2 - Review of literature

2.1 - Introduction:

Plants producing an aromatic oil were used in religious ceremonies or for personal use and adornment long before recorded history, and remain popular for similar reasons. Words derived from their use, including perfume from the Latin perfume and alembic from the Arabic alinbic, are in common use. Aromatics were considered more than perfumes, as in languages of the region atar means smoke, wind, odour and essence. Probably the most well documented and certainly the best known ancient use of a wide range of aromatic material was in dynastic Egypt. The gums and oils employed in empalming are detectable today, together with the remains of scented unguents contained in ornate funerary jars and cosmetic pots found in the pharaoh's tombs.

Essential oil is contained in specialised structures in all or some plant parts: cavities or ducts in the epidermis as in eucalyptus leaves or citrus fruit peel; glands or hairs originating from epidermal cells as in the modified leave hairs on geranium while terpenes leached from eucalyptus leaves contribute to allopathic effects on the forest floor thus inhibiting germination and growth of competitors (1).

A wide range of plant materials contains essential oils or volatile oils. The two terms are used synonymously. These oils are primarily responsible for the characteristic aroma of the plant material, they are generally complex mixture of organic chemicals and are insoluble in water. Essential oils were obtained by different methods of extraction, depending on the nature of the plant material, the quantity of oil present and the relative stability of the various components (2).

Native to Australia, the genus *Eucalyptus* contains more than 700 species and belongs to the family *Myrtaceae*. Owing to the adaptability and fast growth of these trees, extensive plantations were started in many parts of the world, particularly in Egypt (3).

Eucalyptus trinber is used as firewood, industrial fuel, and in the paper industry. The essential oils distilled from the leaves and terminal branches are used in perfumes, in medicines, and as chemical raw materials. The compounds of essential oils are different and depend on the different *Eucalyptus* species or even on the local populations of the same species (4).

2.2 - The extraction methods of essential oils and semi-volatile compounds:

The chemical composition of the volatile oils isolated from aromatic plants depends strongly, among other variables, on the extraction method. Essential oils are obtained by hydrodistillation (HD), simultaneous distillation-solvent extraction (SDE), solvent extraction, Soxhlet and supercritical fluid (CO_2) extraction (SFE).

Chemical transformations such as hydrolysis , oxidation , isomerization can occur during HD and SDE (5). For example the monoterpene alcohols may be formed by hydration or oxidation of monoterpene hydrocarbons during the extraction of essential oil from different *Eucalyptus* species by HD or SDE method. Moreover hydrolysis, followed by dehydration, of 1,8-cineol can be a route to some of these alcohols according to fig (1) (6). Headspace, and purge and trap techniques permit recovery of only the most volatile metabolites, complete extraction of the less volatile compounds requires time consuming methods like Soxhlet, that needs large volume of organic solvents and produces complex extractions which require careful concentration before application and analysis (7).

The development of new separation techniques has gained increasing importance in the chemical and food industries primarily due to recent

environmental and public health regulations and the necessity of minimising energy requirements. Using CO_2 as solvent in the supercritical fluid extraction technique (SFE) has drawn more and more attention during the last years because of its environmental safety. The high capital investment and inherent risk in the use of high pressures **(8)** are drawbacks of the method, but on the other hand there are the following important advantages: The energy demands are comparatively low as well as the overall operating costs; CO_2 as solvent does not create environmental risks and in particular isomerisation and hydrolysis can be minimised during the extraction process because of the low extraction temperatures and also no water has to be added **(5)**.