

Ring Structure of Cyclic Poly(2-vinylpyridine) Proved by Py-GC/MS

[Background] Ring polymers having no chain end are expected to have quite different natures from those of the corresponding linear ones. However, the ring structures of the cyclic polymers have not been directly proved through the characterization of the chemical structures yet. In this work, the ring structure of cyclic poly(2-vinylpyridine) (P2VP) was confirmed by the Py-GC/MS method.

[Experimental] A P2VP with two living ends was prepared by anionic polymerization of 2VP. The cyclization was carried out by reacting the living P2PV with dibromo-p-xylene as an initiator followed by terminating with excess P2VP. Three kinds of linear P2VP model polymers (L-1 through L-3) with different junction structures were prepared for comparison. Determination of molecular weight and fractionation were done with size extrusion chromatography. Analysis was done by a GC equipped with a capillary column and with an FID detector and MS.

[Results] Figure 1 shows the pyrogram of the fractionated P2VP sample, R-1. P2VP monomer, dimer, and trimer were observed. It is considered that the possible smallest characteristic fragments reflecting the coupling moiety in the cyclic P2VP should be in the trimer region. The expanded pyrogram in the trimer region consists of a number of peaks in addition to the strongest 2VP trimer (VVV). Figure 2 shows the observed partial pyrograms in the trimer region for L-1, L-2, L-3 and R-1. The entire pyrograms of R-1 and the model linear P2VPs were almost identical. The trimers observed on the pyrogram of L-2, however are missing on that of L-3 can be the candidates of VXV. By the logical comparison of the pyrograms of the three model polymers (L-1, L-2 and L-3), it was deduced that the peaks 1, 2, and 3 appearing on the pyrograms of L-2 should clearly be attributed to the peaks of the key trimers of VXV having a ring structure.

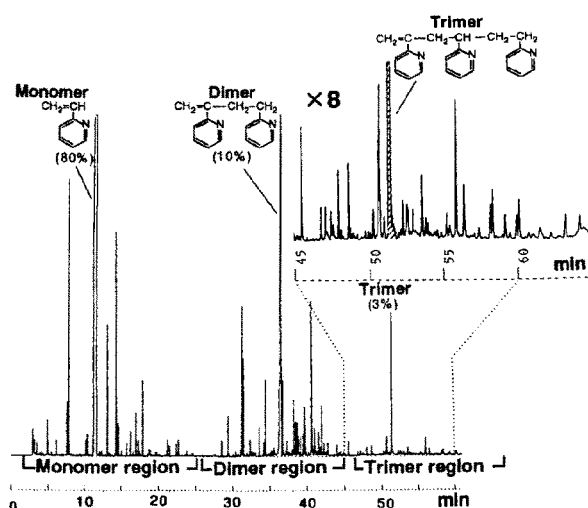


Figure 1. Pyrogram of poly(2-vinylpyridine) [P2VP] containing cyclic polymer fraction (sample R-1) at 650°C.

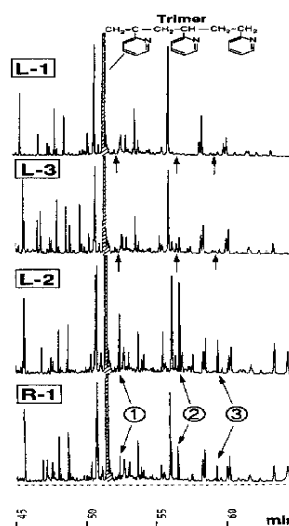


Figure 2. Detailed pyrograms in the trimer region of poly(2-vinylpyridine) [P2VP] containing cyclic polymer fraction (sample R-1) and model linear P2VP (L-1 to L-3)

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Applications : General polymer analysis

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