# NOTE

## *Equivalence of Cyclohexanone and Tetrahydrofuran as Solvents for Poly(vinyl Chloride)*

The majority of the published measurements on the relation of solution viscosity and molecular weight determinations of poly(vinyl chloride) polymers are in agreement in those cases in which the solvent is cyclohexanone. Reference may be made to the summary by Kurata.[1] However, the data of Batzer[2] in tetrahydrofuran at 20°C. vary sufficiently to suggest the question whether the two solvents do vary in solvency for poly(vinyl chloride) as was indicated by Danusso.[3] His values of intrinsic viscosity of a laboratory-prepared poly(vinyl chloride) were 1.19 and 1.44 dl./g. in cyclohexanone and tetrahydrofuran, respectively, at 25°C. in contrast, Mencik[4] has assumed equivalence in the two solvents since he has made his viscosity measurements in cyclohexanone but his osmometric molecular weight determinations in tetrahydrofuran.

The following data obtained in connection with an evaluation of the processing of commercial vinyl chloride polymers support the equivalence of these two solvents. As suggested by others, cyclohexanone is easier to work with because of its lower volatility. The specific viscosities of three commercial types of poly(vinyl chloride) have been measured at 30°C. in the two solvents cyclohexanone and tetrahydrofuran, (Table I) and the intrinsic viscosities determined by graphical extrapolation (Table II).

TABLE I
Specific Viscosities of Three Commercial Poly(vinyl Chlorides)[a]

| | | Specific viscosity | | |
|---|---|---|---|---|
| | Concn., g./100 ml. | Cyclohexanone (30°C.) | Tetrahydrofuran (30°C.) | Tetrahydrofuran (20°C.) |
| Escambia 2250 | 0.4 | 0.496 | 0.493 | 0.506 |
| | 0.6 | 0.801 | 0.795 | 0.824 |
| | 0.8 | — | 1.134 | — |
| | 1.0 | 1.515 | 1.525 | — |
| Opalon 630 | 0.4 | 0.377 | — | 0.376 |
| | 0.6 | 0.597 | 0.601 | 0.596 |
| | 0.8 | — | 0.847 | — |
| | 1.0 | 1.105 | 1.112 | — |
| Exon 965 | 0.4 | — | 0.217 | 0.225 |
| | 0.6 | — | 0.335 | 0.348 |
| | 0.7 | 0.406 | — | — |
| | 0.8 | 0.476 | 0.467 | — |
| | 0.9 | 0.544 | — | — |
| | 1.0 | 0.621 | 0.601 | — |

[a] Viscosity measurements by the Analytical Department, Research and Development Center. Cyclohexanone, b. p. 154–156°C.; tetrahydrofuran, b.p. 66.1–66.3°C., spec. gr. 0.884.

TABLE II
Intrinsic Viscosity of Three Commercial Poly(vinyl Chlorides)

| | Intrinsic viscosity, dl./g. | | |
|---|---|---|---|
| | Cyclohexanone (30°C.) | Tetrahydrofuran (30°C.) | Tetrahydrofuran (20°C.) |
| Escambia 2250 | 1.060 | 1.056 | 1.066 |
| Opalon 630 | 0.836 | 0.837 | 0.840 |
| Exon 965 | 0.502 | 0.500 | 0.525 |

It is obvious that within the usual variation of experimental results the specific viscosities and therefore the calculated intrinsic viscosities of these three commercial vinyl chloride polymers are identical in these two solvents.[5]

In order to estimate the possible temperature factor in Batzer's data the specific viscosities of these three poly(vinyl chlorides) were determined at 20°C in tetrahydrofuran. The change of intrinsic viscosity with temperature for these polymers in tetrahydrofuran is small, averaging 0.2%/°C., the same variation as reported by Mead and Fuoss[6] for poly(vinyl chloride) in cyclohexanone.

## References

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