EDIBLE COATINGS FOR MINIMALLY PROCESSED AVOCADOS

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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. Mamgola

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 5ºC 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, Protonal SF 40, Protonal SF 40 + Ca^{2+}, Protonal 686 and Protonal 686 + Ca^{2+}; 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 10^8 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, Protonal 686 + Ca^{2+} 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

Deur

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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 to voer na lande met meer gematigde temperature. 'n Rakleeftyd 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 to afbraak in kleur, tekstuur en geur van die produkte. 'n Moontlike wyse om hierdie probleem te oorbrug en om die rakleeftyd van minimaal verwerkte avokado's te verleng, is deur gabruik te maak van eetbare deklae. Die hoofdoel van hierdie projek was om ondersoek in te stel na die gebruik van eetbare deklae om die rakleeftyd 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 + Ca^{2+}, Protonal 686 and Protonal 686 + Ca^{2+}; 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 rakleeftyd 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 10^8 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 verpakkingsmaterial waarskynlik 'n meer betekenisvolle rol gespeel by die verlenging van die rakleeftyd 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 mikrobes 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 to kombineer met 'n bedekking in van elk van die drie kategorieë wat die beste vertoon het. Dit was Olyfolie, Protonal 686 + Ca^{2+} en Casinella QN.

In Fase 2 met inagneming van die totale plaattellings, kolivormige organisms, giste en skimmels en anaerobiese spoorvormers, is bevind dat alle monsters aanvaarbaar was vir naasteby 5 dae. Dit is minder as die voorgestelde rakleeftyd 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 rakleefyd 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 fakrore: 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 rakleeftyd 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 kwalitiet van roumateriaal, oesseisoen (middel van seisoen), stadium van rypwording (post-klimakteries), uniforme aanwending van die deklae en die gebruik van anti-mikrobiese middels (bv. Kaliumsorbaat) in die eetbare deklae.

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