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DETECTION OF ANIONIC POLYACRYLAMIDE BY GPC

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By addition of a salt to the eluent, the large increase was observed for the elution volume of the partially hydrolyzed polyacrylamide. This feature was applied to the detection and the separation of the anionic polymers in the technical products of polyacrylamide.

Polyacrylamide and its related materials have been used widely for wastewater treatments. Particularly, the partially hydrolyzed anionic polymers have shown high activity as a flocculant[1]. The activity depends on the molecular weight and also on the degree of hydrolysis(D.H.). Therefore the evaluation of these parameters could provide assistance in the actual treatments.

This short report aims to detect the existence of anionic materials by GPC, especially, the polymers having a very low extent of hydrolysis which are included in the commercial substance produced for technical uses.

A polyacrylamide sample Y2($M = 4.69 \times 10^5$), and two anionic samples H-30-6(D.H. = 6.9 %) and H-30-30(D.H.= 30.2 %) were obtained from a commercial source B(nominated as $M = 3 \times 10^5$ by the supplier)by means of the fractional precipitation method and the alkaline hydrolysis, respectively. Other technical polymers A($M = 3 \times 10^6$) and C($M = 1.2 \times 10^5$) were also employed without any purification.

As the stationary phase and the eluent of GPC, the controlled porosity glass (CPG-10, Electro-Nucleonic Inc.) of mean pore diameter 3125, 486, 255 and 75 A packed in four 4 ft.x3/8in. stainless columns and formamide were used at 45 °C under the flow rate of 1 ml/min[2].

GPC chromatograms of these samples eluted with pure formamide are given in Fig.1 by the broken lines. The solid lines show the chromatograms of the same samples eluted with 5 x 10^{-3} M KCl-formamide. The existence of KCl was concerned in the delay of the retention volume over 10 counts(50 ml) for the hydrolyzed samples. Furthermore, increasing the salt concentration did not substantially alter these chromatographic results.

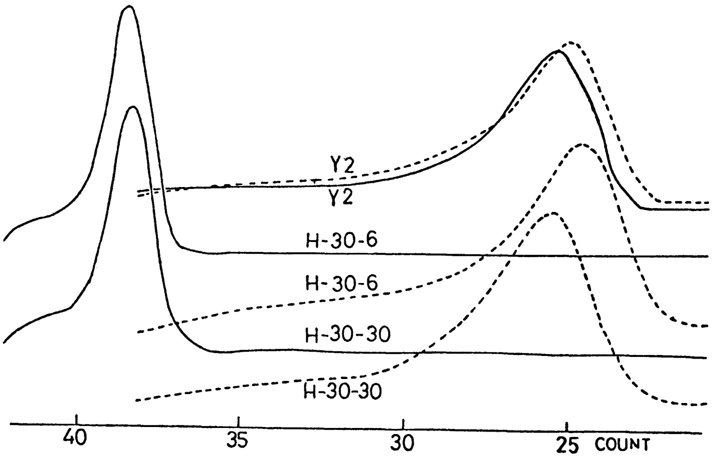

Fig.1. Elution curves of polyacrylamide(Y2) and the partially hydrolyzed samples(H-30-6 and H-30-30). Eluted with formamide (----) and 5x10^{-5}M KCl-formamide(——).

Subsequently, the technical polyacrylamides were eluted under the same conditions, namely with 5 x 10^{-3}M KCl-formamide. As shown in Fig.2, all chromatograms are composed of two distinctly separated peaks; one peak(right) is situated in the range of polyacrylamide and the other(left) in that of hydrolyzed materials. Under the elution with pure formamide, these polymers(A, B and C) gave only a single peak. The colloid titration performed for these substances failed in the quantification, which would mean that the amounts of hydrolyzed groups in a polymer chain is too small to be detected by this technique[3]. Judging from the chromatographic and titration evidence, the second component in technical products seems to be polymer having a very low extent of hydrolysis.

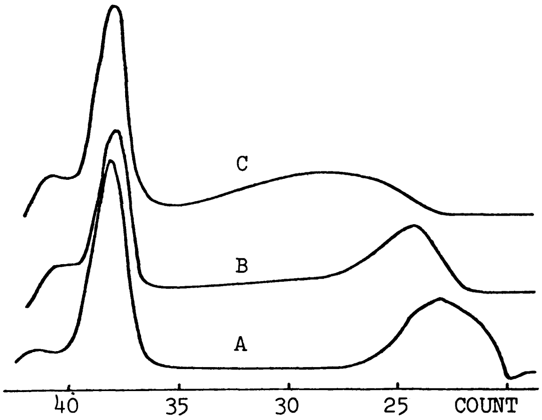

Fig.2. Elution curves of technical polyacrylamide eluted with 5x10^{-3}M KCl-formamide.

Finally, we can say that GPC performed in this work has a capability of the separation of polyacrylamide and its hydrolyzed materials, and serves satisfactorily as a tool to detect the presence of anionic polyacrylamide.

References

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