Foods 2024 Conference

The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

MDPI

A comparative study on the effects of starch, glycerol and clay contents on the morphological and mechanical properties of corn starch nanocomposite films

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INTRODUCTION & AIM

Starch is a biodegradable, abundant, renewable, and eco-friendly polymer, which is widely used in various applications within the food, pharmaceutical, and cosmetic industries. However, starch-based films have serious problems in terms of performance, stability, and shelf life during storage [1,2].

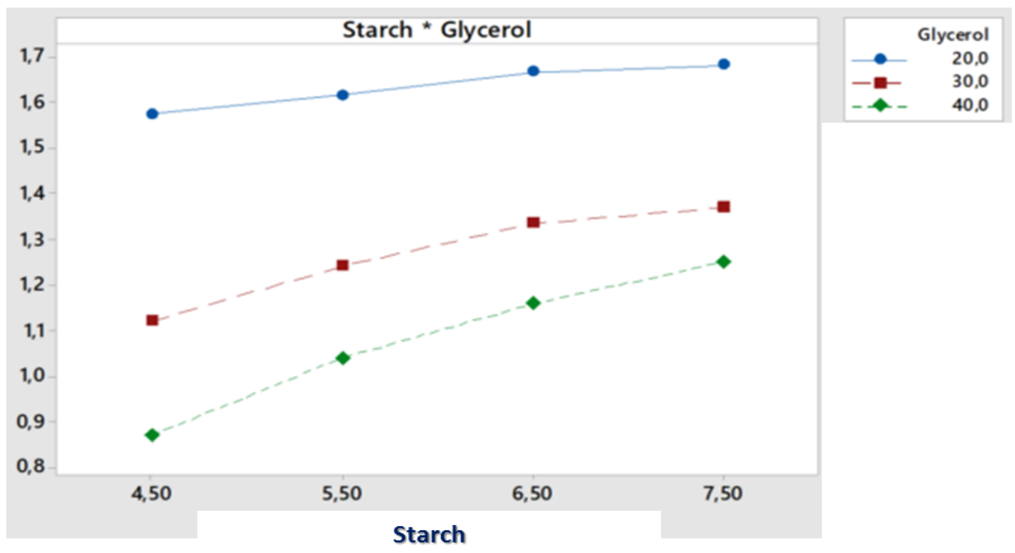
The aim of the present work was to examine and compare the effect of starch, glycerol and sodium montmorillonite [NaMMT] contents on morphological and mechanical properties of corn starch nanocomposite films

METHOD

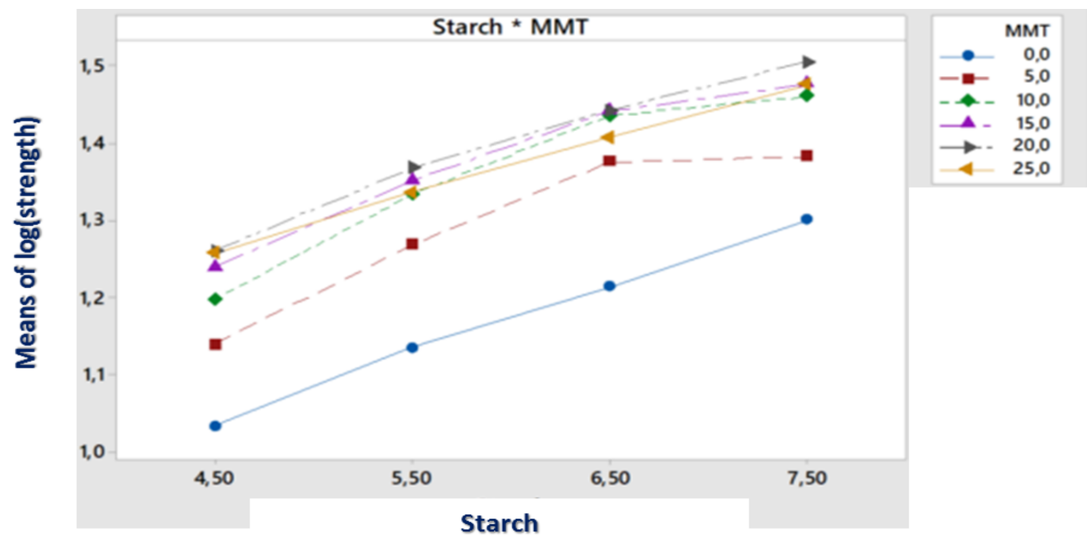
- Biodegradable starch films were prepared by the casting method, using different concentrations of starch [4,5 to 7.5% w/w], glycerol [20 to 40%] and sodium montmorillonite [NaMMT] [0 to 25% w/w], based on the amount of dry starch
- The morphology of the corn starch-based films was investigated using Optical microscopy and Confocal Scanning Electron microscopy.

RESULTS & DISCUSSION

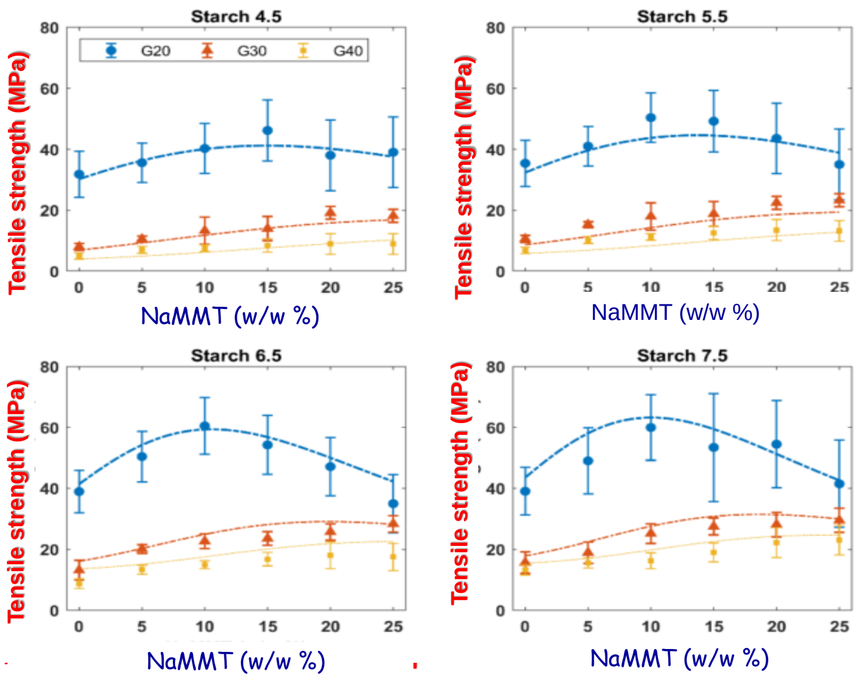
Mechanical properties



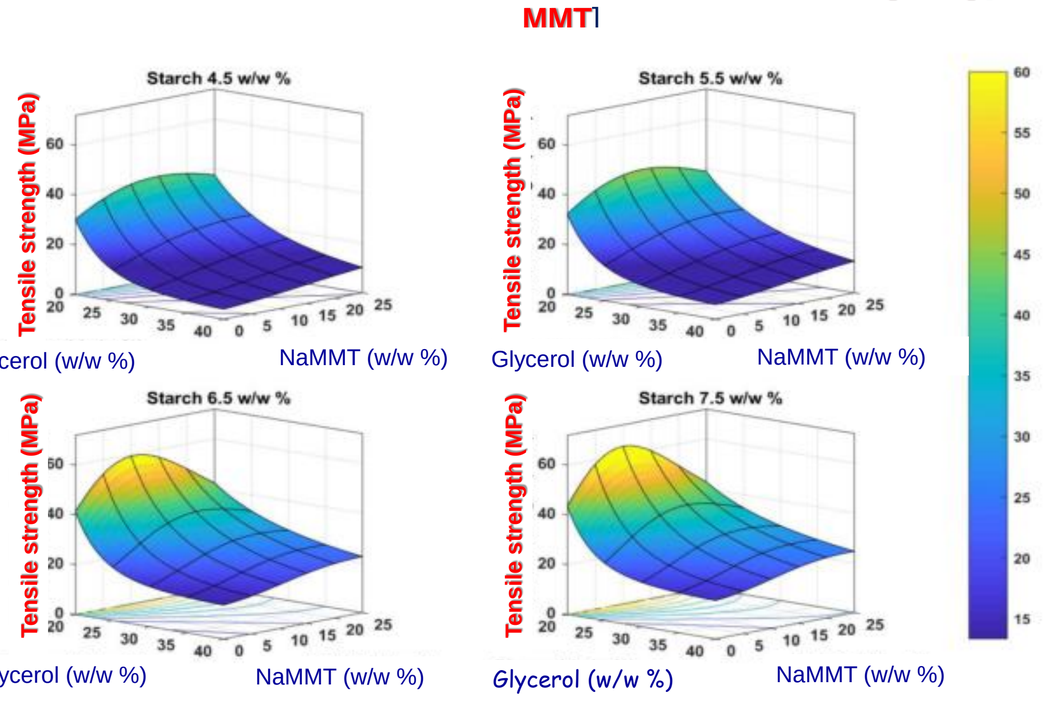
Interaction of **starch concentration with glycerol** [starch* glycerol]



Interaction of **starch concentration sodium montmorillonite [MMT]** [starch* **MMT**]



Tensile strength curves of thermoplastic starch-NaMMT clay nanocomposites as a function of clay content with glycerol contents [20 , 30 or 40%



Regression models of thermoplastic starch-NaMMT clay nanocomposites as a function of clay content with glycerol contents [20 , 30 or 40%]

CONCLUSION

- The interaction of starch and glycerol showed that the films prepared with low glycerol content and high starch content presented better tensile strength properties
- The interaction of starch and NaMMT revealed that there is an increase tensile strength with an increase of clay content.
- Microscopic examination revealed a uniform distribution of the clay particles in the starch film matrix.
- The best mechanical properties were obtained for the nanocomposite films containing starch in the concentration ranger of 6.5 to 7.5% w/w, at glycerol concentration of about 20-40% w/w and NaMMT clay content ranging from 10-15% w/w.

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