



LAKELAND LABORATORIES LIMITED

Manufacturers of Speciality Surfactants

4 Wax Emulsions

Why? Which? Where?

1 Amphoteric

2 Phosphate Esters

3 Imidazolines

4 Wax Emulsions



CHEMICALS FOR INDUSTRY

Certificate No.890395

Why Wax Emulsions?

INTRODUCTION

Lakeland Laboratories have developed a range of completely aqueous polyethylene wax emulsions. They include homopolymers, oxidised homopolymers, copolymers and montan ester waxes. The emulsions are manufactured under pressure, or by the wax to water

method, and are nonionic or cationic in nature. The pressure emulsions are of particularly fine particle size, giving much improved stability, with some grades being translucent.

Some of the many properties/advantages wax emulsions offer to the formulator are;

- **Ease of handling;**
Free flowing liquids with low viscosity.
- **Slip properties;**
Improved mechanical handling of packaged goods.
- **Lubricity;**
Increased stitching speed in fabrics.
- **Durability;**
Excellent 'wearability' in dry-bright floor polishes.
- **Film forming;**
Added toughness in polymer coatings.
- **Aqueous based;**
No solvents contained, compatibility with aqueous systems.
- **Anti scuff;**
Surface coatings protected from abrasion.
- **Anti blocking;**
Coat to coat adhesion reduced.

Lakelands Wax Emulsion Range

PROPERTIES					
Lakewax	Ionic Character	Appearance _(A10)	pH (neat) _(p2)	Solids Contents _(S3)	Optical Absorbance at 650nm
POLYETHYLENE COPOLYMER					
Lakewax 52	Nonionic	Homogeneous translucent emulsion	10.0 - 11.0	24.0 - 26.0%	1.7 maximum
OXIDISED HOMOPOLYMER					
Lakewax 29	Nonionic	Translucent emulsion	7.5 - 9.0	31.0 - 34.0%	1.8 maximum
Lakewax 37	Nonionic	Off-white translucent emulsion	8.0 - 10.5	34.0 - 36.0%	1.8 maximum
Lakewax C37	Cationic	Homogeneous and translucent emulsion	3.0 - 5.0	25.0 - 29.0%	-
Lakewax 60/40	Nonionic	Off-white translucent emulsion	7.3 - 8.8	38.0 - 40.0%	1.81 maximum
Lakewax C60	Cationic	Homogeneous translucent emulsion	5.0 maximum	24.5 - 28.5%	0.6 maximum
Lakewax 65	Nonionic	Off white emulsion	8.0 - 9.0	26 - 32%	-
MONTAN ESTER					
Lakewax 20	Nonionic	Milky white emulsion	3.0 - 6.0	18.0 - 20.0%	1.7 maximum

(Analytical method reference) available on request.

Which Wax Emulsion?

The case has been made “WHY” wax emulsions are used. The problem for the formulator then becomes - “WHICH WAX EMULSION”? Consideration of the following characteristics should be the main criteria for selection of the correct emulsion.

- Ionic Character
- Slip Resistance
- Hardness of Film
- Hardness of Wax
- Solvent Compatibility

Ionic Character

Nonionic

Lakeland wax emulsions produced using nonionic emulsifiers are not substantive to hard surfaces. In coating applications they are used in combination with film forming polymers where the emulsion particles are mechanically lodged in the polymer lattice, or form surface layers at the polymer/air interface.

Cationic

Lakeland wax emulsions produced using cationic emulsifiers are film forming and more substantive to surfaces. This property makes cationic wax emulsions ideal for temporary protective coatings, textile applications and for formulating water repellents.

Wax Hardness and Particle Size

Product	Drop Point of Wax Component, °C (ASTM 3954)	Typical Softening Point of Dried Wax Film Via DSC, °C	Hardness of Wax dmm (ASTM D5)	Typical Particle Size (Microns)
Lakewax 20	85	85	N/A	0.3
Lakewax 29	140	130	0.5 max	60.0
Lakewax 37	138	130	0.5 max	0.6
Lakewax C37	138	128	0.5 max	0.3
Lakewax 52	105	101	2.0	0.1
Lakewax 60/40	102	102	5.5	0.6
Lakewax C60	102	102	5.5	80.0
Lakewax 65	88	*	90.0 (ASTM D1321)	5.0

* No exact indication of softening point from DSC due to softness of wax.

Slip Resistance

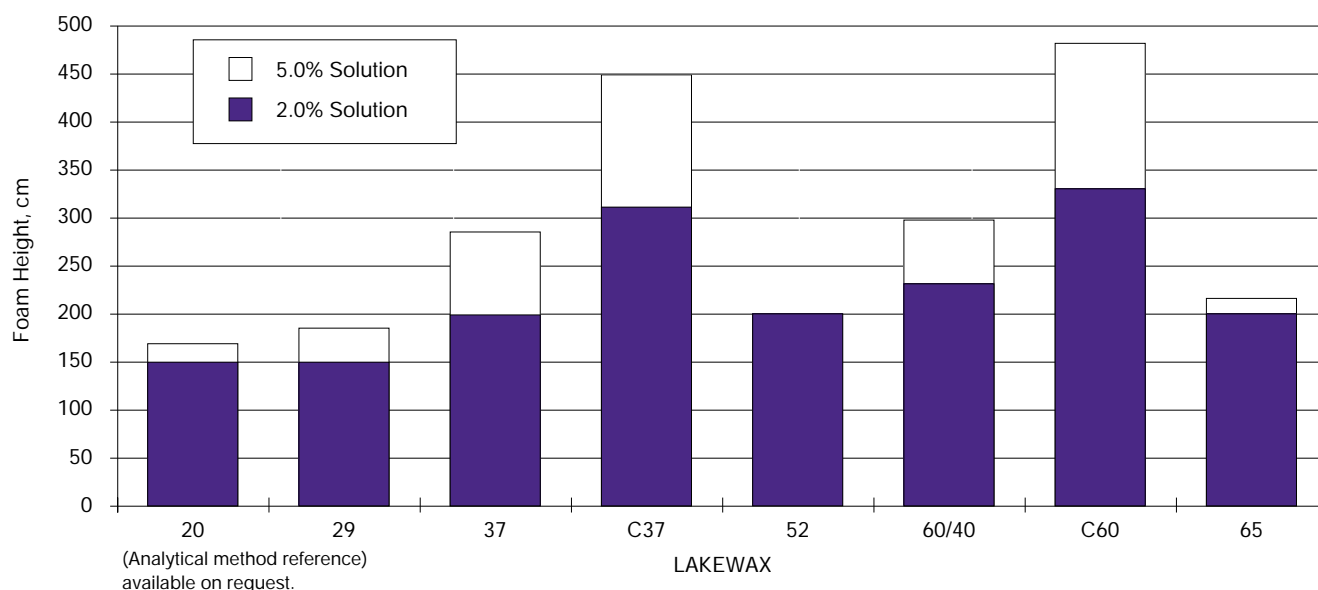
The slip resistance of a wax emulsion can be approximated from its softening point. In general it is observed that the softer more flexible waxes show greater slip resistance than the harder wax emulsions.

Solvent Compatibility

Product	10% Lakewax in 10% Solvent + 80% Water				10% Lakewax in 45% Solvent + 45% Water			
	Water	IPA	Methanol	DPM*	Water	IPA	Methanol	DPM*
Lakewax 20	✓	✓	✓	✓	✓	✗	✓	✓
Lakewax 29	✓	✓	✓	✓	✓	✓	✓	✓
Lakewax 37	✓	✓	✓	✓	✓	✓	✓	✓
Lakewax C37	✓	✗	✗	✓	✓	✗	✗	✗
Lakewax 52	✓	✗	✗	✓	✓	✗	✗	✗
Lakewax 60/40	✓	✓	✓	✓	✓	✓	✓	✗
Lakewax C60	✓	✓	✓	✓	✓	✗	✗	✗
Lakewax 65	✓	✓	✓	✓	✓	✓	✓	✗

* Dipropylene glycol monomethylether.

Foaming Properties_(F6)



Compatibility with Lakeland Surfactants

Amphoterics	Imidazolines	Phosphate Esters
All Lakewaxes, except for 52, should be stable in systems containing dipropionate type amphoterics such as AMA and AMA LF40. Lakewaxes are not very stable with monopropionate type amphoterics, such as Lakeland ACP-70.	The more water soluble Imidazolines, such as Imidazoline 18OH, are stable at relatively high concentrations with Lakeland's cationic waxes. The nonionic waxes have only been found to be stable with Imidazolines in their acetate form.	The potassium salts of phosphate esters based on ethoxylated phenols and ethoxylated alcohols, such as PPE 604 and PAE 136, have been found to be stable in systems with Lakeland's wax emulsions. The emulsions are, however, known to be less stable with free acids.

General Information

Product	Emulsifier	S.G (20°C) (typical)	Standard Pack Size*	CAS No of Wax	Wax Content %	Viscosity 20°C (typical) cPs	Data Sheet
Lakewax 20	Nonionic	1.002	200 Kg	73138-46-2	17	52	963
Lakewax 29	Nonionic	0.995	200 Kg	68441-17-8	27	25	965
Lakewax 37	Nonionic	1.010	200 Kg	68441-17-8	26	200	967
Lakewax C37	Cationic	1.000	200 Kg	68441-17-8	19	15	972
Lakewax 52	Nonionic	0.995	200 Kg	9010-77-9	20	25	968
Lakewax 60/40	Nonionic	0.990	200 Kg	68441-17-8	31	70	969
Lakewax C60	Cationic	0.990	200 Kg	68441-17-8	19	15	973
Lakewax 65	Nonionic	0.985	200 Kg	68441-17-8	24	15	971

Temperature Stability

All wax emulsions are sensitive to cold and as such should be protected from freezing/cold temperatures. Optimum storage conditions: 10°C to 25°C in sealed containers.

*Lakewaxes are available in pack sizes from 25kg up to bulk road tankers, as well as in our standard containers.

Where to use Wax Emulsions?

We now have answers to WHY and WHICH wax emulsion. The following examples of WHERE Wax Emulsions are

often applied should give the formulator a complete picture of the flexibility of these types of surfactant.

Major Areas of Application

Paints/Lacquers

Due to environmental pressures, replacing solvents in paint systems is a major requirement/problem for the paint industry. The obvious choice to the formulator is to move towards water-based systems. Polyethylene wax emulsions are the ideal additive for water-based coatings due to their physical stability, small particle size and ease of handling. Addition of polyethylene wax emulsion can improve anti-scuff properties, gloss, anti-blocking, waterproofing, and slip properties. Polyethylene wax emulsions are finding applications in emulsion paints and wood finishes. Lakewax 37 and 29 are the preferred emulsions for these purposes.

Printing Inks

Water-based flexographic printing systems have been designed for economical printing of, for example, packaging material and disposable paper goods. The systems were designed for water-based printing inks. Therefore aqueous wax emulsions were required to impart anti-scuff properties and more importantly anti-blocking properties. Lakewax 37 and 29 are the preferred products due to their hardness and anti-slip properties.

Textiles

Polyethylene wax emulsions are used in the textile industry on both natural and synthetic fibres. Nonionic wax emulsions are generally applied in admixture by padding prior to heat setting, to add softening, improved tear strength, anti-pilling, and reduced needle cutting, due to lower friction. Cationic wax emulsions, due to their substantive nature, can be used as post dye-bath additives for synthetic fibres to impart an antistatic and softening finish.

Fabrics such as cotton and its polyester blends are usually resin treated for easy care. The handle of the fabric is altered and can be rectified by the use of Lakewax 60/40 as a softener. Where sewing speeds and needle wear/burn are of prime consideration Lakewax 37, 29 and C37 are recommended since these are based on harder waxes and provide better sewing lubricity. The higher melting point of these grades also provides benefits in terms of greater permanence/resistance to removal by laundering. The average level of use is 0.8% - 1.0% on weight of fabric.

Cationic wax emulsions are substantive and can be applied as post dye-bath additives to impart softening and antistatic effect. This latter property is particularly useful in treating acrylic yarn prior to knitting. For this application Lakewax C37 is recommended.

Floor Polishes/Maintainers

Oxidised polyethylene waxes are an essential component of liquid floor polish systems. The addition of the wax gives the following properties: durability, gloss, black heel mark resistance, self-healing, buffability, and water resistance. Hard waxes such as Lakewax 37 are used when high gloss is required. Softer waxes such as Lakewax 60/40 are used for institutions where there is concern over injury due to slipping. Lakewax 52 is a popular choice of wax as it offers gloss with lower slip properties. Lakewaxes are often used in combination to produce the desired effect.

After applying the polish, the floor has to be maintained until stripped and re-applied. Maintainers are produced by incorporating a wax emulsion in a neutral detergent. The preferred wax for maintainers is Lakewax 52. *For information on floor strippers we would refer you to our brochure on amphoteric.

Facade Protection

Lakewaxes are used in combination with film forming polymers to produce facade protection/coatings that are barely visible and non-yellowing. They are designed to act as sacrificial coatings, that is, resistant to rain water but removable by hot water or slightly alkaline stripper. For this application Lakewax 60/40 and 20 are the preferred emulsions.

Wood and Timber Protection

Wax emulsions are widely used in interior wood finishes as well as for outdoor timber treatment. Interior wood finishes are enhanced by the addition of a wax emulsion; in particular their gloss, anti-scuff and sandability properties are improved, along with a better feel to the finish. In Timber Protective Coatings improvements experienced from wax emulsion addition are in abrasion resistance, water proofing, weathering and anti-blocking properties.

Lakewax 52 is often the preferred emulsion for use in interior wood finishes, whereas Lakewax 37, due to its film hardness, possesses better weathering resistance, and is therefore preferred in exterior wood treatment. Wax emulsions are used in wood coatings as anti-blocking agents. They are also used to impart sandability, surface protection and softness of touch. Lakewaxes 29 and 37 are the recommended waxes for these applications, and Lakewaxes 52 and 60 are also recommended as anti-slip agents.

Further Application Areas

Mould Release

Oxidised Polyethylene wax emulsions are used as mould release agents for the production of polyurethane products. The emulsion is diluted and sprayed on the mould. The melting point of the wax emulsion should be above the mould temperature, so that the emulsion dries, to form a film. Lakewax 37 is usually preferred in this application.

Tube Drawing

Oxidised polyethylene wax emulsions are used as lubricants in tube drawing, Lakewax 37 is the most commonly used emulsion in this application.

Agricultural

A potential use for Lakewaxes is in spraying on seeds/fertilizer. This can improve the flow properties of the bulk material, as well as protecting the seeds from moisture loss/penetration and aiding the release properties of the fertilizer.

Automobile Polishes

The incorporation of polyethylene wax emulsion in a non-built detergent system gives the formulator the option to dispense the polish via a trigger spray or a high pressure hose. When using the trigger spray method, the car can be cleaned by cloth followed by the buffing of the wax with a dry cloth. Lakewax C37 and C60 are the preferred emulsions.

Packaging Films

The application of wax emulsions by roller imparts improved properties on polyethylene and polypropylene film used for packaging. Lakewax 20 is recommended for this application.

Temporary Protective Coatings

Due to environmental constraints, solvent based products are frequently being replaced by water based systems. Wax emulsions can be formulated to show complete film forming properties. The coatings give atmospheric corrosion protection and the film itself is easily removable by 2 - 3% ammonia or 1-2% sodium hydroxide solution.

Fruit Coatings

Although not on the range, Lakeland can produce 'Anionic' based wax emulsions. These can be incorporated into shellac based resins and used in the coating of citrus fruits. In this application the fruit skin is coated to protect both the skin and the fruit itself from moisture loss.

Metal Working

Wax emulsions coated onto small metal parts/components such as nails, tacks and screws ease handling for the operator by reducing agglomeration and also help protect the components from abrasion. Lakewaxes 29 and 20 are recommended for this application.

Alkali Strippable Coatings

Combinations of Lakewax 37 and Lakewax 60/40 with ethylene-acrylic acid copolymer emulsion can be used in coatings where severe soiling is a problem, eg automotive coatings, trains, Aluminium cladding, tiled walls, brick and

concrete facades. The coatings give atmospheric corrosion protection and soiling pick-up and the film is then easily removable using 2-3% ammonia or 0.5-1% sodium hydroxide solution.

Anti-Transpiration

When applied to foliage of plants the coating acts as a barrier to water vapour whilst allowing the passage of gases essential for continued growth.

Paper and Board

Coatings/Lubricant - High quality glossy printing paper is produced by clay coating followed by a subsequent friction glazing procedure. The lubricant normally used is calcium stearate which acts to reduce dusting and to facilitate release during calendering. Lakewax emulsions can replace the stearates particularly in high speed calendering of heavy publication grade paper.

Sizing - In combination with resin and wax sizes, Lakewax emulsions improve low temperature properties, chemical resistance and surface smoothness. Lakewax 37 and 29 are the preferred emulsions.

Corrugated Board Treatment - Lakewax emulsions can be sprayed or roll coated on to board to matt down the fibres. This reduces the tendency of packaging to scratch furniture and appliances. Lakewax 37 is recommended in this application.

Transfer Papers - Receptor sheets of duplicating paper are frequently treated with Lakewax emulsions in order to improve ink release.

Wet Strength Improvement - Lakewax emulsions improve wet and dry strength of the melamine wet strength resins.

Printability Improvement - Lakewax 60 is added to the starch treatment to improve ink hold-out. With certain inks this gives a better print and lower ink consumption.

Glass Bottle Lubricant

Lakewaxes used at 0.1-0.3% solids are sprayed onto bottles as they leave the annealing furnace, ie whilst they are still hot and the water flashes off. Lakewax 52 is preferred as it does not interfere with the printing or gluing of labels. The thin polyethylene film acts as a lubricant thus reducing breakages.

Glass Fibre Sizing

Lakewax 37 and C37 improve lubricity and pilling.

Insecticide Stickers

Lakewax 60/40 with excess surfactant are added to insecticide concentrate. The emulsion acts as a spreading agent for better distribution of insecticide. The latter retains its activity for a longer period due to better water resistance from the inclusion of polyethylene.

Leather Treatment

Lakewax additives improve surface smoothness, buffability, plating and glazing properties in typical casein-type dressings. They are also used on the surfaces of grained, buffed and aniline leathers. The preferred products are Lakewax 37 and 60/40.

SYNTHESIS CAPABILITIES

The following represent the synthesis capabilities of Lakeland plant resources;

- Amidation
- Cyclisation
- Esterification
- Quaternisation
- Oxidation
- Condensation
- Dehydration
- Organophosphates
- Saponification
- Others Considered

TOLL MANUFACTURE AND CUSTOM SYNTHESIS

Toll manufacture has always been an important part of Lakeland's business. The strategic location and our proven track record leads to long lasting working relationships. With on-site engineering facilities our existing plant can be easily modified to customer requirements. All custom and Toll manufacture is carried out under a mutually agreeable secrecy contract.

TECHNICAL SERVICES

Research and development of in-house products extends our expertise into new markets. Toll and custom synthesis is backed-up by lab-scale work and customer liaison. To support the above and to develop and improve new products the laboratory facilities include;

- Gas Chromatography
- FTIR
- Ultraviolet/Visible Spectroscopy
- Automated Wet Analysis Methods:- Karl Fisher, Chloride Determination, Titroprocessor
- Classical Wet Analysis
- Autoclave Facilities
- Process Development
- Formulation

Small scale custom laboratory synthesis will be considered. Applications and formulation help is given where possible.

QUALITY

At Lakeland we are fully aware of the necessity for complete customer service in terms of both technical back-up and quality/flexibility of supply.

We are a BS EN ISO 9002 registered company which, in itself, shows our dedication to quality manufacture and customer satisfaction.

AMPHOTERIC

Types	Properties	Industrial Applications
Dipropionates	Solubilisation Hydrotrope Highly Alkali Stable Acid Stable	Detergents Maintenance Chemicals Metal Finishing Lubricants-Bottling/Conveyer Vehicle Cleaning
Monopropionate	Salt Free Corrosion Protection Low Foam/High Foam Biostatic Wetting	Toiletries Textiles Oil Fields Micro Emulsions
Amino Betaines	Emulsification Hydrophobe (In Acid) Free Rinsing Non Toxic	Agriculture Institutional Water Treatment
Amido Betaines	Hard Water Stable Skin Friendly Lubrication	

PHOSPHATE ESTERS

Types	Properties	Industrial Applications
Phosphated Alcohols	Wetting Solubilisation Hydrotropes Highly Alkali Stable Corrosion Inhibition	Metal Work/Finishing Detergents Maintenance Chemicals Textiles Agriculture
Phosphated Alcohol Ethoxylates	Low Foam/High Foam Emulsification Load Carrying Free Rinsing Hard Water Stable	Oil Fields Institutional Water Treatment Vehicle Cleaning
Phosphated Phenol Ethoxylates		Lubricants Emulsion Polymerisation

IMIDAZOLINES

Types	Properties	Industrial Applications
Aminoethyl	Corrosion Inhibition Dispersants Dewatering Emulsification	Oil Fields Metal Working Textiles Paper
Hydroxy Ethyl	Rheology Modifiers Oil Soluble Water Soluble (Salts) Adhesion Promoters	Lubricants Road Making Paints Inks
Amido Ethyl	Acid Stable Flocculation Textiles Softeners	Agriculture Maintenance Chemicals Lapping Compounds
Amide Blends	Bitumen Emulsification	Pigment Dispersion

WAX EMULSIONS

Types	Properties	Industrial Applications
Polyethylene	Completely Aqueous Nonionic	Floor Polish Printing Ink (Flexographic)
Oxidised Polyethylene	Cationic Small Particle Size Highly Stable	Temporary Protective Coatings Metal Working Wood Finishes
Polyethylene/ Acrylic Copolymers	Hard Waxes Soft Waxes 18-35% Solids	Facade Protection Textile Finishing Packaging Films
Montan Ester		Paints (Water Based) Fruit Coating Anti Blocking Mould Release

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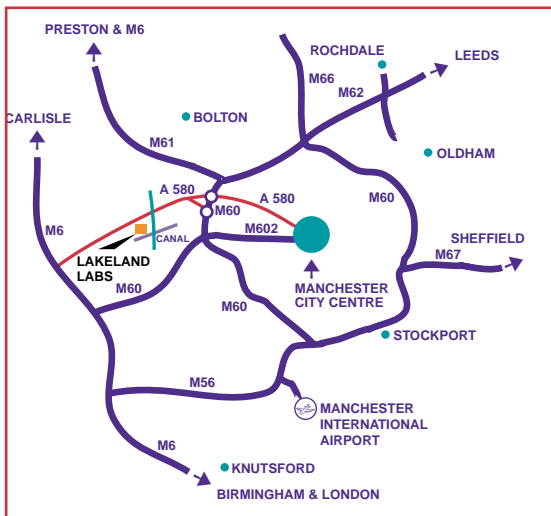
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