Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2021 18(2): 1493-1497. **OPEN ACCESS**

Effectiveness of Frangipani (*Plumeria alba*) essential oil on Microbial, Chemical and Sensory characteristics of dried Nomei (*Harpadon nehereus*)

Nguyen Phuoc Minh

Binh Duong University, **Vietnam**

***Correspondence:** npminh@bdu.edu.vn **Received 22-02-2021, Revised: 08-05-2021, Accepted: 11-05-2021 e-Published: 12-05-2021**

Nomei (*Harpadon nehereus*) is an important fish in Vietnamese fishery economy. This fish is commonly processed into dried form for long stability. However, it's also sensitive to rancidity and off-flavor due to endogenous enzyme and spoilage bacteria. Frangipani essential oil has a very distinctive scent as an air freshener aromatherapy and other applications. This research focused on the influence of Frangipani essential oil (0.1-0.5%) incorporated to the dried nomei during 10 weeks of storage. Results showed that incorporatio of 0.4% Frangipani essential oil into dried nomei could improve quality during 10 weeks of storage by controlling spoilage bacterial (4.0-5.3 cfu/g), peroxide formation (0.21-0.30 mEq/kg) and total volatile based-nitrogen or TVB-N (4.90-5.30 mgN/100g) accumulation. Overall acceptance of the dried nomei treated by 0.4% Frangipani essential oil was 7.92-8.24. This Frangipani essential oil is extremly effective in the preservation of the dried nomei within 10 weeks.

Keywords: Essential oil, frangipani, nomei, peroxide, spoilage bacterial, TVB-N

INTRODUCTION

Nomei (*Harpadon nehereus)* belongs to the family of *Synodontidae* from class *Actinoptergyii* (Muhammad et al. 2017). It's estuarine fish widely caught in coastal and and estuary region of Vietnam. It plays an important role in fishery economy. It's commonly caught by trawl fishing gear. This fish is normally preserved in dried form for long shelf life. However, its quality is highly degradable by rancidity and amino acid decomposition due to endogenous enzyme and spoilage bacteria. Frangipani (*Plumeria alba*) is in the family of *Apocynaceae*. This large evergreen shrub has narrow elongated leaves, large and strongly perfumed white flowers with a yellow center (Nagaraj et al. 2012). Essential oil of Frangipani flowers was normally received from hydrodistillation (Zahid et al. 2010). The proximate composition of frangipani essential oils included alcohols, terpenes, ketones, esters, and acid (Ni et al. 2014). Frangipani essential oil had excellent antimicrobial activity against Bacillus anthracis, Pseudomonas aeruginosa (Nargis et al. 1993). It's highly evaluated as a potential antibacterial agent against several anti biotic resistant strains (Kordali et al. 2005). Frangipani essential oil is utilized for various purposes like cosmetic, aromatherapy, food preservative. It's beneficial to treat ulcer, herp, scaby, cancer, diabete, hypertension, renal disease, inflammation, infectious and skin disease (Nagaraj et al. 2012). Objective of our study is to examine the influence of incorporated Frangipani essential oil to the quality of dried nomei during storage.

MATERIALS AND METHODS

2.1 Material

Nomei fishes were collected from Vinh Chau district, Soc Trang province. They should be processed as soon as possible. They were dried under sun light. Frangipani essential oil was originated from Sri Lanka. Chemical reagents were all analytical grade.

2.2 Researching method

Nomei fish was soaked with 0.1-0.5% Frangipani essential oil before drying under sunlight for 16 hours to the final moisture content 18±0.5%. The dried fish was kept in PA bag at ambient temperature for 10 weeks. In 2 week-interval, the sample was taken to evaluate microbial load, peroxide content, TVB-N value and overall acceptance. Total plate count (log cfu/g) was numerated by 3M-Petrifilm. The peroxide value (PV, mEq/kg) was measured by method of Rahman et al. (2015). Total Volatile Based-Nitrogen (TVB-N, mgN/100g) was estimated following AOAC (1990). Sensory score was evaluated by a group of panelists using 9-point Hedonic scale.

2.3 Statistical analysis

The experiments were run in triplicate with different groups of samples. The data were presented as mean±standard deviation. Statistical analysis was performed by the Statgraphics Centurion version XVI.

RESULTS AND DISCUSSION

Total plate count (log cfu/g) of the dried nomei during 10 weeks of storage was presented in table 1. the initial total plate count of the dried nomei in this research was 3.5-5.7 log cfu/g. The dried nomei treated with 0.4% or 0.5% Frangipani essential oil revealed the stability extended to 8 or 10 weeks (total plate count < 5.0 log cfu/g). It could be due to the antimicrobial activity of Frangipani essential oil. Dried nomei treated with 0.4% or 0.5% Frangipani essential oil showed a perfect influence by retarding the microbial load in the acceptable limit of food safety. Generally, 0.4% Frangipani essential oil was appropriate to prolong the microorganism stability of dried nomei. Frangipani essential oil was demonstrated with an excellent antibacterial activity even at low concentration (Zahid et al. 2010). It's more active against Gram-positive (*S. aureus* and *B. subtilis*) than against Gram-negative bacteria (Zahid et al. 2010). Outer membrane of Gram-negative bacteria, surrounding the cell wall, which limits diffusion of hydrophobic components through its lipopolysaccharide covering (Ratledge and Wilkinson, 1988). Meanwhile, Gram-positive bacteria without this barrier facilitates the direct exposure of the essential oil's hydrophobic components with the phospholipids bilayer of the cell membrane, leading either an increase of ion permeability and leakage of vital intracellular constituents, or impairment of the bacterial enzyme systems (Wendakoon and Sakaguchi, 1995; Cowan, 1999).

Peroxide value of the dried nomei treated by Frangipani essential oil was presented in table 2. Peroxide accumlation revealed the signal of oxidative rancidity. The dried nomei treated by Frangipani essential oil had the peroxide value in range of 0.19-0.73 mEq/kg within acceptable limit of food safety (10 mEq/kg). Peroxide occurred as a result of lipid decomposition (Waindu and Jamala, 2013; Rathod et al. 2018). Drying raw nomei fish under sunlight for a long time also facilitated the lipid oxidation. Our result was parallel with finding by Domiszewski et al. (2011). Fluctuation of peroxide value was depended on fish proximate (Sarnes et al. 2020).

TVB-N value was as an important parameter reflecting for wholesomeness of dried fish. Proteolytic enzyme originated from spoilage bacteria could metabolized the amino acids into volatile elements inducing bad smell (Tokur et al., 2006). TVB-N value of the dried nomei treated by Frangipani essential oil was presented in table 3. With 0.1% Frangipani essential oil, the highest TVB-N value (6.4-10.54 mgN/100g) on the dried nomeil was clearly noticed. Meanwhile, with 0.4 or 0.5% Frangipani essential oil, the lowest TVB-N value (4.90-5.30 mgN/100g or 4.73-5.14 mgN/100g). There was insignificant difference of TVB-N value in the dried nomei treated by 0.4 % and 0.5% Frangipani essential oil. Generally, TVB-N value of the dried nomei during 10 weeks of strage was within the acceptable limit (35 mgN/100g) according to regulation of Commission of the European Communities (1995).

The overall acceptance of the dried nomei treated by Frangipani essential oil was reported in table 4. With 0.3% or 0.4% Frangipani essential oil, the dried nomei had the highest sensory score within 10 weeks of storage. Meanwhile, 0.1% Frangipani essential oil induced the lowest sensory score of the dried nomei. Spoilage microorganism was responsible for decomposition of flavor, aroma, texture (Jouki et al. 2014). Frangipani essential oil minimized endogenous

enzyme and spoilage bacteria (Cai et al. 2015)

Table 1: Frangipani essential oil to total plate count (log cfu/g) of dried Nomei during storage (week)

Storage (week)	0	2	4	6	8	10
0.1% Frangipani essential oil	5.7±0.0^{a}	6.4±0.3^{a}	7.1±0.2^{a}	7.9±0.1^{a}	8.6±0.0^{a}	9.4±0.3^{a}
0.2% Frangipani essential oil	5.1±0.2^{ab}	5.4±0.0^{ab}	5.9±0.1^{ab}	6.5±0.3^{ab}	7.0±0.2^{ab}	7.6±0.1^{ab}
0.3% Frangipani essential oil	4.6±0.1^{b}	4.9±0.3^{b}	5.1±0.2^{b}	5.4±0.0^{b}	5.8±0.1^{b}	6.2±0.2^{b}
0.4% Frangipani essential oil	4.0±0.3^{bc}	4.2±0.0^{bc}	4.5±0.1^{bc}	4.8±0.2^{bc}	5.0±0.0^{bc}	5.3±0.1^{bc}
0.5% Frangipani essential oil	3.5±0.2^{c}	3.6±0.1^{c}	3.9±0.0^{c}	4.1±0.3^{c}	4.4±0.1^{c}	4.5±0.2^{c}

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant (α = 5%)

Table 2: Frangipani essential oil to peroxide value (mEq/kg) of dried nomei during storage (week)

Storage (week)	0	2	4	6	8	10
0.1% Frangipani essential oil	0.31±0.02^{a}	0.39±0.01^{a}	0.48±0.03^{a}	0.57±0.00^{a}	0.66±0.02^{a}	0.73±0.01^{a}
0.2% Frangipani essential oil	0.29±0.03^{ab}	0.33±0.02^{ab}	0.39±0.00^{ab}	0.43±0.02^{b}	0.47±0.01^{b}	0.50±0.02^{b}
0.3% Frangipani essential oil	0.26±0.00^{b}	0.27±0.01^{b}	0.30±0.01^{b}	0.32±0.00^{bc}	0.34±0.03^{c}	0.35±0.00^{c}
0.4% Frangipani essential oil	0.21±0.02^{bc}	0.22±0.03^{bc}	0.24±0.00^{c}	0.27±0.03^{c}	0.29±0.02^{cd}	0.30±0.03^{cd}
0.5% Frangipani essential oil	0.19±0.03^{c}	0.20±0.02^{c}	0.23±0.03^{c}	0.25±0.01^{c}	0.26±0.00^{d}	0.27±0.01^{d}

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant (α = 5%).

Table 3: Frangipani essential oil to Total Volatile Based-Nitrogen (TVB-N, mgN/100g) of dried nomei during storage (week)

Storage (week)	0	2	4	6	8	10
0.1% Frangipani essential oil	6.40±0.00^{a}	7.21±0.02^{a}	8.07±0.01^{a}	8.92±0.03^{a}	9.71±0.00^{a}	10.54±0.02^{a}
0.2% Frangipani essential oil	5.79±0.02^{ab}	5.90±0.01^{ab}	5.97±0.03^{ab}	6.23±0.00^{b}	6.56±0.02^{b}	6.80±0.01^{b}
0.3% Frangipani essential oil	5.14±0.01^{b}	5.21±0.03^{b}	5.29±0.00^{b}	5.44±0.01^{bc}	5.57±0.03^{c}	5.63±0.02^{c}
0.4% Frangipani essential oil	4.90±0.03^{bc}	5.01±0.00^{bc}	5.12±0.02^{c}	5.19±0.00^{c}	5.25±0.01^{cd}	5.30±0.00^{cd}
0.5% Frangipani essential oil	4.73±0.02^{c}	4.82±0.01^{c}	4.90±0.01^{c}	4.98±0.02^{c}	5.09±0.03^{d}	5.14±0.02^{d}

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant (α = 5%).

Table 4: Frangipani essential oil to sensory score of dried nomei during storage (week)

Storage (week)	0	2	4	6	8	10
0.1% Frangipani essential oil	7.45±0.03^{c}	7.30±0.00^{c}	7.21±0.02^{c}	7.15±0.01^{c}	7.08±0.03^{c}	7.00±0.02^{c}
0.2% Frangipani essential oil	7.91±0.00^{bc}	7.87±0.02^{bc}	7.78±0.01^{bc}	7.70±0.02^{bc}	7.64±0.01^{bc}	7.59±0.03^{bc}
0.3% Frangipani essential oil	8.65±0.02^{a}	8.62±0.01^{a}	8.57±0.03^{a}	8.50±0.00^{a}	8.43±0.01^{a}	8.40±0.00^{a}
0.4% Frangipani essential oil	8.24±0.01^{ab}	8.19±0.03^{ab}	8.10±0.00^{ab}	8.03±0.03^{ab}	7.98±0.02^{ab}	7.92±0.03^{ab}
0.5% Frangipani essential oil	8.03±0.03^{b}	7.99±0.02^{b}	7.93±0.03^{b}	7.88±0.01^{b}	7.83±0.00^{b}	7.78±0.01^{b}

Note: the values were expressed as the mean of twenty two samples; the same characters (denoted above), the difference between them was not significant (α = 5%

CONCLUSION

Nomei is one of most important fish having high economic value in Vietnam. Frangipani essential oil is utilized for different applications. Supplementation of 0.4% Frangipani essential oil enhanced quality of dried nomei during 10 weeks of storage. This essential oil retarded microbial reaction, peroxide and TVB-N accumulation. Frangipani essential oil showed an excellent preservative role in extending the stability of the dried nomei in the acceptable mode.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

We acknowledge the financial support for the publication provided by Binh Duong University, Vietnam.

AUTHOR CONTRIBUTIONS

Nguyen Phuoc Minh arranged the experiments and also wrote the manuscript.

REFERENCES

Cai L, Cao A, Li Y, Song Z, Leng L, Li J. The effects of essential oil treatment on the biogenic amines inhibition and quality preservation of red drum (*Sciaenops ocellatus*) fillets. *Food Control* 2015; 56: 1-8.

Cowan M. Plant products as antimicrobial age nts. *Clin Microbiol Rev* 1999; 12: 564–582.

Domiszewski Z, Bienkiewicz G, Plust D. Effects of different heat treatments on lipid quality of striped catfish (*Pangasius hypophthalmus*). *Acta Scientiarum Polonorum Technologia Alimentaria* 2011; 10: 359-373.

Jouki M, Yazdi, FT, Mortazavi SA, Koocheki A, Khazaei N. Effect of quince seed mucilage edible films incorporated with oregano or thyme essential oil on shelf life extension of refrigerated rainbow trout fillets. *International Journal of Food Microbiology* 2014; 174: 88-97.

Kordali S, Kotan R, Mavi A, Cakir A, Ala A, Yildirim A. Determination of the chemical composition and antioxidant activity of the essential oil of *Artemisia dracunculus* and of the antifungal and antib acterial activities of turkis *Artemisia absinthium, A. dracunculus, Artemisia santonicum*, and *Artemisia spicigera* essential oils. *J Agric Food Che m* 2005; 53: 9452-9458.

Muhammad F, Soemarno, Gatut B, Tri DL. Growth and age structure of nomei (*Harpadon nehereus*, Ham. 1822) in Juata Laut Waters of Tarakan Island, North Borneo, Indonesian. *International Journal of Sciences: Basic and Applied Research* 2017; 31: 208-218.

Nagaraj B, Barasa M, Divya TK, Krishnamurthy NB, Liny P, Dinesh R. Environmental benign synthesis of gold nanoparticles from the flower extracts of *Plumeria alba* Linn. (*Frangipani*) and evaluation of their biological activities. *International Journal of Drug Development and Research* 2012; 4: 144-150.

Nargis A, Abdul M, Saminanoor A. A New antibacterial triterpenoid from *Plumeria* alba. *Fitoterapia* 1993; 2: 162-166.

Ni MW, Ganda PGP, Ina PT. Chemical composition of essential oil of cendana frangipani flower (*Plumeria alba*) with re-extraction using ethanol solvents. *Agroindustrial Journal* 2014; 3: 158-162.

Rathod N, Pagarkar A, Pujari K, Shingare P, Satam S, Phadke G, Gaikwad B. Status of valuable components from Pangasius: A Review. *International Journal of Current Microbiology and Applied Sciences* 2018; 7: 2106-2120.

Ratledge C, Wilkinson SG. An overview of micro bial lipids. In: Ratledge C, Wilkinson SG. (Eds.), Microbial Lipids, Academic Press, London 1988; 1: 3–22.

Sarnes R, Ngoc TTA, Binh LN. Effect of lemongrass and mint essential oils combined with food additives soaking solution on the quality of *Pangasius* fillets during cold storage. *Food Research* 2020; 4 (Suppl. 6) : 138 – 145.

Tokur B, Ozkütük S, Atici E, Ozyurt G, Ozyurt CE.

Chemical and sensory quality changes of fish fingers, made from mirror carp (*Cyprinus carpio* L., 1758), during frozen storage (−18°C). *Food Chemistry* 2006; 99: 335-341.

Waindu C and Jamala G. A Study of Rancidity of Fish Sold In Mubi Markets, Adamawa State, Nigeria. *IOSR Journal of Agriculture and Veterinary Science* 2013; 6: 47-50.

Wendakoon CN, Sakaguchi M. Inhibition of a mino acid decaboxylase activity of *Entero bacter aerogenes* by active components of spices. *J Food Prot* 1995; 58: 280–283.

Zahid Z, Khan SW, Patel KA, Konale AG, Lokre SS. Antimicrobial activity of essential oil of flowers of plumeria alba linn (Apocynaceae). *International Journal of Pharmacy and Pharmaceutical Sciences* 2010; 2: 155-157.