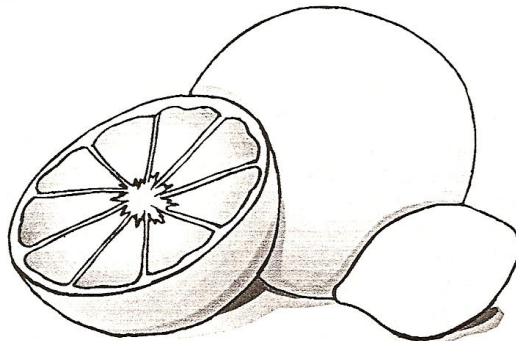


# ISOLATION OF ORANGE OIL



The aroma of freshly cut orange, or other citrus fruit, comes primarily from a mixture of terpene hydrocarbons primarily limonene produced in the oil glands in the orange peel. Two aldehydes are also present, p-cymene and citral. Once isolated from the peel, this mixture is known as "orange oil". These plant oils are also called "essential" oils, not because they serve some essential biological function, but because of the essence, or pleasant odor.

Orange oil can be obtained from the peel in several ways, including solvent extraction, cold pressing, and steam distillation. In this experiment, we will use the latter approach. Steam distillation is a technique for purifying high-boiling liquids that are immiscible with water. A mixture of water and the substance to be purified is brought to a boil, and the two distill together at a temperature slightly below the boiling point of pure water. This is useful for liquids that might decompose at their normal boiling point if distilled in the usual way.

Once extracted, the oil can be used for various purposes. One common application is as a solvent. Many general purpose cleaner, surface cleaners, hand cleaners, furniture polishes, bar soaps, and pet shampoos are made from orange peel extracts. In addition orange oil is often used in flavor applications. Very small amounts of orange oil, usually cold pressed, may be incorporated into certain food products including reconstituted orange juice, non-juice beverages, cookies and pastries, candies, extracts for baking, and marinades. The third major industrial use of orange oil is as a fragrance. In this function the oil mixture is employed in aerosol air fresheners, gel air fresheners, solid air fresheners, candies, product scenting and in aromatherapy products.

In aromatherapy, the fruity, sweet scent of orange oil has been traditionally used to brighten mood, calm and reduce stress, and as an environmental disinfectant. The complex odor is thought to relieve apathy, emotional abuse, worry addiction, burnout, hopelessness, and self-

consciousness. In general, the aroma is thought to be generally calming, and is often blended with lavender, clove, myrrh, clary sage, lemon, and neroli.

## PROCEDURE

Obtain the peel of one grapefruit (or two oranges, lemons, or limes). Weigh the peel, then cut it into tiny pieces or grind it in a blender, using just enough water to facilitate grinding. It is not necessary to reduce the peel to a pulp; small chips will work fine as long as they will fit through the neck of the distilling flask. Transfer the ground peel to a 500 mL round bottom flask. Assemble the proper apparatus for a simple distillation using a 125 mL Erlenmeyer flask cooled in ice for the receiver. Add water to the round bottomed flask as necessary to make the volume 300-350 mL.

Proceed to distill the sample collecting about 2-drops of distillate per minute. After about 50 mL have been distilled, add slowly 50 mL of water to the round bottom flask to partially maintain the initial volume in the distilling flask. In all, collect about 100 mL of distillate.

Allow the distillate to stand watching the orange oil separate from the water as two distinct layers. The orange oil is less dense than water and will be on the top. Remove this layer with a pipette measuring the final volume of your orange oil in a graduated cylinder. Place your final product in a clean test-tube and use to answer the following questions.

## QUESTIONS

1. Using the mass of the peeling that you started with, and the volume of oil that was produced, calculate the mL of oil produced per gram of orange peeling.
2. Based on the calculation above, how many oranges would be needed to produce 1.0 Liters of orange oil?
3. Close your eyes, and waft the oil fragrance towards your nose, write down your olfactory impressions.
4. Look up the structure of the aldehyde citral that is a component of this oil. Draw it. What alcohol could be used to produce this aldehyde?
5. What if you wanted to synthesize citral and all you had access to were alkenes. Show the steps you could use to make it. (at least three reactions).
6. Draw the acid that citral could be oxidized to.
7. Why do you think we collected our product in a cold flask?
8. List three name brands of products currently on the market that contain orange oil. Have you tried any of these? If so, what did you think?