Water Vapor Permeability of edible packaging based on native starch from improved cassava (*Manihot esculenta* Crantz) variety in Ivory Coast

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Introduction

A study in Ivory Coast entitled '' artisanal and industrial valorization of native cassava (*Manihot esculenta* Crantz) and yam (*Dioscorea sp*)'' starches showed that film produced with starch cassava and vegetable oil showed most promising coatings capabilities. This film was designed without plasticizer and showed mechanical limits. Thus, in this present study, starch based films have been strengthened with glycerol, soy lecithin and potassium sorbate to produce biodegradable edible packaging.

Material and Methods

Native starch used was obtained by cold water extraction from a cassava variety Olekanga belonging to the genotype collection of National Agricultural Research Center in Ivory Coast.

Table 1: Films formulations

Formulations	Starch (%)	Water (ml)	Oil (%)	Glycerol (%)	Soy lecithin (%)	Sorbate Potassium (0.2 g)
F1	4	100	5	25	0	0.2
F2	4	100	5	25	5	0.2
F3	4	100	5	30	0	0.2
F4	4	100	5	30	5	0.2

Films preparation and WVP determination

Step 1:

Cassava starch, glycerol and water mixture is heated at 30-75°C at 750 rpm / 20min

Oil, water or oil, water and soy lecithin is also heated at 30-75°C at 750 rpm / 20min

Step 2:

Oil, water or oil, water and soy lecithin mixture is homogenized at 24000 rpm / 2 min

Both mixtures were mixed together and heated at 75-95°C at 750 rpm / 25 min

Step 3: Final solution is poured into Petri dishes and dried at 35 °C / 24 hours. After drying, films are removed and stored at 25 °C and 62 % humidity / 48 hours.

Water Vapor Permeability was conducted according ASTM method E96 and the differences between means were tested at p <0.05 level using Minitab17 software.

Conclusion

- Films generally appear uniforms, homogeneous, transparent and present no cracks
- Homogenization of emulsions (oil / water) with the Ultra-Turrax had a considerable effect on the visual appearance of films (Figure b)
- For non-homogenized films (Figure a), oil droplets are observed and visible
- For Water Vapor Permeability, values varied from $2{,}13.10^{-11}$ to $2{,}8.10^{-11}$ g/Pa·s·m. This results are nevertheless lower than those obtained by **Phan The and al. (2009)** which varied from 2,75 to $2{,}94.10^{-11}$ g/Pa·s·m on emulsified films based on cassava starch
- Method applied in the preparation of various starch based films improved cassava Olekanga has produced films in which oil appeared scattered
- WVP of film didn't shows large variations with different combinations performed

Results

Films visual appearance

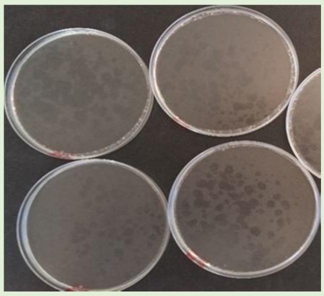


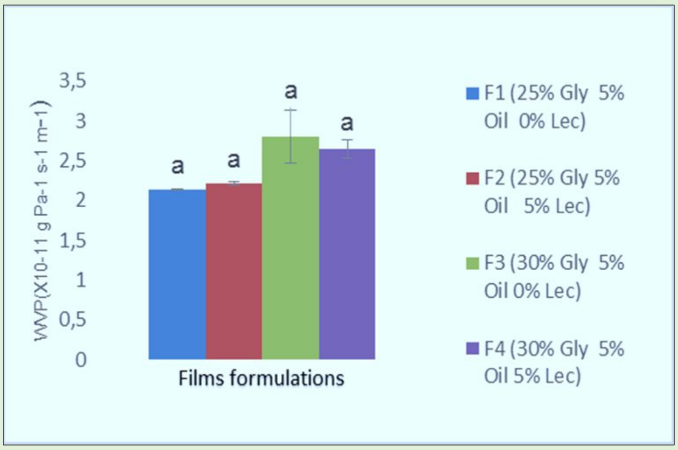
Figure a: non-homogenized films

Figure b: homogenized films

Table 2: Values of films WVP

Formulations	WVP (x 10^{-11} g Pa^{-1} s^{-1} m^{-1})	Thickness (µm)
F1	$2.13^a \pm 0.00739$	74.25 ± 4.60
F2	$2.21^a \pm 0.0198$	79 ± 0.707
F3	$2.8^a \pm 0.332$	73.65 ± 0.119
F4	$2.64^a \pm 0.116$	70.75 ± 2.47

Figure c: Water Vapor Permeability of films



References

ASTM, American society for Testing an materials: Standard ASTM E96 for Cup Method Water Vapor Permeability Testing, Annual Book of ASTM, Philadelphia, PA.

Phan The D., Debeaufort F., Voilley A and Luu D. (2009). Influence of hydrocolloid nature on the structure and functional properties of emulsified edible films. Food hydrocolloids 23, 691-699

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