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in water at 30°C for the removal of water soluble parts of films. The extracted films were then air-dried and subjected to heat treatment at 40, 80, 120, 160 and 200°C for 10 minutes. Original films were also similarly treated. The swelling, solubility and density of the two series of films were compared. In the case of heat treatment at lower temperature, there was a distinct difference between the two series. Extracted films showed lower swelling and higher density and crystallinity. Similar experiments were also carried out with an unfractionated polyvinyl alcohol of DP 1550 to obtain similar results.

Studies on the Swelling of Polyvinyl Alcohol. (VI)

Swelling of Films Prepared from Water-Soluble and Insoluble Parts of Polyvinyl Alcohol Films

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Chemistry of High Polymer, Japan (Kobunshi Kagaku), 14, 96 (1957)

A fractionated polyvinyl alcohol of DP 720 was used as a starting material and separated into water-soluble and insoluble parts by the method given in the previous report. DP's of the water-soluble and insoluble parts were 540 and 770, respectively. Films were prepared from these two kinds of polyvinyl alcohol and subjected to heat treatment to compare the swelling, solubility and crystallinity of them. In the case of heat treatment at lower temperature, there was a distinct difference between the two. Films from water-soluble part showed higher swelling and lower density and crystallinity. It was attributed not to the difference of molecular structure but to the difference of molecular weight.

Studies on the Swelling of Polyvinyl Alcohol. (VII)

Influence of the Residual Acetyl Groups on the Swelling of Polyvinyl Alcohol Films

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Films were prepared from the following two kinds of polyvinyl alcohol and subjected to the heat treatment to see the influence of residual acetyl groups on the swelling of polyvinyl alcohol films: 1. Fractionated and unfractionated polyvinyl alcohols (DP 235-3630) with some residual acetyl groups (0.05-5.95 mol %), 2. Polyvinyl alcohol with no residual acetyl groups, obtained by the resaponification of 1. When the temperature of the heat treatment of films is low, the residual acetyl group, even when its concentration is very low (0.2-0.3

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mol %), has a marked disturbing influence on the crystallization. However, in the heat treatment above 160°C this effect disappears.

Studies on the Swelling of Polyvinyl Alcohol. (VIII)

Swelling of Perfectly Deesterified Polyvinyl Alcohol Films

with Various Degrees of Polymerization

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The relation between the degree of polymerization, swelling and crystallinity of polyvinyl alcohol films were discussed in Part I. On the other hand, in the preceding paper, it was found that the residual acetyl group had a great influence on these properties. Then, a new series of experiments was undertaken with perfectly deesterified polyvinyl alcohols. DP's of the fractionated polyvinyl alcohols were as follow : 140, 310, 500, 1120, 1683, 2042, 2570, and 3631. In the polyvinyl alcohols of lower DP's (<500), the effects of DP on the swelling, solubility and density were considerably observed at lower temperature of heat treatment. In polyvinyl alcohols of DP greater than 500 however, the relation between the swelling and crystallinity could be given by a single curve independent of the DP and the temperature of the heat treatment. The linear relationship between the density and the crystallinity B was also found.

Studies on the Swelling of Polyvinyl Alcohol. (IX)

Swelling of Films Prepared from Mixture of Two Kinds of Polyvinyl

Alcohols with Different Degree of Polymerization

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Fractionated polyvinyl alcohols with DP 140 and 3370 were selected. These polyvinyl alcohols were mixed in aqueous solution in various proportions and mixture films were prepared. They were air-dried and subjected to the heat treatment. When the temperature of the heat treatment and the content of the lower molecular weight portion are not so high, the lower molecular weight portion dissolves out by the swelling, and the degree of swelling is mainly effected by the higher molecular weight portion. So long as the mean degree of polymerization is the same, the heterogeneity has not a great influence on the swelling properties of the films.