Purified Wax

11,529 tonnes per year

Synonyms: synthetic crystalline wax, straight chain hydrocarbon wax, FT wax, Fischer Tropsch Wax, low melting microcrystalline wax, paraffin wax, synthetic wax, hard wax.

Molecular Formula (carbon number) : The waxes have the formula (CH2)nH2, where n ranges between about 40 and 120

Chemical Properties

Appearance: White or off white / cream solid at room temperature

Congealing point: 96-100°C

Mettler drop point: 110°C

Density: 0.76 g/cm3

refractive index: 1.446
Flash point : > 183°C, > 361°F

Penetration at 25 deg C - <1

storage temp: Store at RT.

Stability: Stable. Substances to be avoided include strong oxidizing agents, peroxides, acids organic solvents

Water Solubility: not miscible; soluble in non-polar organic solvents

Cas No - 8002-74-2

Detection Methods: GC / FID & DSC

Molecular weight – 800 to 1100

Not a hazardous substance or mixture according to OSHA HCS 2012

Acid value (mg KOH/g) <1

Purified / FT Waxes Background

Waxes are organic substances that are solid at room temperature but become free-flowing liquids at slightly higher temperatures. While the main commercial source of wax is crude petroleum, mineral wax can also be produced from lignite, plants, animals, and insects.

Overall synthetic wax consumption in North America in 2010 was estimated at 420 million pounds (AFPM 2013a).

The fastest growing wax markets are for hydrogenated vegetable and natural palm waxes. Synthetic waxes mainly represented by Fischer-Tropsch(FT)and polyethylene(PE)waxes currently represent 11 percent of global wax supply (Zaworski, 2011).The United States imports a significant share of the waxes supplied(65.3percent).

International trade has grown increasingly important in wax markets, with the United States being a major global market demander. Important import source countries include China and Canada (AFPM, 2013)
Fischer-Tropsch waxes are synthetically produced in a controlled manner from carbon monoxide and hydrogen as feed. This results in their consistently high quality.

Fischer-Tropsch waxes consist mainly of saturated, straight chain hydrocarbons with almost no branches. This linear structure of Fischer-Tropsch waxes is responsible for the many desirable properties of Fischer-Tropsch waxes.

The combination of a high melting point, low viscosity and excellent hardness, even at elevated temperatures, provides superior performance in a variety of applications.

Important areas of application for the use of high melting Fischer-Tropsch Waxes in conjunction with lower melting microcrystalline and paraffin waxes are:

Hot Melt Adhesives

Hot melt adhesives (HMA) have become part of everyday life. With the development of high speed manufacturing and processing equipment, hot melt adhesives can be found in many diverse areas. These range from furniture and shoe manufacture to packaging applications to the production of baby diapers and cigarettes.

What is a hot melt adhesive?

A hot melt adhesive is a thermoplastic material, solid at room temperature, which is applied in its molten form and will adhere to a surface when cooled to a temperature below its melting point. They differ from other liquid adhesives in that they set simply by cooling rather than by chemical curing or the evaporation of a solvent.

Advantages of hot melt adhesives

Hot melt adhesives being 100% solid systems, reduce transportation and storage problems. The instantaneous bond strength supplied by these adhesives has allowed the development of high speed production machinery. Their higher viscosity compared to solvent based systems allows them to be used on various porous and non-porous substrates without sacrificing bond strength. In addition, because they do not set by means of solvent evaporation, they do not create a pollution problem. This latter fact is becoming increasingly important with the rising environmental awareness being experienced globally.

The role of wax in hot melt adhesives

- The low viscosity of the wax is used to reduce the high viscosity of the polymer and resin to ensure efficient mixing. This reduction in viscosity is particularly important during the application stage. A low viscosity is required to pump the molten adhesive from the storage tank to the application area and to ensure proper surface wetting when applied.
- The degree of crystallinity and the congealing point of the wax in the adhesive formulation control the open and set times of the HMA and also influence the flexibility and elongation properties.
- Wax plays a major role in increasing the blocking point of the final adhesive, preventing the adhesive pastilles from sticking together during transport and storage.
- The high temperature properties of a hot melt adhesive are largely controlled by the melt range and the type of wax being used.

A typical HMA contains 10-30 % wax.

Inks, Paints, Coatings (IPC)

Waxes are used as additives in printing inks and coatings to:

- Improve the resistance of the ink or coated film to rubbing, scuffing, scratching and impact factors.

- Serve as a slip aid.
- To serve as an enhancer in order to achieve certain surface and matt effects.
- To act as a barrier and enhance water barrier and respiration properties.

Textile Coating

Natural fibres contain wax-like substances as a protective agent against atmospheric and biological influences. The removal of these substances during processing alters the frictional and absorbency characteristics of the fibres, resulting in a loss of softness, pliability and elasticity, making it necessary to re-apply a suitable finish. A suitable finish is also necessary to lubricate synthetic fibres for high speed processing.

Wax performance in textiles

In a number of processing steps in the textile industry, waxes and their emulsions (dispersions) are used either directly, or as important components of textile auxiliary chemicals. These waxes improve the ease of textile processing, as well as the finish and performance of the final fabric or garment.

Waxes reduce fibre-to-fibre friction and fibre-to-metal friction in fast moving machines, resulting in fewer processing problems and optimised production outputs. Waxes can be applied to textiles in solid form, as a melt or as a wax emulsion.

Polishes

Polishes are used to produce or restore shine on a variety of surfaces such as floors, furniture, shoe/leather and automobiles. They also clean these surfaces and provide protection against abrasion, marring and spills and improve its weather resistance.

Normally a blend of several waxes is required to fulfil these functions, in conjunction with components such as solvents, emulsifiers, abrasives and colorants'.

FT Hard Waxes

Chemical structure and properties

Like most waxes, Fischer-Tropsch waxes are multi-component blends. However, almost no iso- or cyclo-paraffins are formed during the synthesis, which is why the products consist predominantly of saturated n-alkanes. The lengths of the carbon chains range from medium to long. The chemical structure is the crucial factor in determining product characteristics, which are manifested in the features of hardness and crystallinity, and in some cases great brittleness and very limited flexibility. Together with the very high solidification point, the high degree of crystallinity and hardness are the crucial factors in determining the applications for hard waxes.

Applications

Foodstuffs

Hard Fischer-Tropsch waxes are used as additives in the manufacture of base materials for chewing gum. Due to their approval as food additive E905, they can also be used as coatings and release agents, thus replacing plant waxes and other substances.

Beauty cosmetics and care products

Fischer-Tropsch waxes are also employed as shaping base materials in beauty products such as mascara wands and eyeliners and also as base materials for lipsticks. More rarely, Fischer-Tropsch waxes are used as regulators for the melting point in creams or lotions.
As a general rule for all applications:

Fischer-Tropsch waxes can supplement or replace plant waxes, hydrogenated fats and other hard base substances.

Approvals

Cosmetics:

Cosmetics regulations, European cosmetics regulation (No. 1223/2009)

Colipa: Recommendation No. 14 lip and oral care products

Food additive/Food Contact: DE (BfR Recommendation XXV.), EU (PM Ref. No. 95859;E905), US (FDA 178.3720)

Pharmacopoeia: EU (monograph planned), DE (none), US (USP XXXI/NF 26: Synthetic Paraffin – H1, H105, SP 30, SP 105 total compliance, C 80 meets not due to oil content

Hot Melt Adhesives

Fischer-Tropsch hard waxes are excellent waxes for all HMA formulations. Their high crystallinity and low viscosity make them the perfect choice to reduce the viscosity, control the open and set times, improve heat stability, flexibility and elongation properties of the HMA.

Printing Inks, Paints and Varnishes

Waxes are used as additives in printing inks primarily to improve the resistance of the ink fi lm to rubbing and scuffing and to serve as a slip aid. Fischer-Tropsch hard waxes are an attractive alternative to polyethylene waxes in solvent and water based printing inks.

Polymer Processing

Fischer-Tropsch hard waxes are excellent external lubricants for use during PVC processing due to their linear structure and their low viscosity. These properties lead to increased fusion time, reduced fusion torque and increased stability time. Fischer-Tropsch hard waxes are also used extensively in injection moulding, rubber extrusion and expanded polystyrene.

Textiles

Oxidised Fischer-Tropsch hard waxes have been specifically developed to enhance process stability, from easier emulsification and application through to final fabric performance in areas such as sewability, knitability, flex abrasion resistance and tear strength.

Polishes

Polish producers use waxes to fulfil the basic function of polishes, i.e. protection, beautification and cleaning. Fischer-Tropsch hard waxes find applications in a range of polishes that include the traditional solvent and emulsion pastes as well as liquid emulsion polishes.

Wax Demands

Wax consumption has been projected to grow at an average annual rate of greater than 2 percent from 2010 to 2020 (Craig, 2007; Zaworski, 2011).Waxes are used in a variety of products, including packaging, coatings, personal care products, and, of course, candles. Waxes can also be further processed into synthetic lubricants. FT hard and medium waxes have a variety of uses. Currently, shortages of hard waxes exist resulting in increased demand in the next decade from adhesives, inks, PVC lubrication, and new applications. Medium waxes can be used for making candles, while paraffins can used in polymers, bitumen modifiers, hot melt adhesives, and printing inks. Medium waxes can also be used in construction, packaging, paper, personal care, and tire industries.

The largest volume growth in wax demand will arise from applications that currently use petroleum waxes (Cook, 2010). However, in order for FT waxes to play a role in meeting this demand, gas to liquid technology is needed (Cook, 2010).

Overall wax demands are largest for board sizing and candles. Combined these two products account for about 44% of the demand. These uses are followed by

Rheology/Surface Application, which is in turn driven by plastics, tire, rubber and hot melt adhesives industry growth. The next largest category is corrugated boxes.

Petroleum wax production is driven oil industry developments, with production from this source expected to decline in the future.

If a decline in production occurs, an undersupply will develop over next decade, with FT medium waxes being a candidate source to help meet this short fall. FT medium waxes have a high degree of purity (no sulphur, aromatics) (Cook, 2010).

Wax Prices

Wax prices in the United States track Asian prices. Both of these sets of prices are heavily influenced by petroleum prices (see Figure 1).In 2012, U.S. Bulk Slack wax (a semi-refined wax) prices were about $1,300 per MT. Prices for paraffin wax FOB at the US Gulf have shown a steady increase over the past several years (Figure 9). These increases were spurred by tight wax supplies and rising crude oil prices (Zaworski, 2011).Prices spiked in 2008 with in crude oil prices. In 2012, prices averaged about $1,300 per metric ton. Asian paraffin prices were about $1,450 per MT. High melting point and low viscosity FT wax can bring as much as $2,500 per ton.