SEPARATION OF HYDRATION ISOMERS OF $^{51}$CrCl$_3$·6H$_2$O BY THIN-LAYER CHROMATOGRAPHY AND ITS APPLICATION TO THE INVESTIGATION OF ISOMERIC TRANSITIONS OCCURRING IN THE TITRATION OF THESE ISOMERS WITH A BASE

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A thin-layer chromatographic method was elaborated for the separation of hydration isomers of $^{51}$CrCl$_3$·6H$_2$O. The layer consists of Dowex 50WX4 and microcrystalline cellulose. As developing solvent the aqueous solution of NaClO$_4$ and NaCl is used. The precision of the method for the determination of the amounts of the dark- and light-green isomers is ±2 abs %, and for that of the violet isomer ±0.5 abs %. The method was used in the study of changes occurring in the aqueous solutions of pure isomers in the course of titration with NaOH or in back titration with HCl. From the results obtained it follows that the transitions of hydration isomers of CrCl$_3$·6H$_2$O from dark- and light-green to the violet form or the basic forms of chromium(III) chloride or chromium(III) hydroxide is irreversible in aqueous solutions.

Introduction

In aqueous solutions of commercially available CrCl$_3$·6H$_2$O three hydration isomers: $[\text{CrCl}_2(\text{H}_2\text{O})_4]\text{Cl} \cdot 2\text{H}_2\text{O}$ dark-green, $[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$ light-green, and $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ violet can exist in equilibrium. The composition of the solution depends on temperature and/or chromium concentration.

Commercial $^{51}$CrCl$_3$·6H$_2$O used as labelling agent for organic compounds, especially radiopharmaceuticals, has a similar composition as unlabelled. The labelling ability of $^{51}$CrCl$_3$·6H$_2$O preparations changes from batch to batch. It is probably connected with the variable content of indi-
vidual hydration isomers in the solution. In this case each isomer should be treated as independent chemical compound.

The best way to prove this statement is to prepare the pure isomeric forms of $^{51}$CrCl$_3$·6H$_2$O and use these to label the chosen compounds. It follows that a new purity factor should be introduced to the specification for this kind of preparations: "radioisomeric purity". The term means the percentage content of a specified isomer in the preparation e.g. the content of the dark-green hydration isomer $^{51}$CrCl$_3$·6H$_2$O in the preparation specified as $[{^{51}\text{CrCl}_2(\text{H}_2\text{O})_4}]\text{Cl} \cdot 2\text{H}_2\text{O}$. The other isomers are treated as "radioisomeric contaminations".

Two factors qualify the applicability of radioisomeric preparations: the radioisomeric purity and stability of the specified form under the conditions of the labelling process. The latter means in most cases the pH-changes, as very often the pH of the labelling and labelled solutions differ in many units. To have some knowledge about these two factors it was necessary:

(1) to elaborate a method for the routine control of radioisomeric purity;

(2) to establish the course of changes induced by pH-changes in the aqueous solutions of individual hydration isomers of $^{51}$CrCl$_3$·6H$_2$O.

As presented in the literature, methods for the separation of hydration isomers of CrCl$_3$·6H$_2$O are mainly extraction, column ion exchange chromatography and paper electrophoretic method. None of these fullfill all the conditions essential for routine control methods which should be simple and fast with good separation ability and with good precision in a wide concentration range. The method should also separate the basic and polymeric forms of chromium(III) chloride together with chromium(III) hydroxide. Thin-layer chromatography appeared to be the most useful method for this purpose.