

THE COSMETICS INDUSTRY

Few cosmetic ingredients are manufactured in New Zealand, and the cosmetic industry here involves mainly blending and packaging. However a wide range of products is made by a considerable number of companies.

In this article the following products are discussed:

- **Surfactant mixtures for cleaning - shampoos, bubble baths, facial scrubs etc.**
- **Stabilised emulsions - moisturisers, sunscreens etc.**
- **Concealer products - make up**
- **Alcoholic and hydroalcoholic solutions - colognes, toners, aftershaves etc.**
- **Alcoholic and hydroalcoholic gels - hair gels, fragrance gels**
- **Solid wax products - lipsticks, leg wax etc.**

INTRODUCTION

Cosmetic manufacturing in New Zealand is a fairly simple industry, with manufacturing being limited mainly to blending and packaging. Few of the ingredients are made in New Zealand, and there is a trend for the final manufacturing to move offshore as the multinational marketing companies consolidate their manufacturing in fewer sites around the world. In spite of this there is a vigorous and varied local manufacturing industry making a wide range of products, often on a contract basis to the multinational brand name holders.

In the main the industry in New Zealand is made up of relatively few multinational manufacturers, several multi-disciplinary contract manufacturers, and a wider group of small companies which manufacture and market their own products. This importance of contract packers in the New Zealand industry is typical of what happens in other parts of the world - this has come about partly because of the internationalisation of cosmetic brands, and partly because the skills involved in marketing and making cosmetics are not necessarily the same. There are of course exceptions to this latter point - at the time of writing (1998) Revlon and Gillette each has their own plant in New Zealand, as does Lever Rexona and Colgate Palmolive.

The pattern of the last few years has been for the larger players to seek manufacturing efficiencies by moving offshore completely, or by concentrating on fewer products and making these as efficiently as possible. Companies where the first approach was adopted include Beechams, S.C. Johnson, Reckitt & Colman, Elizabeth Arden, L' Oreal, Lenthéric Morny Cyclax, Avon, Wella and Helene Curtis. In contrast to this the strategy of concentrating on fewer products and making these on an internationally competitive basis has allowed Gillette to become the regional supplier of shaving foams, hair sprays and antiperspirants to the Gillette group. Lever Rexona and Colgate have taken this one step further and concentrated almost entirely on detergent products, and now import their cosmetic products from plants outside New Zealand or in some cases from contract packers within New Zealand.

In this article the approach has been taken to divide the topic into groups where similar manufacturing processes apply, and to concentrate mainly on areas where significant manufacturing takes place with in New Zealand. The main exception to this approach is in the manufacture of toilet soap from tallow which is covered in the previous article.

SURFACTANT MIXTURES WHOSE PRIMARY FUNCTION IS CLEANING - (shampoos, bubble baths, facial scrubs etc.)

A large part of cosmetic chemistry is to do with making blends of mild detergents which can be used to clean the skin. These mixtures have to be effective, mild and safe, and make up a large proportion of the total volume of cosmetics. When traced back to source the basic feedstocks for these surfactants are either plant oils or petroleum, although there is a lot of stainless steel and industrial chemistry between the primary raw material and the final surfactant.

Formulations

A typical shampoo, bubble bath or facial scrub is usually an diluted anionic surfactant, such as the sodium, triethanolamine or ammonium salt of lauryl sulphate (SLS, TLS or ALS), or the sodium salt of lauryl ether sulphate (SLES). Because these are harsh on human skin and hair when used alone, these are usually blended with other surfactants to reduce this harshness, and to improve the cosmetic properties of the product at the same time - for example the creaminess and stability of the foam. These secondary surfactants are usually amphoteric (coco betaine or cocoamidopropyl betaine), or nonionic (coconut diethanolamides). The former are primarily for mildness and the latter are mainly for foam stabilisation and thickening. At this stage the only other essential ingredient is a preservative without which the shampoo would rapidly become unsafe and unusable, and a small amount of acid or alkali to adjust the pH to around pH 4 - 5. It worth noting it is worth noting that any scrub intended for the face or near the eyes is usually formulated to be much milder than a typical shampoo - the skin near the eyes is extremely sensitive.

To this basic shampoo are then added the "cosmetic" ingredients - colour, perfume, sometimes a pearl effect, plant extracts perhaps, abraasive grit, and usually a small amount of sodium or ammonium chloride to thicken the product by partially "salting out" the surfactants. The list of potential additional ingredients is endless but is worth noting that most are added at such low levels that any beneficial effect is doubtful.

Raw material sources

Shell has a modern thin film sulphonation plant at Seaview in Wellington which makes the main surfactants used in shampoo and bubble bath products - principally the lauryl sulphate and ethoxylated lauryl sulphate salts. In Auckland Chemcolour Industries NZ Ltd manufactures several of the secondary surfactants - alkanolamides, betaines, cocoamidopropyl betaines, amine oxides. Both companies import the raw materials to make their products. The same products can be imported from manufacturers in Australia, Asia and the rest of the world to a lesser extent.

STABILISED EMULSIONS - (moisturisers, sunscreens etc.)

A colloid is a mixture of two phases in which one (the dispersed phase) is distributed in the other (the continuous phase). An emulsion is a colloid in which both phases are liquids, i.e. a mixture containing very small droplets of one liquid dispersed in another liquid.

Creams and lotions of all types have one underlying principle - they are all emulsions of water and oily materials and all are stabilised in some way to stop separation. The emulsion can be the actual product (a light moisturiser for example), or it can be a vehicle for other materials - a sunscreen for example.

Usually the oil phase is emulsified into the aqueous phase (O/W for short) but occasionally it can be the reverse (W/O). Generally O/W emulsions are preferred because they feel less greasy when applied to the skin.

A simple emulsion would quickly separate and for this reason they are always stabilised, either by choosing an emulsifier system which produces a gel structure to "trap" the internal phase trapped within it, or by adding a stabiliser to the external phase to stop the emulsified oil from moving freely within it. In fact in most cases a mix of both effects is operating. For externally stabilised emulsions a stabilising polymer of neutralised cross-linked polyacrylic acid (carbomer -BF Goodrich's Carbopol) is almost universally used. The use of a carbomer type stabiliser makes for the stable, light "cosmetically elegant" emulsions which are preferred today. Modified carbomers are available now which incorporate a measure of emulsifying ability within the carbomer polymer itself, which allows stable emulsions to be made which have no conventional emulsifier at all.

Formulations

A typical light cream or lotion will be an O/W emulsion where oily materials such as cetyl alcohol, fatty esters, glyceryl esters, paraffin oil, lanolin, plant oils and so on are emulsified into hot water, using emulsifiers such as the ethoxylated higher alcohols, sorbitan esters, fatty acid soaps or mixtures of these. The emulsion is usually made by adding the melted oils to the hot water phase, stirring strongly until the particle size of the emulsion has reduced sufficiently, and then cooling while maintaining stirring. External stabilisers such as carbomer are usually added to the water at the beginning and neutralised at the end before or during cooling. As with almost all cosmetics a preservative is essential and is usually added at the end or during the cool down phase.

Special ingredients are added at the appropriate time taking into account any special properties - if they are aqueous then generally to the water phase, and if they are oily then to the oil phase. Some materials cannot withstand high temperatures and must be added at the end, others will be difficult to emulsify and must be added at the beginning. The list of additives is endless but includes such things as perfume, colour, vitamins, antioxidants, plant acids, ultra violet absorbers. Cosmetically desirable additives are often unstable and can present a challenge to the formulator to incorporate satisfactorily into an acceptable cream lotion.

Sunscreens

Sunscreen creams and lotions are usually similar to that above, but with high levels of ultra violet light absorbing materials included in the emulsion. Often the UV absorbers are oily materials themselves which means that they can be incorporated along with the other oils, and now ultra fine titanium dioxide pigment is often used because of its effectiveness and non oily feel. This material is usually supplied as a dispersion in a suitable cosmetic oil, and is incorporated into then lotion appropriately.

A special and important consideration with sunscreens is that they must have good resistance to washing off in water, which means that the selection of the emulsifying and stabilising system must be made very carefully - a good emulsifier might also mean the product washes off easily. In this area some of the newer stabilising polymers which have some emulsifying properties of their own can be very effective.

CONCEALER PRODUCTS - (make up)

A liquid make up is essentially a light lotion with pigment added to match skin colour. The considerations are the same as for ordinary lotions, other than that particular care must be taken to make sure that the pigments do not settle because this can product colour change at the least and complete product failure at worst. Usually a stabilising polymer of the carbomer type is used to give a system with a high enough yield value so that the heavy pigment particles do not sink over time.

ALCOHOLIC AND HYDROALCOHOLIC SOLUTIONS - (colognes, toners aftershaves)

These are essentially a solution of active materials in ethanol and water. The ethanol is used because it is a good solvent for the actives, it has an acceptable odour, it is known to be safe, and because it evaporates rapidly once applied to the skin. A small amount of water is usually added to reduce the "solvent" perception of the ethanol and in aftershaves a small amount of a skin conditioning agent is often added.

Being solutions they are very straightforward to make, with the main considerations being to use high quality near odourless grade of ethanol, and that the quantity of water used is not too much to risk causing the generally oily active materials to fall out of solution. Preservatives are not necessary because of the preservative effect of the ethanol. As with other cosmetics, special ingredients can be added, provided they are stable in the formulation.

The ethanol used is always a denatured type - that is it has had added to it a foreign chemical to make it undrinkable. In this form it can be purchased without paying excise tax, and there is little temptation for anyone to drink it. In New Zealand almost all the ethanol used in cosmetics is produced by the dairy industry by the fermentation of lactose.

ALCOHOLIC AND HYDROALCOHOLIC GELS - (hair gels, fragrance gels)

A gel is a lyophilic (solvent loving) colloid that has coagulated to a rigid or jelly-like solid. The disperse medium has formed a loosely held network of linked molecules through the dispersion liquid. Gels of this type are primarily a thickened mixture of water and ethanol, with additional ingredients to tailor the product to its particular end use. For example a hair gel will usually incorporate some sort of binder and hair conditioning agent in order to exert some binding action on the hair, whereas a perfume gel will contain little other than the fragrance, alcohol, dye and probably some water. Clear gels have only been possible since the advent of the cross linked polyacrylic acid thickeners of the carbomer type, some of which can produce extremely clear very thick gels in water and in water ethanol mixtures.

Formulation

A typical gel formulation is made up of approximately 50/50 water and ethanol, although the precise ratio is not important - ethanol is more expensive than water and it is possible to make an acceptable product with no ethanol at all. However it is important to realise that with gels, the manufacturing technique is particularly important if the final product is to be clear and bright.

The water and ethanol are added to the tank first and the carbomer sprinkled in while mixing all the time. The batch should be mixed gently for enough time to completely disperse the carbomer. The length of time taken will depend on the size of the batch, but is unlikely to be less than 45 minutes even for a small batch. Care must be taken not to mix air into the product, because once the product thickens the air will be difficult if not impossible to remove.

At this stage the product will be a hazy fairly thin liquid and it is usually at this point that the other ingredients are added - perfume, film former, hair conditioning agents, colour and so on. The reason that these materials are added now is that carbomer dispersions need to be neutralised with an alkali before they will thicken, and after thickening it will be almost impossible to mix in other materials without incorporating air bubbles. Air bubbles in the product at this stage will be almost impossible to remove.

After stopping the stirrer for around fifteen minutes or so and skimming off any air bubbles which come to the surface, the neutralising alkali is added. The alkali is usually added as a dilute solution of sodium hydroxide or triethanolamine for gels with little or no ethanol. For a gel containing a high level of ethanol, a higher molecular weight, more polar amine is needed - this is because if the gel is to be clear, the neutralised polymer must be soluble in the water/ethanol mix, which requires a less polar amine to match the less polar ethanol. To put it another way, a high level of ethanol requires an amine which has a low enough polarity to ensure that the neutralised polymer is still soluble.

After neutralisation mixing should be stopped and the tank sealed to stop evaporation of the ethanol. The gel will clear quite quickly although full clarity might not develop for several hours.

SOLID WAX PRODUCTS - (lipsticks, leg wax etc.)

Like powders and colognes these are simple mixtures, but perhaps with more potential to make mistakes. The particular mixture will depend on the end use but these are basically mixes of materials such as paraffin wax, waxy esters, oily materials, pigments, sunscreen actives. The most complex of these products are the lipsticks where a careful balancing of texture, softness, durability, gloss, appearance and taste are needed. Once the composition has been decided upon the materials are gently melted, stirred together and then cast into moulds. Once released from the mould they are usually briefly passed through a gas flame to make the stick glossy and then packed.

Leg waxes are much simpler. The basic component is paraffin wax, and the main consideration is to choose a mix of wax which will be soft enough to be applied to the skin without burning. Colour and perfume are optional. Manufacture is simply by melting, mixing and casting.

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