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Studies on the Analytical Method of Polymer Materials by Gel Permeation Chromatography

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Gel permeation chromatography (GPC) is a special case of liquid chromatography.

It is rapidly becoming indispensable in the polymer science both for the rapid determination of molecular weight distribution (MWD) of polymers and for the separation analysis of low molecular weight (MW) materials and polymer additives.

This paper deals with "Studies on the analytical method of polymer materials by GPC" and consists of 12 chapters.

Chapter 1 is "Introduction". The role and the significance of this paper is described.

Chapter 2 describes "History and principle of GPC".

Chapter 3 deals with "Preparation of polystyrene (PS) gels for GPC".

Gels were classified into three types: non solvent modified gels, good solvent modified gels, poor solvent modified gels.

Their separation efficiencies were discussed.

With combination of the two types of gels, polymer materials of MW ranging from several hundreds to more than 10^6 could be separated effectively.

Chapter 4 deals with "Preparation of special macroporous gels".

The special macroporous gels with inner fine, outer coase pore distribution structures were designed and prepared.

Those gels were more excellent for separation than the above-mentioned conventional gels.

Chapter 5 discribes "Improvement of column efficiency".

Some factors on column efficiency; i.e, gel particle size, flow velocity, column diameter and column packing procedure were examined.

Consequenty the highest efficiency column for present liquid chromatography could be obtained.

Chapter 6 describes "Preparation of GPC apparatus and characteristics of detectors".

GPC apparatus using ultraviolet absorption detector and differential refractometric detector were designed and prepared.

The characteristics of those detectors were discussed.

Chapter 7 discribes "Determination of MWD of PS".

A GPC—UV method was developed.

MWD and the average MW obtained by this method agree well with those obtained by various traditional methods.

Resolution and long term reproducibility of the method were satisfactory.

Chapter 8 deals with "Determination of MWD of high desity PE".

The calibration curves obtained by three methods were essentially consistent with each other.

The integrated MWD curves and values of average MW obtained by GPC agreed well with those by traditional column fractionation.

It was deduduced that the MWD of commercial PE samples show logarithmic normal distribution functions.

Chapter 9 deals with "Determination of MWD of low density PE".

By using fractions of branched PE possessing different degree of branching, single calibration curve was adequate.

This curve was applied in the GPC analysis of various commercial low density PE and the features of MWD of these samples were revealed.

Chapter 10 deals with "Application for analysis of low MW polymers and polymer additives".

The analytical methods of the low MW polymers or the antioxidants in PS were established.

Chapter 11 deals with "Preparation of tetranitrobenzyl PS (TNBPS) gels and analysis of polymer additives".

TNBPS gels which was synthesized from PS gels formed II complexes with aromatic compounds.

In comparison with GPC molecular size separation, the separation was very unique.

Chapter 12 is "Summary".

In this chapter the above-mentioned investigation results are summarized briefly.