Trace amounts of fluorescein have been measured in beer as a model for the detection of contaminants using the PerkinElmer Model LS-50 Luminescence Spectrometer.

Many food treatment processes involve cooling using heat exchanger coils filled with toxic substances such as glycols. Leakage from these coils can release varying amounts of coolant into the foodstuff, these contaminant levels being at times difficult to trace although potentially toxic. This application serves as a model for tracing of contaminants from a wide range of sources (coolants, lubricants, etc) by the addition of fluorescein, a highly fluorescent material, to the potential contaminant. Beer was chosen for this application since it represents one of the most potentially difficult sample types due to quenching and absorbance effects from its constituents. By monitoring for the fluorescein rather than the carrier coolant, extreme sensitivity can be achieved without the need for very expensive analytical instrumentation.

Similar methods are used for the tracing of effluents in streams and lubricating oils (1,2), where high sensitivity is obtained by the use of fluorophores with spectral characteristics which are distinct from background effects.

METHOD

Sodium hydroxide (AnalaR grade) and fluorescein were obtained from BDH, Poole, UK, and deionized water was used throughout the analysis.

Samples of three bottled beers were obtained and each was thoroughly degassed using a vacuum pump. 1 N sodium hydroxide solution was added gradually to each degassed sample until the pH of the beer had reached approximately 9.0.

A stock solution of 10 µmol/L fluorescein in 0.1 N sodium hydroxide was prepared. Aliquots of this solution were added to the beer to produce standards of 1, 5, 10, 50 and 100 nmol L⁻¹ fluorescein in beer.

Approximately 2.5 mL of each standard were analyzed using a silica cuvette placed in the single position thermostatted cell holder.

RESULTS

Data was collected as emission spectra over the range 500 to 600 nm, excitation wavelength 480 nm, slits 5/5 nm, scan speed 480 nm/min. Limit of detection measurements were obtained using excitation and emission slit widths of 15 and 20 nm respectively in order to maximize sensitivity.

Figure 1 shows the superimposed emission spectra recorded for the samples of lager containing fluorescein. The fluorescence intensity at 515 nm was measured for each spectrum and this data was used with Enzfitter© to obtain calibration graphs for fluorescein. Figure 2 shows the graphs obtained for the three beer samples.

The limits of detection (defined as the concentration of fluorescein required to produce a signal equal to twice that of the noise) were calculated for each beer sample and are displayed in Table 1.
CONCLUSIONS

Fluorescein can be detected in beer at levels less than 1 nmol L\(^{-1}\) despite the high levels of quenching and absorbance by the background. Hence the presence of fluorescein in food materials can be detected with high sensitivity using the Model LS-50 Luminescence Spectrometer to monitor the contamination.
REFERENCES


*Enzfitter is a product of Biosoft