The chemical behaviour of Cr(VI) at low concentrations (10^{-6}-10^{-7} mol.l^{-1}) in several aqueous formic acid solutions was studied using high specific activity \(^{51}\)Cr(VI). A simple and efficient radio-chromatographic method using paired cation and anion exchange analyses was used to quantify the \(^{51}\)Cr(VI) remaining in solution after different time periods as well as the several \(^{51}\)Cr(III) species formed. The product distribution of monomeric \(^{51}\)Cr(III) species includes those with 0, +1, +2 and +3 charges. Very little dimeric or higher polymeric species are formed. The rate of reaction of \(^{51}\)Cr(VI) with formic acid depends on the acid concentration, the presence or absence of sodium chloride and whether, or not, the samples are exposed to light.
Previous studies have shown that trace quantities of Cr(VI), monitored by means of radiochromium $^{51}$Cr, are reduced in the presence of mineral acids such as perchloric$^1$ and nitric$^2$ acids, producing several different Cr(III) species which can be separated using paired cation and anion exchange chromatography. The present work was undertaken to investigate the behaviour of Cr(VI) in aqueous solutions of formic acid and to determine the products thus obtained.

EXPERIMENTAL

Formic acid solutions /1.0 and 1x10^{-3} mol.l^{-1}/ were prepared from AR reagents and triply-distilled water. High specific activity $^{51}$Cr(VI) as Na$_2$CrO$_4$ was obtained from Amersham either in isotonic saline /37 MBq.ml$^{-1}$/ or in water solution /111 MBq.ml$^{-1}$/). A sufficient quantity of the radioactive solution was transferred to appropriate volumes of triply-distilled water /pH = 6.2/ or formic acid to have a total chromium concentration of about 10^{-6} mol.l^{-1}. As a result, solutions prepared from $^{51}$Cr(VI) in saline were also about 2x10^{-3} mol.l^{-1} in sodium chloride. Some of the prepared solutions were protected from ambient light.

Separation of $^{51}$Cr(VI) and the neutral, +1, +2, +3, +4 and higher charged species of $^{51}$Cr(III) was carried out using pretreated cation /1.5 ml of BioRad AG50Wx8, 100-200 mesh, $H^+$ form/ and anion /0.5 ml of BioRad AGlx8, 200-400 mesh, $Cl^-$ form/ resins placed in small /30x6 mm/ glass columns using a modification of a previously published procedure$^3$. The sample volume applied to the cation column was 0.2 ml. The eluent solutions were: /1/ 12 ml of triply-distilled water; /2/ 12 ml of 1x10^{-3} mol.l^{-1} HClO$_4$; /3/ 14 ml of 1x10^{-2} mol.l^{-1} HClO$_4$; /4/ 18 ml of 1x10^{-1} mol.l^{-1} HClO$_4$; /5/ 24 ml of 1.0 mol.l^{-1} HClO$_4$;