Analytical Methods for Cationic Polyacrylamides at Levels of Environmental Significance

This project was carried out by the Agency's National Laboratory Service at its Llanelli laboratory in order to review those methods using fluorescence spectrophotometry for the determination of cationic polyacrylamide based polyelectrolyes in water and to assess whether further method development is required to meet the Agency's needs.

At present there is only a limited analytical service within the industry to monitor discharges that may contain cationic polyacrylamide contaminants. Currently the levels capable of causing environmental effects are lower than the levels which can be detected by analysis. Reliable methodology is required for routine and non-routine analysis and for monitoring consent levels.

For the purposes of this review, the polyacrylamides Percol 292 and Zetag 87 were used to investigate the methods. These were chosen as a starting point because Percol 292 was the calibration standard chosen by the authors of one of the papers and Zetag 87 is a cationic polyacrylamide based water treatment flocculant. Any future analytical method development should concentrate on the specific products applied and should ensure that efforts are correctly targeted.

Reviews of methods available for the determination of polyacrylamides indicated that there are few methods that can be applied to concentrations of less than 20ug/l. The lowest detection limits were found to be with Size Exclusion Chromatography (SEC) and fluorescence spectrophotometry which claim to determine levels as low as 10 and 20 ug/l respectively. Size Exclusion Chromatography, which also claims low limits of detection for polyelectrolyte analysis, is commonly used to determine the molecular weight and molecular weight distribution of polymers. However, SEC of high molecular weight cationic polyelectrolytes is quite problematical due to the adsorption of charged polymers to the column packing. Suitable commercially available packings have been developed recently and quantitative analysis is possible.

Since the instrumentation was already available in the Llanelli laboratory it was decided to investigate fluorescence techniques rather than SEC, but it is recommended that this is reviewed similarly elsewhere as a priority.

The report finally concludes that significant further method development would be needed in order to achieve the required limit of detection of 0.05mg/l (the level of interest being 0.5mg/l). When applied to real sample matrices the sample spike is not recovered. The true concentration of polyacrylamide in the sample is not reflected.

Discussion with other bodies within the water industry and manufacturers, also interested in the development of analytical methods to help optimize their use, confirmed the findings of our research. No further work on these methods is therefore proposed.

The analysis of polyacrylamides is not a simple analytical problem. Consideration should be given

to applying increasing pressure on the manufacturers to develop suitable methods themselves or to modify the products so that they are more readily analysed.

The discussion also highlights the additional problem of acrylamide monomer determination and it is recommended that research into the validity of methods for acrylamide monomer determination is carried out.

Owing to the outcome of the research, the experimental details serve as information only. The report as a whole will interest those concerned with the difficulties of developing sensitive analytical methodology for polyacrylamides in aqueous systems and the implications of the failure to do so.

This Technical Summary relates to information from project E1-042 contained in the following output:

Technical Report E47. Review of analytical methods for cationic polyacrylamides at levels of environmental significance.

Internal status: Released to Regions
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Copies of the report are available internally from Regional Information Centres and externally from Foundation for Water Research (Tel: 01628 891589. Fax 01628 472711)

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