DEVELOPMENT AND EVALUATION OF METHODOLOGY FOR THE CHARACTERISATION OF EFFLUENT DISCHARGES

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ABSTRACT

The establishment of a meaningful framework within which to apply management decisions concerning the present and any future water quality standards requires that data on the composition of effluents and their impact on receiving waters be available. The collection of these data requires the application of methodology which will allow for an adequate characterisation of the effluent discharge. Previous work, and the results of a questionnaire sent to Regional Water Boards, indicated an acute need for methodological guidelines to be established with respect to the sampling and analysis of effluent discharges. This study is concerned with the development and evaluation of methodology for the characterisation of: (i) a municipal sewage effluent, (ii) a freezing works effluent, and (iii) a dairy shed effluent, in terms of the currently used criteria of water quality, and phosphorus and nitrogen forms.

To determine the best preservative treatment for nitrogen and phosphorus forms in filtered and unfiltered samples of sewage and freezing works effluents, two preservative amendments (mercuric chloride and N-Serve) plus one control (unamended) were tested in combination with three storage temperatures (room, 4C, -10C) over a 30-day storage period. No one preservative treatment was ideal for all N and P forms studied for both effluents. In general, however, it was concluded that:

(i) -10C was the best storage temperature for dissolved inorganic phosphorus and dissolved ammonium nitrogen but was unsuitable for analyses involving particulates (total ammonium nitrogen, total Kjeldahl nitrogen) or organics (dissolved Kjeldahl nitrogen, total Kjeldahl nitrogen) for which refrigeration at 4C was the best storage temperature, and

(ii) No preservative amendment was necessary for sewage effluent samples provided samples were stored at 4C

or -10C (as appropriate); however, even with temperature control the addition of 50 mg $HgCl_2$ ℓ^{-1} of effluent greatly assisted in the preservation of N and P forms in freezing works effluent.

The survival of indicator bacteria (total coliforms, faecal coliforms, and faecal streptococci) in samples of each of the three effluents was investigated. Membrane filtrations commenced within 30 min. of sample collection and after 3, 6, 9, 12 and 24 hours storage at room temperature and 4C. The results indicated that samples of the effluents under consideration could be stored for up to 6-9 hours at 4C before appreciable changes in their indicator bacterial composition became apparent.

Monitoring studies were carried out on each of the effluent discharges. Sampling was from 1 to 3 days duration at intervals of not greater than 2 hours. Each effluent was characterised in terms of N and P forms, indicator bacteria, oxygen-demand parameters, solids, and pH. In addition UV absorbance at 250 nm and absorbance at the dominant 'visible' absorbance peak was determined on filtered samples. Correlation coefficients of up to 0.98 between absorbance at 250 nm and a variety of organic or organically-related parameters indicated that UV absorbance at this wavelength could be a monitoring aid for effluent surveillance programmes.

Time- and flow-based variations in flow, and concentration and loading of analytical parameters in the effluent discharges were discussed in terms of possible factors affecting the determination of sampling frequency. A computer integration method and probability plots were used to determine the sampling frequency needed to characterise concentration and loading of analytical parameters in effluents to within prescribed limits of accuracy.

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