Justyna Kadzińska[1], PhD student

Sorption properties of pumpkin edible films incorporated with different hydrocolloids

Co-authors:

Monika Janowicz[1], Stanisław Kalisz[2], Joanna Bryś[3], Łukasz Woźniak[4]

[1] Department of Food Engineering and Process Management, Faculty of Food Sciences, WULS-SGGW, Poland
[2] Department of Food Technology, Division of Fruit and Vegetable Technology, Faculty of Food Sciences, WULS-SGGW, Poland
[3] Department of Chemistry, Division of Organic and Food Chemistry, Faculty of Food Sciences, WULS-SGGW, Poland
[4] Department of Fruit and Vegetable Product Technology, Prof. Wacław Dąbrowski Institute of Agricultural and Food Biotechnology, Poland

PRESENTATION OUTLINE

INTRODUCTION

1. Edible fruit and vegetable films – history and characteristic
2. Application of edible fruit and vegetable films
3. Film-forming properties of fruit and vegetable purée

MATERIALS AND METHODS

1. Aim and research material
2. Pumpkin purée production
3. Film preparation

Fig.1. Vegetable films by Tara H. McHugh

RESULTS

1. Water sorption isotherms
   - 25°C
2. Water sorption kinetics
   - 5 and 25°C

CONCLUSIONS

Photograps:
http://archive.boston.com

Edible films incorporated with fruit and vegetable purée

1996 – the first scientific publication

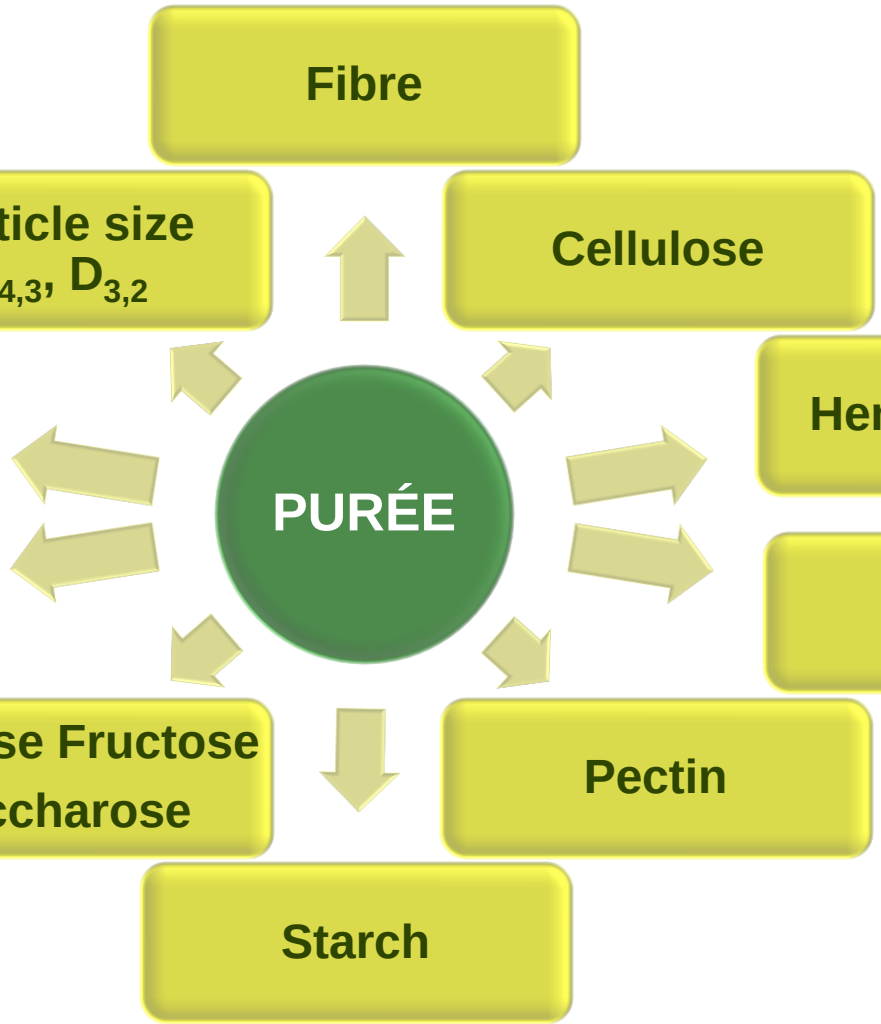
2012 - GemWraps® - the first commercial edible films incorporated with purée

Fig. 2. Potential applications of edible film incorporated with purées proposed by NewGem Foods™ company

Photograps:
http://www.newgemfoods.com

INTRODUCTION

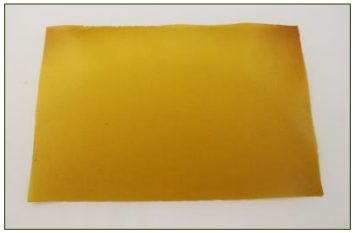
FILM-FORMING PROPERTIES OF PURÉE



Photographs:
http://chemistryafterall.es.tl
http://www.embrapa.br
http://www.nytimes.com

AIM

The aim of this research was the develop the recipe of hydrocolloid edible films incorporated with pumpkin purée as well as the analysis of sorption properties of obtained edible packaging.



HYPOTHESIS

The interactions between purée compounds and hydrocolloids added to the solution determine physicochemical properties of edible films.

Photographs:
http://offgrodniczka.blogspot.com
private collection

Material – pumpkin edible films

Pumpkin:

- variety: *Ambar*
- species: *Cucurbita maxima* Duch.

Orgin:

- The Experimental Field Station of the Department of Plant Genetics, Breeding and Biotechnology (SGGW-WULS) located in Wolica.

Photographs:
private collection

Fig. 3. Pumpkin - variety *Ambar*

Fig. 4. Pumpkin edible film

MATERIAL AND METHODS

PUMPKIN PURÉE PRODUCTION

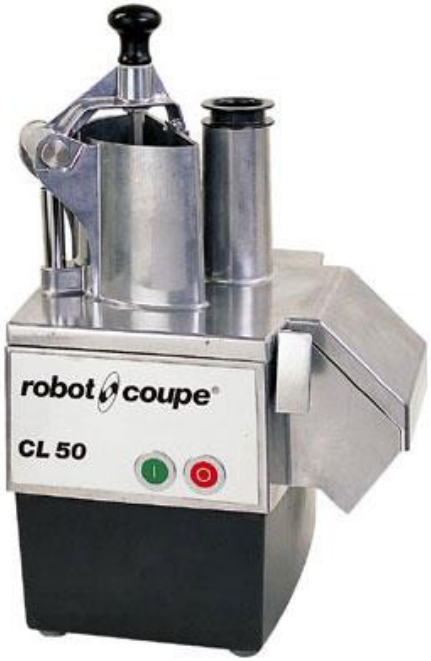
STEP I

SHREDDING → **HEATING** → **HOMOGENIZATION**

- SHREDS

STEAM
t = 10 min

t = 3 min
RPM = 1100-5650



MATERIAL AND METHODS

EDIBLE FILM PREPARATION

T = 120°C
t = 1,5 h

STEP II

p ~ 130 – 230 hPa
t ~ 1,5 – 2 h

T = 25°C
t = 72 h
RH = 50%

FILM-FORMING SOLUTION → **DEGASSING** → **POURING OUT** → **DRYING CONDITIONING**

<u>Gelling</u>
T = 80°C
t = 30 min
<u>Plastification</u>
T = 50°C
t = 20 min
<u>Pumpkin purée</u>
40% (w/v)

0,03 g DM / 1 cm^2
teflon

METHODS AND MATERIAL

RECIPIES

RECIPIES					
SYMBOL	HYDROCOLLOID % (w/v)		Calcium chloride % (w/w of hydrocolloid)	GLYCEROL % (v/w of hydrocolloid)	PUMPKIN PUREÉ % (w/v)
GEL4 GEL8 GEL12	Pork gelatin	4, 8, 12	0	50	40
SPI4 SPI8 SPI12	Soy protein isolate	4, 8, 12	0	50	40
SA1 SA1.5 SA2	Sodium alginate	1, 1.5, 2	0	50	40
HMAP1 HMAP1.5 HMAP2	High-methoxyl apple pectin	1, 1.5, 2	1	50	40
LMAP1 LMAP1.5 LMAP2	Low-methoxyl apple pectin	1, 1.5, 2	1	50	40

RESULTS

SORPTION PROPERTIES

GAB

$$u = \frac{u_m C k a_w}{(1-ka_w)[1+(C-1)ka_w]}$$

Oswin's model (1946)

$$u = h\left(\frac{a_w}{1-a_w}\right)^z$$

Lewicki's model (1998)

$$u = \frac{F}{(1-a_w)^G} - \frac{F}{1+a_w{}^H}$$

Peleg's model (1993)

$$u = Aa_w{}^B + Da_w{}^E$$

Halsey's model (1948)

$$u = \left(-\frac{A}{lna_w}\right)^{\frac{1}{B}}$$

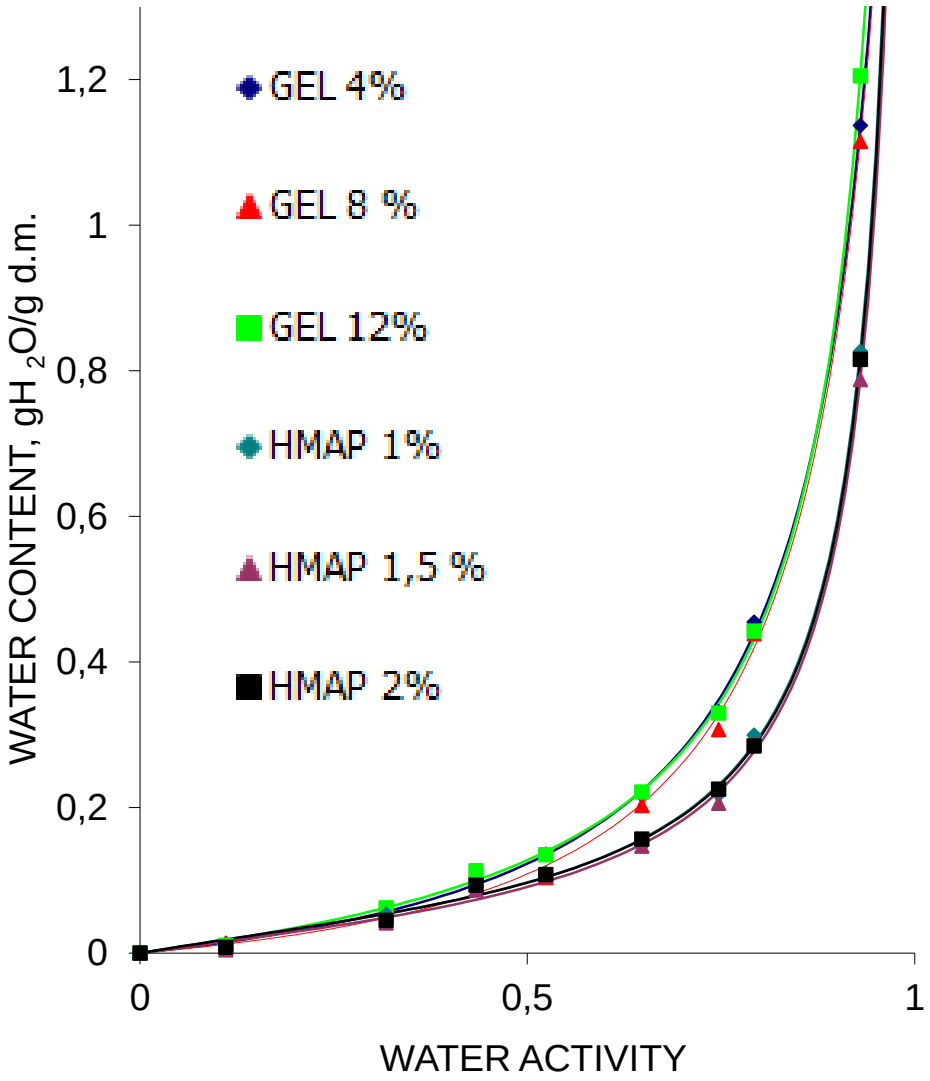
Kinetics model

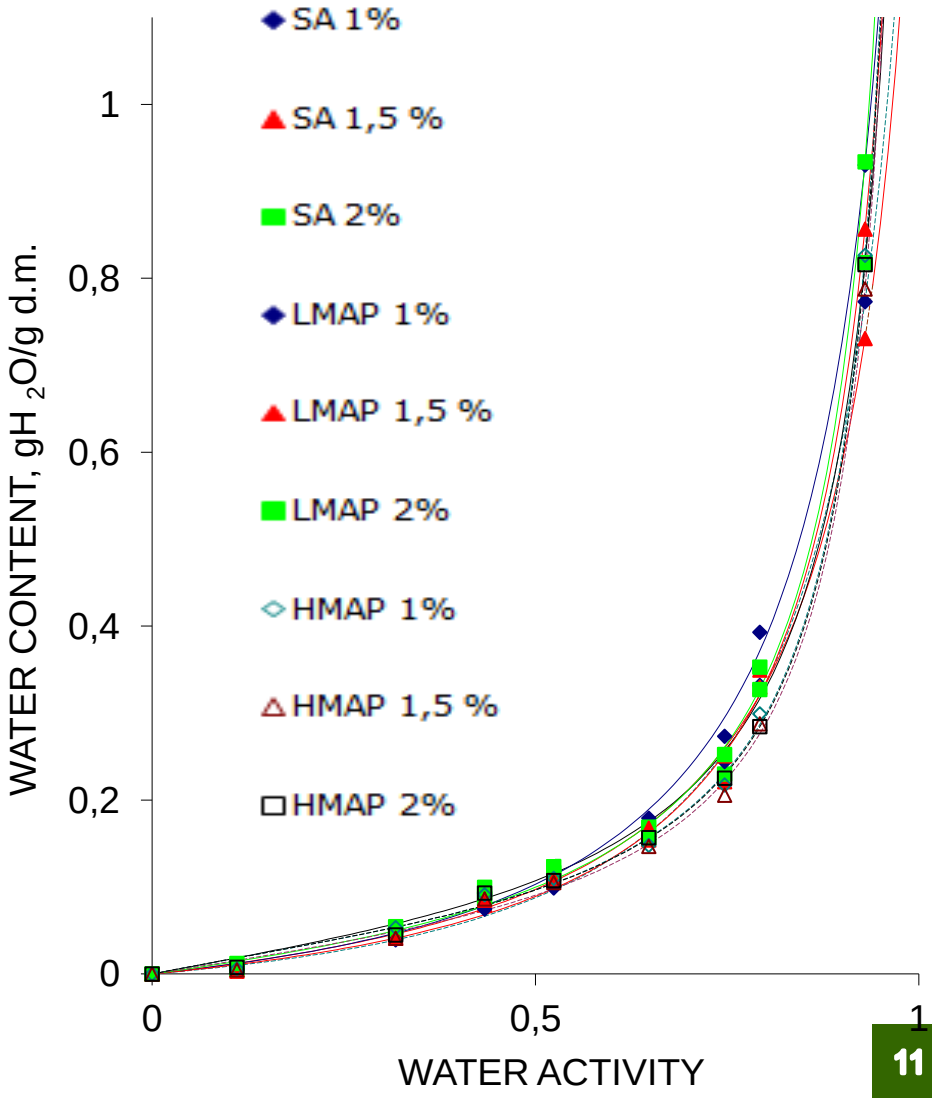
$$y = a + b\left(1 - \frac{1}{1+bcx}\right)$$

RESULTS

WATER SORPTION ISOTHERMS

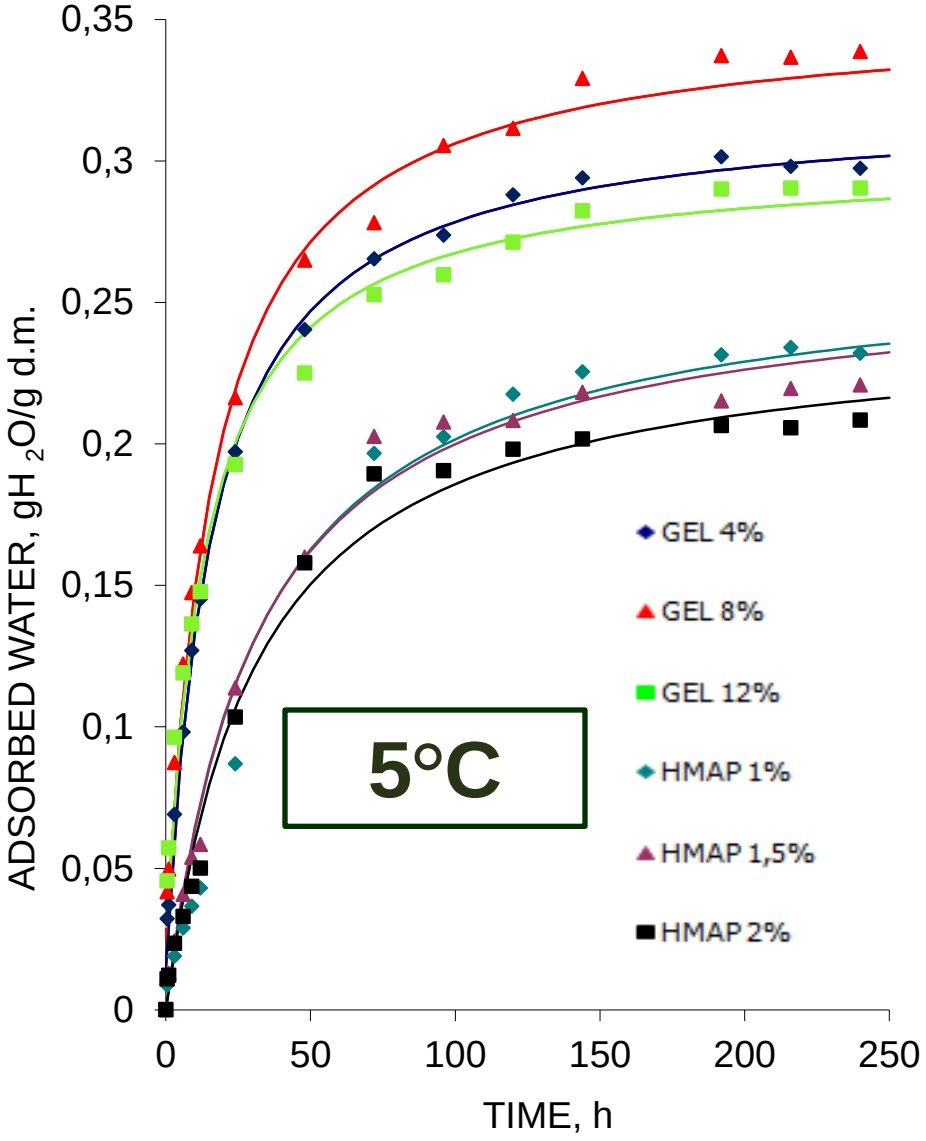
25°C

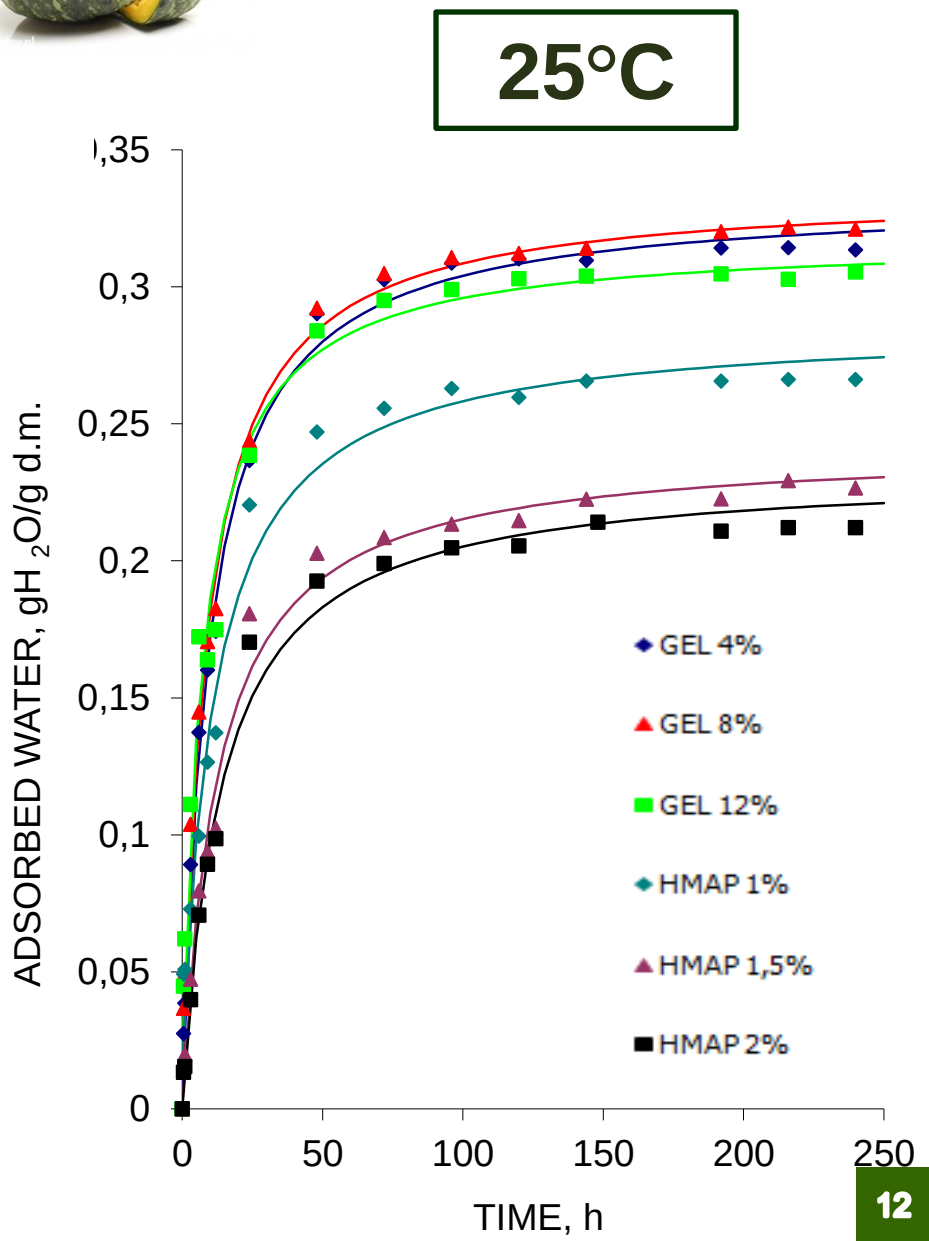




RESULTS

WATER SORPTION KINETICS





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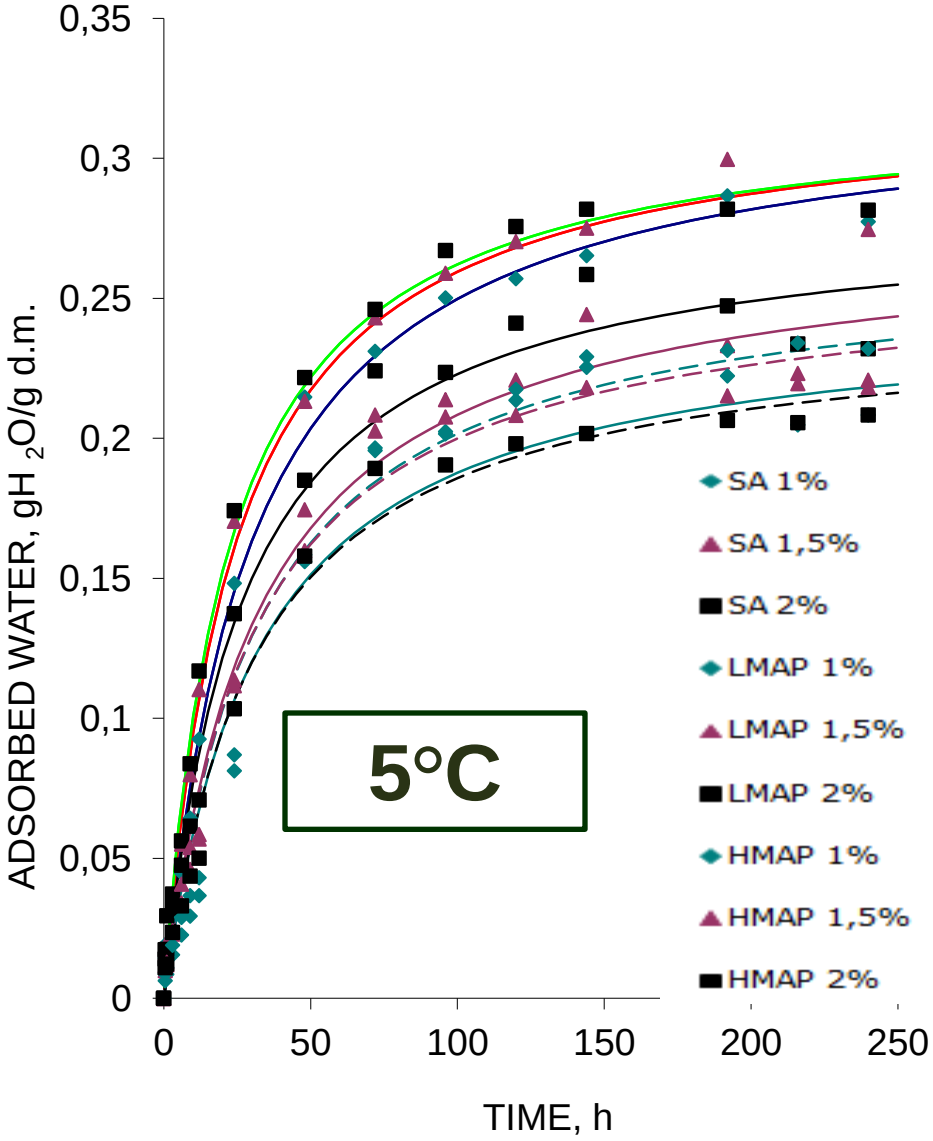

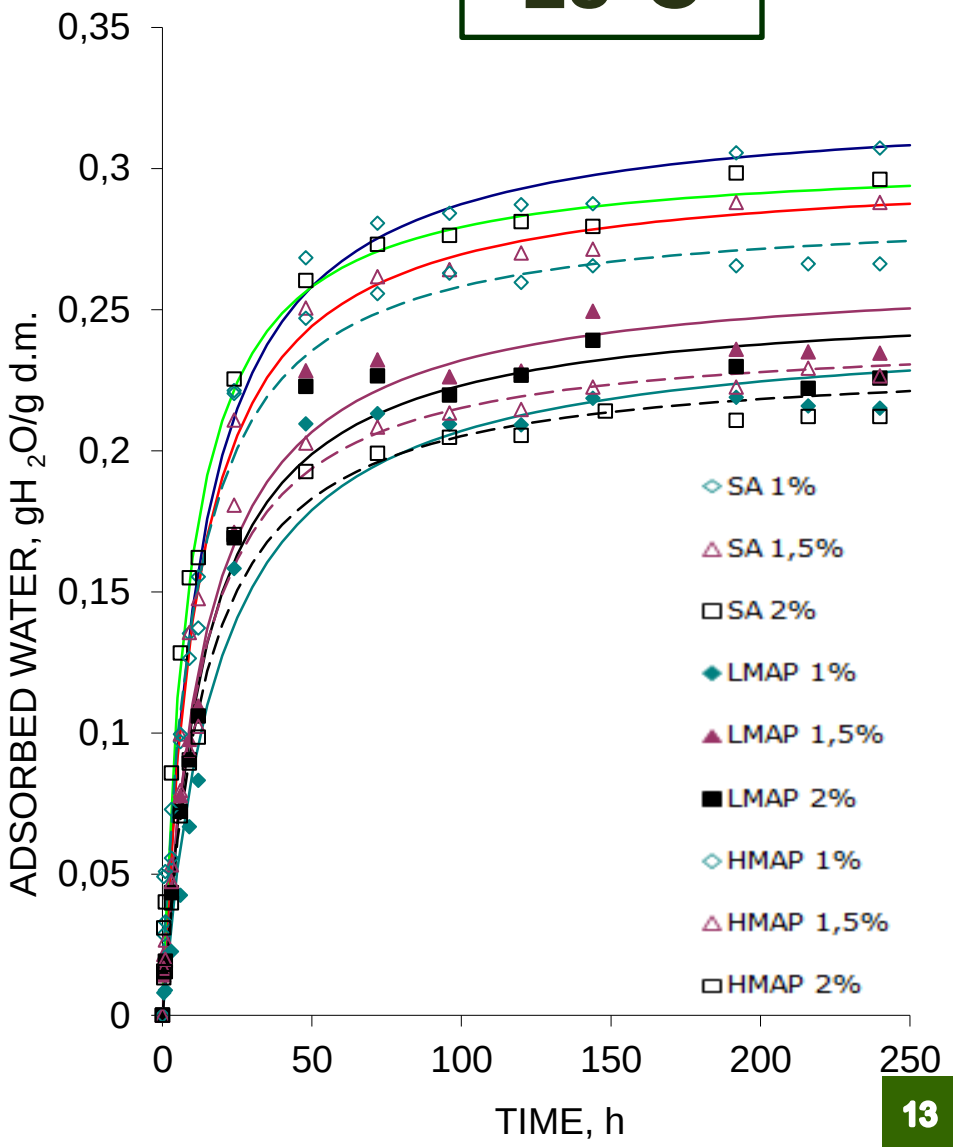

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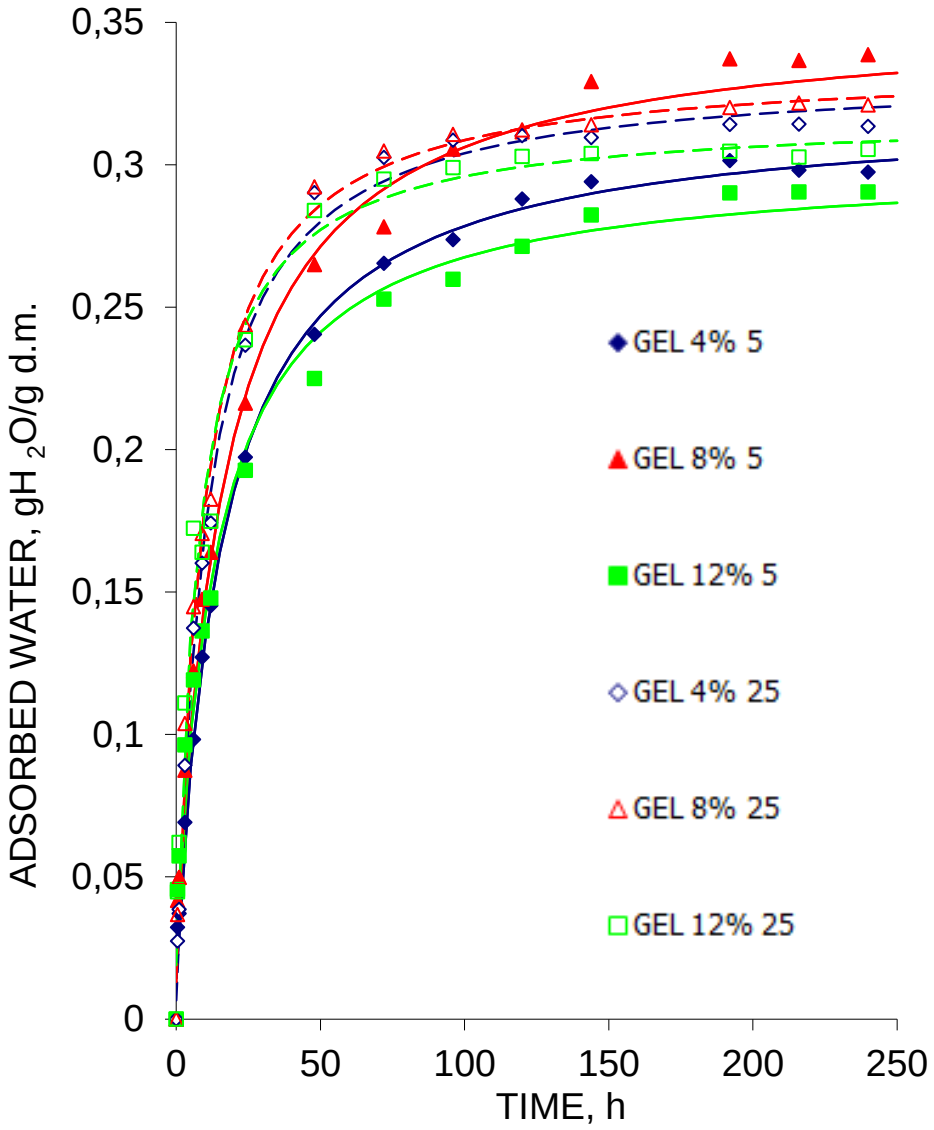

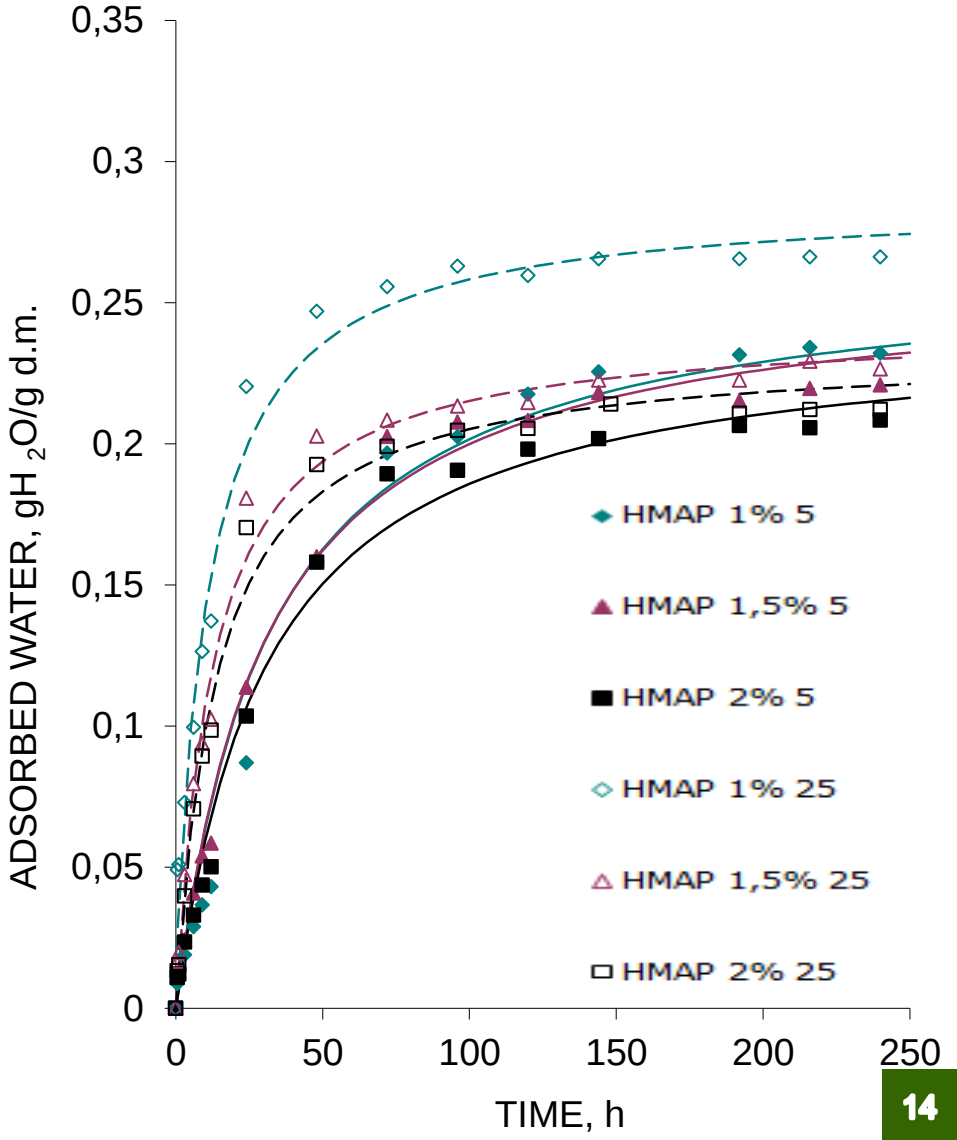

CONCLUSIONS

FUTURE OF EDIBLE FILMS

CONCLUSIONS

1. Chemical composition of pumpkin purée made from pumpkin *Cucurbita maxima,* variety *Ambar* testifies to its film-forming potential.

2. Water sorption isotherms at 25°C for both protein and polysaccharide hydrocolloids have a shape characteristic for food products rich in mono- and oligosaccharides. On this basis sorption isotherms can be included in type III isotherms.

3. The analysis of water sorption kinetics shows there is no significant influence of temperature on the amount of adsorbed water, which enables their application to products demanding different storage conditions.

THANK YOU FOR YOUR ATTENTION