often lorganic photochemistry which seeks to explain the mechanisms of organic p eads to reactions. In the earliest days sunlight was employed while in more modern times ultraviolet lamps are employed. Organic photochemistry has proven to be a very useful synthetic tool. Complex organic products can be obtained simply. Over the last century and earlier an immense number of photochemical reactions have been uncovered. In modern times the field is quite well understood and is used in organic synthesis and industrially. The utility of organic photochemistry has arisen only by virtue of the available mechanistic treatment; reactions which appear unlikely in ground-state understanding become understandable and accessible in terms of electronic excited-state consideration.

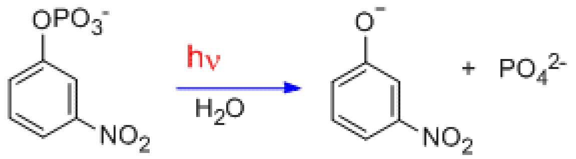
REVIEW OF LITERATURE

One of the earliest photochemical studies dealt with the natural product santonin. In the 19th century it had been observed by Ciamician that in Italian sunlight santonin gave several photoproducts. The structure of santonin was first correctly described by Clemo and Hayworth in 1929. The initial photoproduct obtained from santonin is lumisantonin. As depicted in Eqn. 1, the photoreaction involves a rearrangement. Using steroid numbering, we note that the C-3 carbonyl group has moved to C-2, the C-4 methyl has moved to C-1, and the C-10 carbon has been inverted.



(1)

A comparably bizarre example was uncovered by Egbert Havinga in 1956. The curious result was activation on photolysis by a Meta nitro group in contrast to the usual activation by ortho and para groups.



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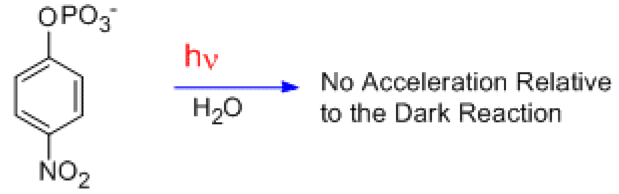

(3)

Over the decades, many interesting but puzzling organic photochemical reactions were discovered that did not proceed by ordinary organic ground state processes. Rather, they arose from the electronic excited states. The real problem was that, at the time, organic chemists were not versed in quantum mechanics and physical chemists were not versed in organic chemistry. Real mechanistic treatments were not possible.

Starting in 1961 it was found that one could understand organic photochemical reactions in the context of the relevant excited states. One example is the n-pi* excitation of mono-carbonyl compounds, the simplest being that of formaldehyde. The structure was first described by Mulliken. The three-dimensional representation (top drawing) is simplified in the second line using a two-dimensional representation, which facilitates arrow pushing.

MATERIAL AND METHOD

Petroleum derived waxes

Although many natural waxes contain esters, paraffin waxes are hydrocarbons, mixtures of alkanes usually in a homologous series of chain lengths. These materials represent a significant fraction of petroleum. They are refined by vacuum distillation. Paraffin waxes are mixtures of saturated n- and isoalkanes, naphthenes, and alkyl- and naphthene-substituted aromatic compounds. The degree of branching has an important influence on the properties. Millions of tons of paraffin waxes are produced annually. They are used in foods (such as chewing gum and cheese wrapping), in candles and cosmetics, as non-stick and waterproofing coatings and in polishes.

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Properties

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Manufacturing

The feedstock for paraffin is slack wax. Slack wax is a mixture of oil and wax, a byproduct from the refining of lubricating oil.

The first step in making paraffin wax is to remove the oil (de-oiling or de-waxing) from the slack wax. The oil is separated through crystallization. Most commonly, the slack wax is heated, mixed with one or more solvents such as a ketone and then cooled. As it is cooled, wax crystallizes out leaving oil in solution. This mixture is filtered into two streams: solid (wax plus some solvent) and liquid (oil and solvent). After the solvent is recovered by distillation, the resulting products are called "product wax" (or "press wax") and "foots oil". The lower the percentage of oil in the wax the more refined it is considered (semi-refined versus fully refined). The product wax may be further processed to remove colors and odors. The wax may finally be blended together to give certain desired properties such as melt point and penetration. Paraffin wax is sold in either liquid or solid form.

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- Coatings for waxed paper or cloth
- Food-grade paraffin wax:
- Shiny coating used in candy-making; although edible, it is non digestible, passing right through the body without being broken down
- Coating for many kinds of hard cheese, like Edam cheese
- Sealant for jars, cans, and bottles
- Chewing gum additive
- Investment casting
- Anti-caking agent, moisture repellent, and dust binding coatings for fertilizers
- Agent for preparation of specimens for histology
- Bullet lubricant – with other ingredients, such as olive oil and beeswax
- Phlegmatizing agent, commonly used to stabilize /desensitize high explosives suchas RDX
- Crayons
- Solid propellant for hybrid rocket motors
- Component of surf wax, used for grip on surfboards in surfing
- Component of glide wax, used on skis and snowboards
- Friction-reducer, for use on handrails and cement ledges, commonly usedin skateboarding
- Ink. Used as the basis for solid ink different color blocks of wax for thermal printers. Thewax is melted and then sprayed on the paper producing images with a shiny surface
- Micro wax: food additive, a glazing agent with E number E905
- Forensic investigations: the nitrate test uses paraffin wax to detect nitrates and nitrites on the hand of a shooting suspect
- Antiozonant agents: blends of paraffin and micro waxes are used in rubber compounds to prevent cracking of the rubber; the admixture of wax migrates to the surface of the product and forms a protective layer. The layer can also act as a release agent, helpingthe product separate from its mould.

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- Mechanical thermostats and actuators, as an expansion medium for activating such devices
- "Potting" guitar pickups, which reduces micro phonic feedback caused from the subtle movements of the pole pieces
- "Potting" of local oscillator coils to prevent micro phonic frequency modulation in low end FM radios.
- Wax baths for beauty and therapy purposes
- Thickening agent in many Paintballs, as used by Crayola
- An effective, although comedogenic, moisturiser in toiletries and cosmetics such as Vaseline
- Prevents oxidation on the surface of polished steel and iron
- Phase change material for thermal energy storage
- Manufacture of boiled leather armor and books
- Skateboard Wax

CONCLUSION

In industrial applications, it is often useful to modify the crystal properties of the paraffin wax, typically by adding branching to the existing carbon backbone chain. The modification is usually done with additives, such as EVA copolymers, microcrystalline wax, or forms of polyethylene. The branched properties result in modified paraffin with a higher viscosity, smaller crystalline structure, and modified functional properties. Pure paraffin wax is rarely used for carving original models for casting metal and other materials in the lost wax process, as it is relatively brittle at room temperature and presents the risks of chipping and breakage when worked. Soft and pliable waxes, like beeswax, may be preferred for such sculpture, but "investment casting waxes," often paraffin-based, are expressly formulated for the purpose.

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