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EDIBLE COATINGS FOR MINIMALLY PROCESSED AVOCADOS

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**EDIBLE COATINGS FOR MINIMALLY PROCESSED
AVOCADOS**

BY

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I declare that the dissertation herewith submitted for the MInst Agrar (Food Processing) degree at the University of Pretoria has not previously been submitted by me for degree at any other University or institution of higher education. *Ukomona*

ABSTRACT

EDIBLE COATINGS FOR MINIMALLY PROCESSED AVOCADOS

by

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The demand for minimally processed fruits (MPR) has grown due to consumers with busy lifestyles, and health and diet conscious consumers with a purchasing power. Avocado fruits are normally cultivated in nearly all tropical and subtropical countries, including South Africa. There is therefore an economical benefit for South Africa to export MPR avocados with a shelf life of more than 7 days at less than 5°C to countries with temperate climates.

MPR avocados are perishable due to physiological and biochemical changes (transpiration, respiration, effect of ethylene, cell wall degradation and enzymatic reactions) and microbial spoilage which may result in degradation of the colour, texture and flavour of the produce. One possible way of overcoming this problem and extending the shelf life of MPR avocados is using edible coatings. The primary objective of the project was to investigate the use of edible coatings to extend the shelf life of minimally processed avocados stored at 5°C.

The objective of Phase 1 was to determine the effect of selected carbohydrate, protein and lipid based edible coatings, alone, on the microbiological, physico-chemical and sensory quality of MPR avocados. Eleven commercially available

coatings from the following three categories were evaluated in terms of microbiological, physico-chemical and sensory quality: Polysaccharide based - Dextrin 10 DE, Dextrin 17 DE, Dextrin 20 DE, Protanal SF 40, Protanal SF 40 + Ca²⁺, Protanal 686 and Protanal 686 + Ca²⁺; Protein based - Emulac 50 and Casinella QN; Lipid based - Lecithin and Olive oil.

In most instances the edible coatings did not perform as expected. From a microbiological (TPC) and sensory viewpoint the use of permeable packaging with and without the selected edible coatings extended the shelf life of MPR avocados to at least 7 days at 5°C. On day 7 of storage, TPC was still below the cut off point of 10⁸ cfu/g and the sensory quality was still acceptable. The probable reasons for the control and treated samples behaving in a similar fashion could have been: non-uniform or inappropriate thickness of the coating, low storage temperature and permeability of packaging. Moreover low temperature storage and permeability of packaging material probably played a more significant role in extending shelf life of the avocados than the use of edible coatings. The control sample had better microbial quality than those with coatings, probably because coatings provided nutrients to the microbes.

The initial intention was to combine the most effective coatings from Phase 1 in Phase 2. However, due to the poor performance of the individual coatings it was **decided** to combine Dextrin 20 DE with the best performing coatings from the **three categories** of edible coatings. These were Olive oil, Protanal 686 + Ca²⁺ and Casinella QN.

In Phase 2 when considering TPC, coliforms, yeasts and mould, anaerobic sporeformers, all samples were found to be acceptable for approximately 5 days. This is less than the proposed shelf life of more than 7 days at 5°C to facilitate exporting. By day 9 of storage the perceived colour of all samples, as indicated

by the L-values of avocados, was unacceptable. It was noted that with time microbes proliferated.

The use of combined coatings packed in permeable material in Phase 2 did not extend the shelf life of MPR avocados significantly. The use of edible coatings were less effective in this phase than in Phase 1. This can be attributed to the following factors: poor and inconsistent quality of the raw material, inappropriate season of harvest (end of the spring season), rain during harvesting, probable climacteric stage of ripening with high respiration and transpiration rates and possibly non-uniform application of coatings.

It is recommended that in order to extend the shelf life of MPR avocados for export purposes (with a shelf life of more than 7 days at 5°C) using edible coatings the following factors must be taken into consideration: high and consistent quality of raw material, harvesting season (mid season) stage of ripening (post-climacteric), uniform application of edible coating and the use of anti-microbial agents (e.g. potassium sorbate) in the coatings.

UITTREKSEL

EETBARE DEKLAE VIR MINIMAAL VERWERKTE AVOKADO'S

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Die vraag na minimaal verwerkte vrugte (MVV) het toegeneem a.g.v. besige lewenstyle van verbruikers, en ook a.g.v. gesondheids-en dieetbewuste verbruikers met 'n hoë koopkrag. Avokadovrugte word normaalweg verbou in bykans alle tropiese en subtropiese lande, insluitend Suid-Africa. Daarom is dit ekonomies voordelig vir Suid-Africa om minimaal verwerkte avokado's uit te voer na lande met meer gematigde temperature. 'n Rakleef tyd van ten minste 7 dae by minder as 5 °C word benodig hiervoor.

Minimaal verwerkte avokado's is bederfbaar a.g.v. fisiologiese en biochemiese veranderings (transpirasie, respirasie, effek van etileen, afbraak van selwande en ensimatiese reaksies) en mikrobiologiese bederf wat mag lei tot afbraak in kleur, tekstuur en geur van die produkte. 'n Moontlike wyse om hierdie probleem te oorbrug en om die rakleef tyd van minimaal verwerkte avokado's te verleng, is deur gebruik te maak van eetbare deklae. Die hoofdoel van hierdie projek was om ondersoek in te stel na die gebruik van eetbare deklae om die rakleef tyd van minimaalverwerkte avokado's (wat by 5°C opgeberg word) te verleng.

Die doel van Fase 1 was om die effek van geselekteerde koolhidraat-, proteïen- en lipiedgebaseerde eetbare deklae op die mikrobiologiese, fisiologies-chemiese en sensoriese kwaliteit van minimaal verwerkte avokado's, te bepaal. Elf kommersieel beskikbare eetbare deklae van die volgende drie kategorieë is getoets in terme van mikrobiologiese, fisiologies-chemiese en sensoriese kwaliteit: Polisakkariedgebaseerd – Dekstrien 10 DE, Dekstrien 17 DE, Dekstrien 20 DE, Protonal SF 40, Protonal SF 40 + Ca²⁺, Protonal 686 and Protonal 686 + Ca²⁺, Proteïengebaseerd – Emulac 50 and Casinella QN, Lipiedgebaseerd – Lesitien en Olyfolie.

In die meeste gevalle het die eetbare deklae nie presteer soos wat verwag is nie. Vanuit 'n mikrobiologiese (Totale plaattelling) en sensoriese oogpunt, het die gebruik van deurlaatbare verpakkins met of sonder eetbare deklae die rakleef tyd van minimaal verwerkte avokado's verleng na ten minste 7 dae by 5°C. Op die sewende dag van opberging, was die totale plaattellings nog steeds minder as die afsnypunt van 10⁶ kve/g en die sensoriese kwaliteit was ook nog steeds aanvaarbaar. Die moontlike redes waarom die kontrole en behandelde monsters dieselfde presteer het kon te wyte gewees het aan die volgende: nie-uniforme of onvoldoende dikte van die deklaag, lae opbergingstemperatuur en deurlaatbaarheid van die verpakking. Verder het die lae opbergingstemperatuur en die deurlaatbaarheid van die verpakingsmaterial waarskynlik 'n meer betekenisvolle rol gespeel by die verlenging van die rakleef tyd van die avokado's as die gebruik van eetbare bedekkings. Die kontrolemonster het ook 'n beter mikrobiologiese kwaliteit gehad as sommige van die bedekte monster, moontlik a.g.v die nutriënte wat aan die mikrobies deur deklae verskaf is.

Die aanvanklike bedoeling was om die mees effektiewe deklae van Fase 1 te kombineer in Fase 2. Maar a.g.v. die swak verrigting van die individuele deklae is daar besluit om Dekstrien 20 DE te kombineer met 'n bedekking in van elk van die drie kategorieë wat die beste vertoon het. Dit was Olyfolie, Protonal 686 + Ca²⁺ en Casinella QN.

In Fase 2 met inagneming van die totale plaattellings, kolivormige organismes, giste en skimmels en anaerobiese spoorvormers, is bevind dat alle monsters aanvaarbaar was vir naasteby 5 dae. Dit is minder as die voorgestelde rakleef tyd van meer as 7 dae by 5°C vir uitvoerdoeleinders. Op die 9 de dag van opberging, was die kleur van al die monsters, soos deur die L-waardes weergegee, onaanvaarbaar. Mikrobes het vermeerder met tyd.

Avokado's wat met gekombineerde deklae verpak is in deurlaatbare verpakkingsmateriaal in Fase 2 het nie die rakleef tyd van minimaal verwerkte avokado's betekenisvol verleng nie. Die gebruik van eetbare deklae was minder effektief in hierdie fase as in Fase 1. Dit kan toegeskryf word aan die volgende faktore: swak en inkonsekwente roumateriaalkwaliteit, onvanpaste oesseisoen en (einde van die lante), reën tydens die oesproses, moontlike klimakteriese stadium van rypwording met hoë respirasie-en transpirasietempo's en die moontlike nie-uniforme aanwending van die deklae.

Dit word aanbeveel dat ten einde die rakleef tyd van minimaal verwerkte avokado's te verleng vir uitvoerdoeleindes (meer as 7 dae by 5°C) met eetbare deklae, moet die volgende faktore in berekening gehou word: hoë en konsekwente kwaliteit van roumateriaal, oesseisoen (middel van seisoen), stadium van rypwording (post-klimakteries), uniforme aanwending van die deklae en die gebruik van anti-mikrobiële middels (bv. Kaliumsorbaat) in die eetbare deklae.

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TABLE OF CONTENTS

	Pages
LIST OF TABLES	v
LIST OF FIGURES	viii
CHAPTER 1: INTRODUCTION	1
CHAPTER 2: LITERATURE REVIEW	3
2.1 Morphology and composition of avocados	3
2.2 Physiology and biochemistry of avocados	4
2.2.1 Physiology of respiration	4
2.2.2 Physiology of ethylene	5
2.2.3 Physiology of transpiration	5
2.3 Physiological stages of avocado fruit and quality of the raw material	6
2.3.1 Fruit maturity	6
2.3.1.1 Changes associated with ripening	9
2.4 Minimally processed fruits	9
2.4.1 Physiological aspects of minimally processed fruits	10
2.4.1.1 Cell wall degradation and loss of firmness	12
2.4.1.2 Enzymatic browning of avocados	13
2.4.2 Microbiological aspects	16

2.5 Use of edible coatings	17
2.5.1 Possible functional properties and advantages of edible coatings	17
2.5.2 Different types of edible coatings used and their functional properties	18
2.5.2.1 Polysaccharide based coatings	19
2.5.2.2 Lipid based coatings	22
2.5.2.3 Protein based coatings	23
2.5.2.4 Composite coatings	24
2.6 Polymeric Packaging	24
CHAPTER 3: OBJECTIVES	26
CHAPTER 4: MATERIALS AND METHODS	27
4.1 Raw material	27
4.2 Experimental design	28
4.2.1 Phase 1: Screening of potential edible coatings	29
4.2.2 Phase 2: Determination of the quality and shelf life of minimally processed avocados	36
4.2.2.1 Preparation of minimally processed avocados	37
4.3 Analysis of samples	37
4.3.1 Determination of moisture content	37

4.3.2	Determination of colour	38
4.3.3	Determination of the level of oxygen and carbon dioxide in the atmosphere surrounding the product in the pack	38
4.3.4	Determination of texture	39
4.3.5	Microbiological tests	39
4.3.5.1	Sampling and preparation of dilutions for microbiological tests	39
4.3.6	Organoleptic evaluation	41
4.4	Statistical analysis	41
CHAPTER 5: RESULTS		42
5.1	Phase 1	42
5.1.1	Determination of moisture content	42
5.1.2	Level of oxygen and carbon dioxide surrounding the avocados in the package	42
5.1.3	Determination of colour measurements	45
5.1.4	Microbiological tests	50
5.1.4.1	Determination of total plate counts	50
5.1.4.2	Determination of anaerobic sporeformers	50
5.1.5	Organoleptic evaluation	53
5.2	Phase 2	58
5.2.1	Determination of moisture content	57



5.2.2	Determination of the level of oxygen and carbon dioxide surrounding the avocados in the pack	57
5.2.3	Determination of colour measurements	60
5.2.4	Determination of texture	67
5.2.5	Microbiological analysis	74
CHAPTER 6: DISCUSSION		86
6.1	Differences between the two phases	88
6.2	Phase 1	89
6.3	Phase 2	96
CHAPTER 7: CONCLUSION AND RECOMMENDATIONS		102
CHAPTER 8: REFERENCES		104

LIST OF TABLES

Table 1	Antibrowning agents used on minimally processed avocados	16
Table 2	Three categories of 11 commercially available edible coatings that are screened during Phase 1	35
Table 3	Edible coatings used for the shelf life test on minimally processed avocados	37
Table 4	The effect of storage (at 5°C) on the moisture content of minimally processed avocados treated with different edible coatings	43
Table 5	The effect of storage (at 5°C) on the O ₂ level in the package of minimally processed avocados treated with different edible coatings	44
Table 6	The effect of storage (at 5°C) on the CO ₂ level in the package of minimally processed avocados treated with different edible coatings	46
Table 7	The effect of storage (at 5°C) on the L- values (lightness) of minimally processed avocados treated with different edible coatings	47
Table 8	The effect of storage (at 5°C) on the a-values (redness/greenness) of minimally processed avocados treated with different coatings	48
Table 9	The effect of storage (at 5°C) on the b-values (yellowness/blueness) of minimally processed avocados treated with different coatings	49
Table 10	The effect of storage (at 5°C) on total plate counts of minimally processed avocados treated with different edible coatings	51
Table 11	The effect of storage (at 5°C) on anaerobic sporeformers	52

	of minimally processed avocados treated with different coatings	
Table 12	The effect of storage (at 5°C) on the appearance of minimally processed avocados treated with different edible coatings	54
Table 13	The effect of storage (at 5°C) on the colour of minimally processed avocados treated with different edible coatings	55
Table 14	The effect of storage (at 5°C) on the taste of minimally processed avocados treated with different edible coatings	56
Table 15	The effect of storage (at 5°C) on the moisture content of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	59
Table 16	The effect of storage (at 5°C) on the oxygen levels of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	62
Table 17	The effect of storage (at 5°C) on the carbon dioxide levels of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	64
Table 18	The effect of storage (at 5°C) on the L-values of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	66
Table 19	The effect of storage (at 5°C) on the a-values of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	69
Table 20	The effect of storage (at 5°C) on the b-value of minimally	71

	processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	
Table 21	The effect of storage (at 5°C) on the texture of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	75
Table 22	The effect of storage (at 5°C) on the total plate count of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	75
Table 23	The effect of storage (at 5°C) on the coliform counts of minimally processed avocados treated with dextrin 20 De alone and in combination with other coatings, with supply as blocking factor	78
Table 24	The effect of storage (at 5°C) on the yeasts counts of minimally processed avocados treated with dextrin 20 De alone and in combination with other coatings, with supply as blocking factor	80
Table 25	The effect of storage (at 5°C) on the moulds counts of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	83
Table 26	The effect of storage (at 5°C) on the anaerobic sporeformers of minimally processed avocados treated with dextrin 20 DE alone and in combination with other coatings, with supply as blocking factor	85

LIST OF FIGURES

Figure 1	Longitudinal section through the avocado fruit	3
Figure 2	Growth and respiration pattern of fruit during development	7
Figure 3	Respiration rate during ripening of four fruits, highest peak in avocados	8
Figure 4	Diagram of an intact and a processed (cut) fruit cell	11
Figure 5	Proposed reaction mechanisms for the oxidation of dopamine by polyphenol oxidase	14
Figure 6	Inhibition of browning by use of reducing agents	14
Figure 7	How properties of maize starch hydrolysates vary with dextrose equivalency	20
Figure 8	Preparation of minimally processed avocados coated with edible coatings	29
Figure 9	Immersing of avocados in a sanitising solution	31
Figure 10	Peeling and pitting of fresh avocados	31
Figure 11	Dipping of avocados in an antioxidant-solution	32
Figure 12	Draining of avocados halves	32
Figure 13	Spraying of edible coatings on avocados	33
Figure 14	Drying of edible coating for 6 min on stainless steel trays	33
Figure 15	Sealing of the packaging tub with a layer of polypropylene	34
Figure 16	Spray bottles containing edible coatings	36
Figure 17	Illustration of where the colour measurements were taken on the avocado half (squares show exactly where the colour measurements were taken)	38
Figure 18	Illustration of where the texture measurements were taken on the avocado half	49
Figure 19	Effect of storage for 9 days at 5°C on the moisture	58

	content of minimally processed avocados treated Dextrin 20 DE alone and combination with other coatings	
Figure 20	Effect of storage for 9 days at 5°C on the oxygen level for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	61
Figure 21	Effect of storage for 9 days at 5°C on the carbon dioxide level for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	63
Figure 22	Effect of storage for 9 days at 5°C on the L-values (lightness) for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	65
Figure 23	Effect of storage for 9 days at 5°C on the a-values (red/green) for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	68
Figure 24	Effect of storage for 9 days at 5°C on the b-values (yellow/blue) for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	70
Figure 25	Effect of storage for 9 days at 5°C on the texture of minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	72
Figure 26	Effect of storage for 9 days at 5°C on the total plate count of minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	75
Figure 27	Effect of storage for 9 days at 5°C on the coliform count for minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	77
Figure 28	Effect of storage for 9 days at 5°C on the yeast count of minimally processed avocados treated with Dextrin 20	79



	DE alone and combination with other coatings	
Figure 29	Effect of storage for 9 days at 5°C on the moulds count of minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	82
Figure 30	Effect of storage for 9 days at 5°C on the anaerobic sporeformers of minimally processed avocados treated with Dextrin 20 DE alone and combination with other coatings	84
Figure 31	Factors affecting the shelf life of minimally processed avocados coated with an edible coating	87