Cambridge Polymer Group

What's in your coffee?

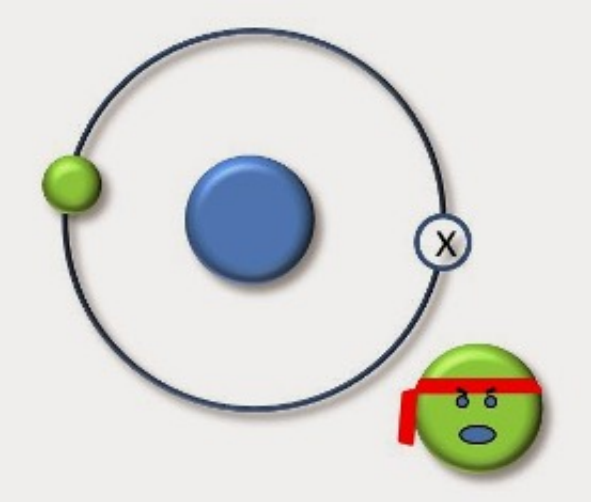
Coffee is prepared by steeping roasted ground coffee beans in hot water, and then removing the grounds. Caffeine, a naturally occurring stimulant found in coffee, can be removed from the coffee bean by a variety of methods. Benzene was originally used to extract caffeine from coffee in the early 1900s, but its toxicity resulted in this process being abandoned. Water extraction, or the Swiss Water Process, is sometimes used, whereby the water is infused with desirable oils found in the coffee to prevent their extraction, and the unroasted beans (green coffee beans) are repeatedly extracted until the desired level of caffeine is achieved. Dichloromethane or ethyl acetate are sometimes used to extract the caffeine from the beans. Super critical carbon dioxide can also be used to extract

caffeine. Caffeine levels in coffee vary according to the bean and the decaffeination process. Decaf will typically contain around 20 ppm of caffeine, while regular coffee may contain around 800 ppm. The decaffeination process may remove or alter desirable aromatics in the coffee that impart its flavor and aroma, hence processors are concerned not only with caffeine levels, but also other properties of the coffee following decaffeination.

Cambridge Polymer Group tested decaffeinated and regular coffee with a variety of techniques to allow assessment of the chemicals that lead to its aroma and flavor, caffeine content, impurities, and shelf-life stability, using gas chromatography, mass spectroscopy, infrared spectroscopy, oxidation induction time testing, rheology, electron spin resonance spectroscopy,sol/gel, and UV spectroscopy.

Read the full white paper here.

Set free the radicals!



Free radicals are unpaired electrons found on molecules, and can be the result of incomplete chemical reaction, radiation exposure, oxidation, or mechanical stress. Normally, free radicals are highly reactive and immediately react with other free radicals, oxygen, or other available chemical species. In some materials, however, free radicals can be temporarily stable, sometimes for years, waiting for the appropriate conditions to react. Knowing the free radical content of a material can sometimes be used to predict long term oxidative stability of the material. Identifying the type and location of the free radical on the material can help determine how to stabilize it and know how it was formed.

Cambridge Polymer Group offers electron spin resonance spectroscopy (ESR), also known as electron

paramagnetic resonance spectroscopy (EPR), to identify and quantify free radical content in materials. This technique is useful for evaluating antioxidants, shelf-life stability, and the effect of chemicals on materials.

Visit our site for more information on electron spin resonance spectroscopy.

Monomer analysis in bone cement

Polymer methyl methacrylate-based bone cement is commonly used in some hip and knee replacement arthroplasty surgeries to fix the metal components in place in the joint space. These cements are normally provided as two components. The first component, a powder, contains pre-polymerized PMMA powder along with some initiator (usually benzoyl peroxide) and a radiopacifier (usually barium sulfate). The second component, a liquid, is methyl methacrylate monomer along with some stabilizer. In the surgery, the operating staff will mix the two components together to form a viscous liquid, which is then injected or packed into the cavity behind or surrounding the metal implant. In the course of 5-15 minutes, the monomer cures after contact with the benzoyl peroxide.

As the residual unreacted monomer may leach out of the cement over time in the body, manufacturers and regulators are interested in knowing the amount of unreacted monomer present in polymerized PMMA. ASTM F451 describes a two methods for determining residual methyl methacrylate monomer in curing and cured bone cement, both based on gas chromatography with mass spectroscopy. In the first method, aliquots of freshly prepared cement are placed into vials containing water, and the monomer amounts that are elutable are quantified with GC-MS at time points up to around 30 minutes after start of mixing. In the second method, fully cured cement is exposed to water for a period of time up to 30 days, and the residual methyl methacrylate monomer is quantified in the water by

comparison of peak heights to a methyl methacrylate monomer calibration curve.

The general method for GC-MS analysis of bone cement is discussed in this application note.

Cambridge Polymer Group, Inc. is an ISO 9001:2008 certified contract research laboratory specializing in polymeric materials. We provide routine analytical testing on materials, custom test design, failure analysis, consultation, instrumentation, custom polymer and hydrogel formulation, and out-sourced research.

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