Solvent Extraction of Essential Oils

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Some of the things we remember most are the pleasant smells associated with special experiences in our lives. The aroma of apple pie with a hint of cinnamon coming from the oven, or the fresh clean scent (and taste) of mint leaves picked from the garden are personal favourites of mine.

These, and a host of other incredibly appealing aromatic compounds, are available to companies developing the foods we eat and the beverages we drink. They add a whole new dimension to what might otherwise be a lack-lustre product with little or no appeal to our sense of smell.

Having spent a number of years as part of a team involved in the development of beverage products, I can easily recall the subtle aromatic notes of strawberries, peaches, and other fresh fruits that permeated the air as we prepared various beverage formulations.

The ways in which these flavours and essences (or “essential oils”) are produced can be quite interesting. Let’s take a look at the production of something as familiar as pure mint or peppermint extract.

One of the original methods to do this was through a process of steam distillation. Here, the crushed mint leaves were placed in a kettle through which steam was passed. The volatile flavour components would be evaporated from the mint leaves and leave the kettle with the steam. By controlling the temperature at which the steam was cooled, the volatile components could be condensed and separated from the water portion of the steam. In this way, the mint extract would be obtained.

Other processes may use solvents, such as alcohols, into which the flavour oils are extracted. The solvents can then be evaporated leaving the flavour oils behind. Depending on the particular solvent, this method may have potential disadvantages. There are many safe processes using this type of solvent extraction in operation today.

Since aromatic compounds are so delicate, any process involving heat can damage them, or reduce their potency. The same can be said for the use of some solvents. For this reason, processes which avoid the application of heat and undesirable solvents are viewed more favourably. Critical solvent extraction is one way to accomplish this.

Critical solvent extraction uses a gas such as carbon dioxide at a sufficiently high pressure to compress the gas into a liquid. Materials such as fresh mint leaves are placed in a stainless steel column capable of withstanding very high pressures. Once

the column is sealed, it is pressurized with carbon dioxide to the critical point where the carbon dioxide gas becomes a liquid. Temperatures employed in this process are typically in the range of 40°C to 50°C, which have little or no negative impact on the final product quality.

In the case of mint leaves, the oils they contain are solubilised in the liquid carbon dioxide. Once sufficient time has passed for the extraction of the flavour oils, the liquid carbon dioxide is pumped under pressure to a separate column. Here, the pressure is gradually reduced so that the carbon dioxide returns to its gaseous form. However, the mint oil remains behind as a liquid which is then recovered and packaged for sale. The gaseous carbon dioxide is subsequently re-used in the extraction of flavour oil from the next batch of material, and the cycle continues.

An added attraction of critical solvent extraction using carbon dioxide is the fact that there is no problem with chemical toxicity from the solvent. Once the flavour oil is at room temperature and normal atmospheric pressure, all the carbon dioxide has been flashed off as a gas. Since carbon dioxide is naturally present in the air around us as a product of our respiration etc., it is not considered hazardous at low levels – even if some of it were to remain in the product, which is generally not the case.

Not only is critical solvent extraction with carbon dioxide enjoying popularity as an industrial processing technique, it is considered to be an environmentally friendly clean technology.

Pure mint oil is only one of the products obtained using critical solvent extraction