

EVALUATION OF DICHROISM ON POLYETHYLENE SHRINKABLE FILMS

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ABSTRACT

Five commercial samples of polyethylene shrinkable films were evaluated with respect to dichroic ratio using an FT-IR equipment. The amorphous CH₂ band at 720 cm⁻¹ was selected and absorbance ratio between longitudinal and transverse film directions was calculated. The values obtained were different indicating that under same shrinkage conditions each material must show different end mechanical properties.

INTRODUCTION

The stress-induced orientation on polymer is a process where the straightening of chains is accompanied of molecular alignment. When the plastic and elastomer chains are displaced, the materials alter their spatial arrangements and the bulk changes from a completely random entanglement to a more orderly arrangement to parallel direction of the applied force. Stretched films with non-balanced orientation are used in food and beverage packaging industries due to their shrinkability, toughness and strength. Polymers such as vinylidene chloride (PVDF), polystyrene (PS), poly(vinyl chloride) (PVC), poly(ethylene therephtalate) (PET), polypropylene (PP) and low density polyethylene (LDPE), for example, are used as oriented films in these fields. The purpose of this work was to evaluate the degree of orientation in five commercial films of polyethylene used as shrink wrapping in beverage industry. The dichroic ratio was calculated from a selected amorphous band using FT-IR equipment.

EXPERIMENTAL

Five samples of polyethylene were evaluated. Samples 1, 2 and 5 were of the same suppliers. The samples 4 and 5 were of the other sources. For the analysis, strips of 20x20x0.07 mm in dimension were cut from the films. An appropriate accessory was used in infrared equipment. The incident light in the samples at angles 0 and 90 degrees were performed and the absorbance variation in amorphous 720 cm^{-1} band was detected. The dichroic ratio was calculated considering the absorbance between longitudinal and transverse directions.

RESULTS AND DISCUSSION

The FT-IR analysis was performed in the films. The dichroic ratio of the samples informs the relative degree of orientation between parallel and transverse directions. The values of dichroic ratio were arranged in Table 1. The values were different showing that the orientation at parallel direction were 76, 152, 27, 61 and 66%, respectively for samples one to five. Only the samples 4 and 5 showed similar dichroic ratio. In the case of shrinkable films, they must have non-balanced orientation but the induced stretching is one of factors that has influence on the withdrawal of the films. At same shrinkage conditions, different orientation must lead to different mechanical end properties of the films.

Table 1
Dichroic ratio of samples

Sample	Dichroic ratio
1	1,76
2	2,52
3	1,27
4	1,61
5	1,66

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