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THE INFLUENCE OF SHELLAC APPLICATION ON ZEIN FILM PROPERTIES

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INTRODUCTION

In this work, zein-based films with the addition of shellac were synthesized and characterized. Shellac was added in two ways: (1) by lamination on the existing dry zein film (L samples), (2) by adding shellac alcohol solution during the synthesis of zein film in a ratio of 50-50 by casting process (M samples). Zein films without the addition of shellac were designated as control. Physico-chemical, mechanical and barrier characteristics were examined for all sample groups.

MATERIAL AND METHOD

C: 10% w/v zein in 85% Et+0.5 g PEG 400/g zein heated at 80°c, and dried in petri dishes; **M**: the same amount (10% w/v in 85% Et) of zein and shellac solution were mixed and dried in petri dishes; **L**: zein film was formed (same as C) and when dried the same amount of shellac solution was laminated over it and dried.

Mechanical properties were measured according to the en iso 527-3:1995. Solubility was determined during 24h at room conditions. Moisture content was determined as a % of weight reduction during film drying. Water vapor barrier properties were determined according to the iso 2528:1995.

DISCUSSION

Control zein film is light yellow in color, while films with added shellac are darker brown. All films are shiny and transparent; firm and flexible, not greasy or sticky.

The shellac addition had a favorable effect on the mechanical properties: in the case of the M sample TS increased, in the case of the L sample the highest value of EB was found.

The most significant influence of the added shellac was in terms of barrier properties with respect to WVP. Lamination as processing proved to be more effective regarding this issue than blending biopolymers.

MC and SD values were uniform for all tested film samples.

A color correlation diagram was created to show the statistical significance of the correlation coefficients between the different variables and the responses. A positive correlation between the TS was noticed; a negative correlation between WVP and the EB and WVP and SD was noticed.

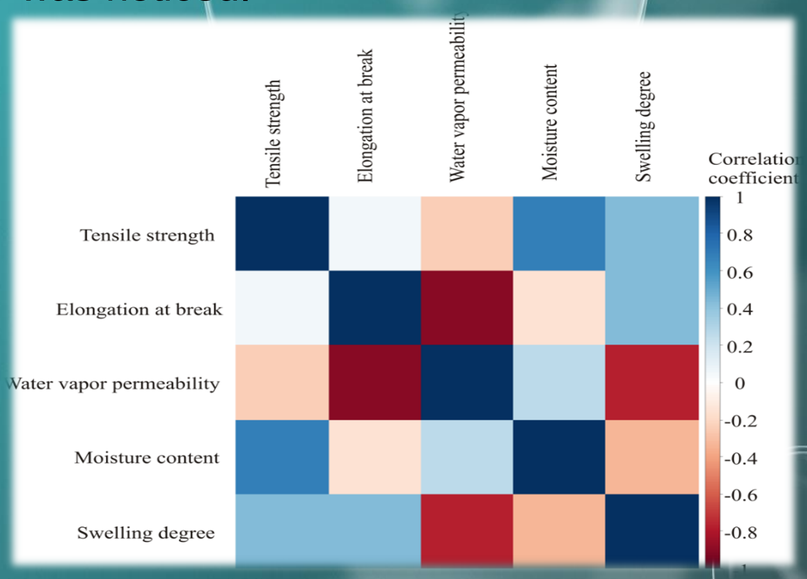

Fig. 2. Color correlation diagram between the observed variables

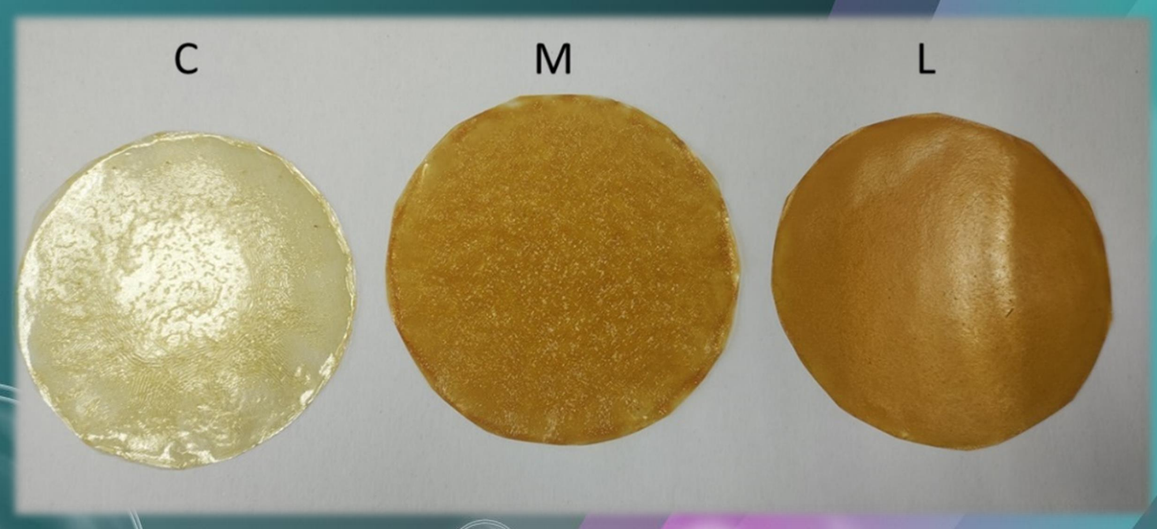

Fig. 1. Visual examination of zein film, composite zein/shellac film and laminated zein/shellac film

Film sample	Tensile strength (MPa)	Elongation at break (%)	Water vapor perm. (g/(m²·h))	Moisture content (%)	Swelling degree (%)
C	6.18±1.02	7.71±1.97	40.33±0.67	7.14±0.41	27.19±1.13
M	15.51±2.31	11.49±2.34	18.41±0.33	5.11±0.37	35.81±1.24
L	8.96±0.98	18.99±1.76	10.04±0.51	5.91±0.16	32.45±0.97

Table 1. Characterisation of zein film, composite zein/shellac film and laminated zein/shellac film

CONCLUSION

Zein films have excellent barrier properties, high tensile strength, and good thermal stability. However, they are often brittle and can be sensitive to moisture, which limits their use in some applications. Combining zein films with shellac through lamination or blending improved the moisture resistance, strength and flexibility of the films. The structures of shellac and zein are different: the polymer structure of shellac gives it a more amorphous and random structure, while the protein structure of zein gives it a more ordered and structured arrangement. This investigation proved that they can be successfully combined to obtain new films with improved properties.

Key words: shellac resin; zein film, properties

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