The word perfume

Introduction: History of Perfume

The word perfume itself is derived from the Latin per fume, which means “ through smoke”. Due to the fact that the original use of aromatic materials was of burning incense, as an offering to the gods. 1 Aromatic materials have been used for a variety of different purposes over the past thousand years. Perfumes during this era largely consisted of uncharacterized aromatic compounds. 2 Ancient Egyptians used such fragrant materials in many different forms. While it wasn’t until the Crusades that perfumery became more knowledgeable, due to the increase in trade of spices which was a known ingredient in perfumes. 1

However it wasn’t until the 19th century when alchemy became more popular that perfumes began to evolve and change into its current state. The past 100 years has seen the rise of many perfumes that extensively use synthetic chemicals. The first example of the modern perfume was in 1882, Fougere Royale created by Paul Parquet, composed of many synthetic compounds. 1 Throughout the next few decades’ major advancements in the structural characterization of aromatic compounds (with the use of gas chromatography and mass spectroscopy2) led to the creation of synthetic materials. Perfume industries of late use large amounts of synthetic ingredients in the perfume production compared to natural sources. Statistically out of 3000 fragrance ingredients, less than 5% come from natural sources. 1

Section 1: Production of Perfume

The components of perfume that provide the fragrance can be produced/extracted in 2 major ways. As mentioned above until 100 years

ago perfumes used natural sources for use of fragrant chemicals, since then the compounds are synthesised artificially in laboratories. Methods of both production types are mentioned below.

Natural Perfume Ingredients

Natural sources vary from plants (lavender, jasmine etc.), fruits (lemon, orange etc.), and animals (musk from deer's, ambergris from whales). The components that contribute to the smell of the above sources are produced using methods that fall into 3 basic techniques.

1. Expression: simplest of the 3, only used for citrus oils, involves squeezing and compression of the material to obtain oil. 3
2. Distillation: used in manufacture and extraction of essential oils in plants, steam is utilised to help release aromatic molecules from the material. The oils co-distil with the steam, causing the water to be separated (using a Florentine flask) and discarded from the oils. However in some cases the water can be distributed as " floral waters", as they may contain certain fragrant qualities. 1
3. Solvent Extraction: the most important and frequently used in modern perfumery. Typical solvents consist of combinations of petroleum ether, acetone, hexane and ethyl acetate and various others. This technique produces a concrete (resinoid) which can then either be distilled into an essential oil or extracted using ethanol to produce an absolute. 1 However ethanol extraction cannot be used on plant materials as they contain water, which can be absorbed by ethanol. Therefore a new technique known as the ' Superficial Fluid' extraction is used where the solvent used is Supercritical CO2(carbon dioxide in

its fluid state). This process is more successful in providing fragrant compounds with odour, that more closely resembles that of its raw material. 3 On the other hand its is a very expensive process, due to the pressure and temperature required to keep CO2 in its liquid state. 1

Synthetic Perfume Ingredients

As organic chemistry began to develop, the fragrant chemicals involved in perfume began to gradually become synthetic. The first perfume to utilise new synthetic materials is known to be the popular Chanel No5 in 1921. It used aliphatic aldehydes for the first, which helped to create a rich jasmine ‘ note’ for the perfume. One major reason that the perfume industry use synthetic compounds over the natural is because of its expense. It is much cheaper to produce the materials synthetically than extracting it by natural means.

Structurally almost all fragrant molecules have stereocenters, any point in a molecule where interchanging of any two groups leads to a stereoisomer. 7 Due to this it becomes difficult to synthesise the particular isomer required for fragrance. In 1991 however a scientist known as Paquette synthesised a steroisomer of Ambrox, which is known to be an amber odorant. 2 The isomer is (-)-9-epi-Ambrox. This was made possible due to the use of a method known as oxy-Cope rearrangement2 to isolate a single isomer.

Process:

1. The active species, the bicyclic ketone is treated with dihydrofuranyl lithium, producing 2.

2. This product is then reacted with phenylselenyl chloride, producing the compound 3.
3. The removal of the phenyl selenium group providing the double bond required, and then followed by alkylation with methyl iodide and LDA.
4. Sodium borohydride (NaBH4) is then used to reduce the ketone molecule into an alcohol.
5. Catalyst palladium utilised to reduce double bonds.
6. This product is then dehydrolated to produce the desired (-)-9-epi-Ambrox. 2

The above example of chemical rearrangement is one of the many process is used in the formation of synthetic fragrances. Determining the fragrant materials of perfumes requires analysis of its chemistry. This is done by the use of gas chromatography and mass spectroscopy. The use of analytical chemistry is also evident in the synthesis of perfume.

These aromatic compounds that have either been extracted or synthesised are eventually formulated with other ingredients to produce the end product, Perfume.

Formulation of Perfume

Once the perfume oils are collected, they will be ready to be blended together. There may be as many as 800 different ingredients and take several years to formulate a special scent. 5 Once the scent is created alcohol is mixed with it, this can dilute the scent of the perfume. Alcohols' also evaporate quickly which allows the scent (top notes) to be released at a faster rate. The alcohol used in perfumery is ethanol and is odourless. 5 Alcohols used in perfumes is usually denatured so that they are not

marketed as alcohol rather than perfumes. This process is known as Blending.

Section 2: ‘ Notes’ on Perfume

The term “ notes” in perfumery means smell. The whole concept behind perfume is its fragrance. Notes are a descriptive form of the many layers of fragrances found in perfume. Perfumes usually consist of three notes:

1. Top Notes: are responsible for the initial smell of perfumes. They normally consist of small, light molecules that evaporate quickly (with the help of alcohol), the most volatile compounds.
2. Heart Notes: the smell that sets after the quick evaporation of the top notes. Forms the main aroma (hence known as ‘ heart’) of the perfume, has the ability to last several hours.
3. Base Notes: expectantly the scent that appears after the exit of the heart notes. These are made of heavy, large compounds which evaporate the slowest. The long lasting scents of the base notes are very rich and deep, helping to sustain the effect of the perfume. 6

Section 3: Physical aspects of Perfume

The main physical aspect of perfume is its colour. Perfumes that have colours are found to be more attractive to the buyer. However not all perfumes are coloured, this is because manufacturers add compounds, compounds that reflect certain colours in light, into the perfume. For example:

Section 4: Allergies caused by Perfumes

Breathing problems, asthma and contact dermatitis (an itchy and inflamed skin rash) are typical reactions to fragrances. These irritations are known to be caused by the various mixes of chemicals in the perfume.

Examples of the many allergenic fragrances include chemicals such as amylcinnamic alcohol, anisyl alcohol, benzyl alcohol, benzyl salicylate, even natural products such as clove oil, nutmeg oil, odor of rose and cinnamon oil. These can result in rashes or swelling on surfaces of hands, arms and face. 9

The addition of alcohol in perfumes only increases the allergies/irritation to the skin. To prevent alcohol allergies it is possible to manufacture perfumes with perfume oils4 instead. Perfume oils other than preventing alcohol allergies can be less expensive to produce and in terms of fragrances allows the scent to last longer. To make perfume oil, carrier oil is required to substitute the alcohol and the water. Jojoba is an example of carrier oil, as it has a very long shelf life, no scent of its own and it is not greasy. 4

Conclusive Summary:

As the above discussion suggests, the manufacturing process of perfumes uses a vast array of chemistry. Organic and analytical chemistry being the most important fields involved in the chemistry of perfumes. With more research and understanding of the mechanisms involved in the mixture of the components. It can be possible to have perfumes with ingredients that are less volatile in the future.