RESEARCH REGARDING THE POSSIBILITY TO PRESERVE THE COLOUROF FRESH AROMATIC PLANTS USING COCONUT OIL

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RESEARCH ARTICLE (REVIEW ARTICLE)

Abstract

Purchasing decision of the consumers is based on many quality markers. The most used in real life is appearance, especialy the colours. The objective of the study was to observe if there is a difference in colour for: celery (Apium graveolens), dill (Anethum graveolens L.), *mint (Mentha spp.) and parsley (Petroselinum crispum) that were preserved in coconut oil (Cocos nucifera) compared to the classical preserving method – the drying technique and comparing to the fresh herb.*

To conduct the study, pictures were taken of fresh minced herbs at the beginning of the research and 72h later pictures were taken of dried minced herbs and herbs that were preserved in different dilutions with coconut oil (1:1, 1:2 and 1:3) after which they were compared to observe the difference.

The obtained results showed a better preservation of colour for the samples that were mixed with coconut oil than the dried ones, compared to the fresh sample. However, considering the sensory analysis, a significant negative change was detected in the aroma of the samples mixed with coconut oil, compared to the dried sample.

Keywords: colour preservation, chlorophyl, aromatic herbs, coconut oil
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INTRODUCTION

Chlorophyl is a natural pigment directly involved in photosynthesis, that can be found not only in leaves but in other parts of almost al plants. Specialised chloroplast cells are responsible to confine the pigment throughout the living plant. (Humphrey,1980)

As its well known, at the centre of the chlorophyll family members, a chlorin ring can be found, that anchors at its centre aromatic hydrocarbon rings with a magnesium ion. This magnesium ion can be easily displaced leading to changes in the pigment from green to brown or yellow. The two most common chlorophylls (*a* and *b*) are virtualy insoluble in water in their native form due to a long hydrocarbon chain attached to the chlorin ring.However, heating can accelerate hydrolysis, turning it highly soluble. High temperatures also rupture the vacuole membrane, accelerating the acid hydrolysis which in turn leads to brownification from inside out (Bouzari, 2024).

According to Harold, 1914, another factor that influences chlorophyll content is exposure to light which leads to the decomposition of the chlorophyll more rapidly than in a shaded environment, but as he later concluded, the photo-decomposition of chlorophyll takes place only in the presence of oxygen.

The main **objective** of this study was to observe and quantify the differences in colour using RGB colour detector and CIE-L*a*b* for samples that were directly exposed to oxygen and samples of different concentrations that were submerged in coconut oil to avoid oxygen exposure.

MATERIAL AND METHOD

1.Material

To elaborate this study, fresh celery, dill, parsley, and mint leaves, were bought from the marketplace in November 2023.

Ecologic coconut oil packaged and distributed by S.C. Pronat S.R.L., was used to obtain the 1:1,1:2 and 1:3 dilutions.

Glass jars (80ml) were used for the dilutions and plastic plates (10x10cm) were used for the samples that were left to dry.

The devices used were a food processor, a HDR camera, an RGB colour detection interface, and an RGB to CIE-L*a*b* space converter interface.

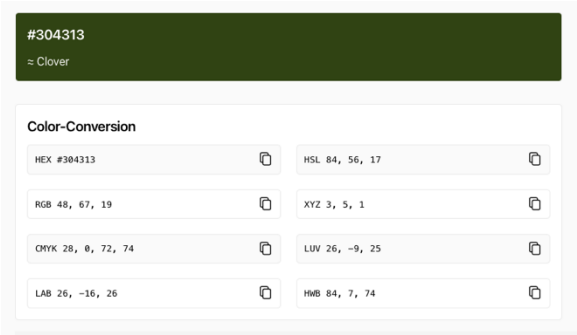

Figure 1 – RGB colour detection interface (https://imagecolorpicker.com)

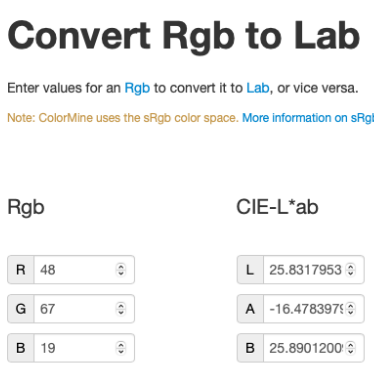

Figure 2 – RGB to CIE-L*a*b* converter interface (http://colormine.org/convert/rgb-to-lab).

The main reason for using the RGB colour and CIE-L*a*b* interface for converting RGB values in CIE-L*a*b* space, to be able to detect the colour as close as possible to reality and to be able to observe the differences in samples by comparing the results.

2.Characterisation of the fresh aromatic herbs and coconut oil

Celery (*Apium graveolens*) has been cultivated as a vegetable since antiquity. It is a vegetable containing a high level of antioxidants, vitamin C and sodium (Profir and Vizireanu, 2013). It has antimicrobial effects on pathogenic bacteria, especialy Gram-positive ones (Alshwaikh et al, 2014). Also, it is used as a flavouring agent in the food industry (Sowbhagya, 2014). Recent studies have been conducted to test if the use of celery juice or powder can replace commercial nitrate in foods such as salami or sausage to extend the shelf life (Çil, 2024)

Dill (*Anethum graveolens* L.) is a popular herb, belonging to the apiaceae family. The seeds are widely used as a spice, while the weed is used as condiment and tea(Blank and Grosch, 1991) It is used for seasoning various foods such as pickles, soups, salads, and sauces(Huopalahti and Linko, 1983) In food industry it is considered a preservative as it inhibits the growth of several bacteria like Escherichia coli, Pseudomonas, Staphylococcus and Streptococcus. Some of the compounds found in dill (Chaubey, 2007) when added to insecticides, prove to increase the effectiveness of insecticides (Jana and Shekhawat, 2010)

Mint (*Mentha spp.*) is a popular aromatic and medicinal herb that is cultivated globaly. Mint leaves are mostly consumed fresh or dried in different serving forms such as: infusions, iced drinks, salad dressings, desserts, etc. It has antioxidant and antimicrobial properties, playing a vital role in building up the immune system and enhancing appetite (Dorman et al., 2003). It is a source of polyphenols and numerous minerals, such as Na, Mg, K, Ca, Fe, Co, Zn and Se (Padmini et al., 2024; Nayak et al., 2020).

Parsley (*Petroselinum crispum*) is an impressively aromatic plant, rich in antioxidants, vitamin C and minerals like K and Ca and other vitamins, minerals, proteins, and fibber (Sarwar et al., 2016). The colour of the leaves varies from green to light yellow, reaching 1m in height depending on the type of the species. It is widely used for food flavouring in soups, stuffing, stews and rice, poultry, etc. It can be found in several industries that range from food to pharmaceutical to cosmetic products due to the phyto-chemical composition that offers it antioxidant and antimicrobial effects (Sarwar et al., 2016; Wong and Kitts, 2006).

Coconut oil is an edible oil extracted from the meat of mature coconuts, harvested from the coconut palm (*Cocos nucifera*). Because its high content in saturated fat, it is slow to oxidize, making it resistant to rancidification (Oseni et al., 2017). It lasts up to 6 months at 24 °C, without spoiling. At 27 °C, the coconut oil is liquid (Lima and Block, 2018).

Because of high content of saturated fatty acids, coconut oil is used as a component of infant milk formulas due to its easy digestibility and stable flavour (Heydinger and Nakhasi, 1996; Theuer, 2024) It is also widely used as a confectionery fat in the preparation of ice creams. It can also be a substitute for cocoa butter in chocolate (Raj et al., 2010).

3.Method

For each type of herb, 3 jars were prepared with 10g, 20g and 30g of coconut oil. To liquify the coconut oil, the jar containing it was placed for 10 minutes in a 35°C water bath. 50g from each herb were thoroughly minced using a food processor. Following this, 10g of

plant was placed in each of the three jars destined for it and the remaining 20 grams were placed on a plastic plate leaving it to air dry. The samples were stored at room temperature, away from direct sunlight. Pictures were taken at the beginning of the experiment and 72h later, after which they were compared using an RGB detection interface and an RGB to CIE-L*a*b* converter interface.

RESULTS AND DISCUSSIONS

The results obtained after comparing pictures taken of the samples, were different from herb to herb, but they al showed notable differences between the fresh sample, the dried sample and the samples that were mixed with different concentrations of coconut oil.

Table 1

Comparison between Celery samples

Celery							
Sample	RGB			CIE-L*ab			Colour
Fresh	49	75	20	28.735435145729184	-20.236916974232937	28.5245554507665	#314b14 ≈ Clover
Dried	50	61	31	24.04650148597313	-10.635971439628245	16.98722421708402	#323d1f ≈ Mallard
1:1	60	80	32	31.11949656483292	-19.019327949005433	37.99017230355992	#3c5020 ≈ Woodland
1:2	42	59	28	22.667733479603008	-13.576466034557338	16.979469073844157	#2a3b1c ≈ Mallard
1:3	48	65	35	25.352424932330514	-13.293308750949889	16.133753209351852	#304123 ≈ Green Kelp

According to the first table, a difference between Celery samples was observed. The results show a significant difference in colour between the fresh sample compared with the dried one. Al three samples that are preserved in coconut oil, have a more vibrant green colour compared to the dried sample.

Table 2

Comparison between Dill samples

Dill							
Sample	RGB			CIE-L*ab			Colour
Fresh	41	65	18	24.26384204372428	-18.087445999517282	24.55842947824592	#294112 ≈ Palm Leaf
Dried	52	58	30	23.168925737295083	-7.995610386243829	16.539832875584636	#343a1e ≈ Black Olive
1:1	67	78	30	31.19774128786907	-12.736175178913317	26.48843828872153	#434e1e ≈ Thatch Green
1:2	55	69	31	27.206453461300526	-13.030170686388566	20.98251116914318	#37451f ≈ Mallard
1:3	53	67	29	26.331841375114053	-13.052427237233017	21.05971747148273	#35431d ≈ Mallard

In the second table, the dried sample was recording a darker shade of green, having brown hues compared to the fresh sample and those mixed with coconut oil. Compared to the fresh sample, the ones mixed with coconut oil, tend to be a bit lighter.

Table 3

Comparison between Mint samples

Mint							
Sample	RGB			CIE-L*ab			Colour
Fresh	36	44	28	16.7978161431475	-7.167721717822179	9.272948130630054	#242c1c ≈ Log Cabin
Dried	71	66	53	28.095696289709046	-0.38473466217919805	8.693618228457723	#474235 ≈ Armadillo
1:1	53	62	28	24.595180245409317	-10.225638757974803	19.551159967965503	#353e1c ≈ Black Olive
1:2	48	58	30	22.82099402986944	-9.91061344737365	16.027044599238373	#303a1e ≈ Green Kelp
1:3	51	58	29	23.062536026273925	-8.620525583310028	17.010794146492934	#333a1d ≈ Black Olive

As it can be seen in table 3, mint oxidises quickly, suffering significant changes in colour. The dried sample is a shade of brown, loosing its green colour. The 3 samples mixed with coconut oil, are lighter than the fresh sample and their colour is greener and more vibrant compared to the dried sample.

Table 4

Comparison between Parsley samples

Parsley							
Sample	RGB			CIE-L*ab			Colour
Fresh	36	67	0	24.919058788268508	-23.162738919134146	32.90705793900063	#244300 ≈ Verdun Green
Dried	28	43	2	15.376720429445509	-14.045077328308246	21.246862473972172	#1c2b02 ≈ Pine Tree
1:1	54	72	20	28.032569492103356	-16.387259405626825	27.882462213487035	#364814 ≈ Clover
1:2	49	66	17	25.53281727469269	-15.641850670598728	26.59344784541514	#314211 ≈ Clover
1:3	48	67	19	25.831795314711606	-16.478397999150296	25.890120095866177	#304313 ≈ Clover

According to table four, parsley is the best-preserved herb, keeping its vibrant colour. The dried sample is a darker shade of green compared to the fresh sample, as well as the samples mixed with coconut oil. The samples mixed with coconut oil are a lighter green compared to the fresh sample, with a slight yellow hue.

CONCLUSIONS

There are few conclusions drawn after the study.

1. The dried sample for each herb is visibly more oxidized than the 1:1, 1:2 and 1:3 samples that preserved the colour better.

2. The 1:1 sample is lighter in colour than the 1:2 and 1:3 sample, for al the herbs, raising questions open to research as „why a more concentrated sample is lighter in colour compared to the ones that are more diluted and darker?"

3. Though the colour was better preserved in the samples mixed with coconut oil, there were significant changes in the odour, so a stabilizing option is considered such as dark recipients, more appropriate preserving temperatures, , etc., as well as precursory treatments: blanching lyophilization, HPP, etc., that would lower water activity and potential microflora development.

4. The best-preserved sample from an olfactive point of view was the dried one, but at the same time, it was the one that changed its colour the most.

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