



GC/MS Determination of Phthalate Concentration in Plastic Toys

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Phthalates are added to plastics to increase flexibility. Recently, concerns have been raised over the effect of phthalate exposure from plastic materials on human health. This health concern has resulted in regulations regarding the type and levels of phthalates allowable in toys. Gas chromatography/mass spectrometry (GC/MS) is an excellent instrumental platform for the identification and quantification of phthalates in plastic-toy components. This paper will demonstrate a GC/MS calibration for common phthalates and the analysis of plastic-toy components for phthalate content.

Experimental

The PerkinElmer® Clarus® 600 GC/MS system provided the instrumental platform for this analysis. The GC was fitted with a programmable split/splitless injector; the injector-port temperature was maintained at 280 °C. The injector-port liner was packed with glass wool to improve vaporization and provide a surface for the collection of any dissolved plastic. A PerkinElmer Elite-5ms (30 m x 0.25 mm x 0.25 μm) GC column was temperature programmed from 100 °C to 260 °C at 8 °C/min, then to 320 °C at 35 °C/min. The carrier gas, helium, was set to 1 mL/min with 25 mL/min split at the injector port. Phthalate calibration standards were prepared in methylene chloride across a range of 1 and 160 μg/mL; the calibration standards used contain 16 phthalates.

An unused toy was broken into small pieces; 1-g samples were taken from each of the 9 different types of plastics used in the toy. The samples were extracted through 15 minutes of sonication in 10 mL of methylene chloride, in a sealed vial. Following extraction, 1 mL of the sample extract was transferred into an autosampler vial for analysis; a 1-μL injection was made.

Discussion

The instrument calibration across the range of 1 to 160 μg/mL for each phthalate was linear with R² greater than 0.999 for all compounds. Applying the calibration range to a 1-g sample extracted in 10 mL of solvent relates a % weight calibration range of 0.001 to 0.16%-weight phthalate in the sample.

The analysis of the toy samples resulted in detection of phthalates in each of the different plastic materials; however the phthalate level of all analyses was well below the regulatory limits. A sample analysis is pictured in Figure 1. In the chromatogram, three peaks are evident: butylated hydroxytoluene, diisobutyl phthalate and di-n-butyl phthalate. Butylated hydroxytoluene is an antioxidant commonly added to polymers. The total % weight of phthalates in this component was 0.007%.

Conclusion

European and North American countries have set limits on the acceptable levels of phthalates in toys. As a result, a reliable technique to determine the phthalate level in toys is necessary. The GC/MS technique presented here will allow for the determination of the phthalate content in plastic-toy components.

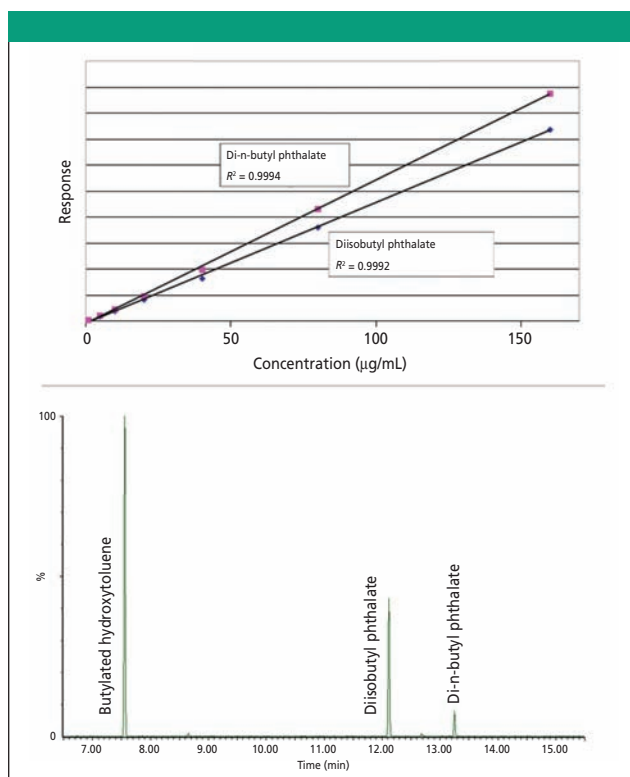


Figure 1: Calibration plot for detected phthalates and chromatographic results for the GC/MS analysis of a plastic-toy component.

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