



---

## **The Effect of Spearmint Oil on the Microbiological Properties of Rainbow Trout (*Oncorhynchus mykiss*) Fillets under Refrigerator Conditions**

**Nermin KARATON KUZGUN**

Munzur University, Faculty of Fisheries, Tunceli, Turkey

[nerminkaraton@hotmail.com](mailto:nerminkaraton@hotmail.com),

ORCID ID: 0000-0002-9430-1802

**Abstract** In this study, it was examined the microbiological properties to *Oncorhynchus mykiss* fillets of spearmint essential oils during storage  $4 \pm 1^\circ\text{C}$ . So as to create all samples was applied 1% spearmint oil to fillets of rainbow trout. During the storage at  $4 \pm 1^\circ\text{C}$  of fillets in the study were made every three days microbiological analyzes (Total Aerobe Bacteria, Psychrophilic Aerobe Bacteria, Yeast-mold). As a result of the microbiological analysis ended the storage period on the 6th day of fresh fish fillets, on the 12th day of the fillets treated with 1% spearmint oil. As a result, it has been observed that the application of spearmint essential oil has a positive effect on the microbiological properties of rainbow trout under refrigerator conditions.

**Keywords** Spearmint, Essential oil, *Oncorhynchus mykiss*, Microbiological properties, Refrigerator conditions

---

### **1. Introduction**

Natural agents can also control of the spoilage of fish, however the usage of artificial preservatives in food disturbs consumers [1]. The use of additives in perishable food before cold storage could minimize microorganism growth during storage. However, since there are limits for additive use, their presence in food products should be limited. Furthermore, it is known that most consumers refrain from consuming food that contains chemical additives, albeit in safe levels [2-4]. Today, the employment of herbal additives has been increasing due economic, nutritional and safety reasons [5].

Spearmint is a creeper, hairless and perennial plant in Lamiaceae family [6-7]. Carvone, eucalyptol, limonene are the main compounds in spearmint essential oil [8-10]. Spearmint essential oil has antibacterial, insecticidal and antifungal properties [11-12]. Spearmint essential oil is widely used in food, pharmaceutical, cosmetic and perfume industries [11, 13].

The present study aimed to report the effect of spearmint essential oil on the microbiological properties of *Oncorhynchus mykiss* fillets at  $4 \pm 2^\circ\text{C}$  during storage.

### **2. Experimental**

Trout samples were procured from a fish farm located in Keban Dam Lake and immediately transported to Firat University Bioengineering Laboratory on ice. Fish were washed and filleted. Then, the samples were randomly divided into three groups: the control group (Group A) without essential oil application, the samples were treated with 1% essential oil (Group B). All analyzes were conducted in triplicate on days 0, 3, 6, 9, 12, 15 and 18.



## 2.1. Microbiological assessment

The samples were analyzed Total Aerobic Bacteria (TAB), Psychrophilic bacteria (PB), and yeast and mold from each of different groups. Fish muscle (10 g) was mixed with 90 ml of sterile Ringer's solution (one-quarter strength) and then stomached for 3 min. Moreover decimal dilutions were made, and then 0.1 ml of each dilution was pipetted onto the surface of plate count agar (LAB149, 125801/093) plates for determination of TAB and PB, incubated at  $30 \pm 1^\circ\text{C}$  for 3 days and at  $5 \pm 1^\circ\text{C}$  for 7 days. Potato Dextrose Agar medium (PDA – LABM098, 123328/229) was used to count the number of yeast and fungi colonies after the cultivated plaques were incubated at  $25 \pm 1^\circ\text{C}$  for 4-5 days [14].

## 3. Result and Discussion

The present study investigated the effects of spearmint essential oil (1%) on the microbiological qualities of rainbow trout in  $2 \pm 2^\circ\text{C}$  storage.

### 3.1. Total Aerobe Bacteria

The TAB properties determined during the storage of the experimental trout fillets are presented in Figure 1. It was determined that the TAB counts of the samples without essential oil was  $2.33 \pm 0.15 \log \text{CFU g}^{-1}$  on the first day of storage and  $5.19 \pm 0.45 \log \text{CFU g}^{-1}$  on the last day of storage (6<sup>th</sup> day). The TAB count of the samples with 1% peppermint essential oil treatment was  $2.47 \pm 0.08 \log \text{CFU g}^{-1}$  on day 0, and the count risen to  $5.63 \pm 0.19 \log \text{CFU g}^{-1}$  at the end of the storage. In a study conducted by Karaton Kuzgun, [15], a risen was observed in the TMA count of fillets covered with chitosan coating film that included thyme, clove, rosemary essential oils. This finding was consistent with the present study results.

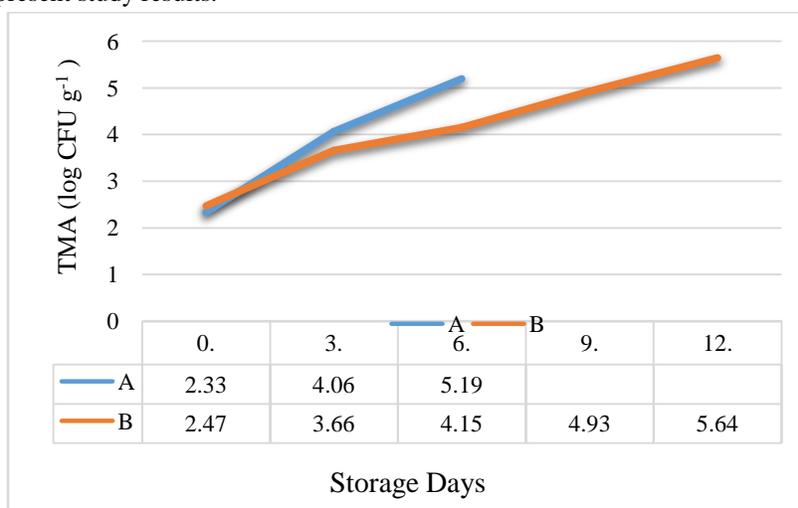


Figure 1: The changes in the TAB count of spearmint essential oil treated trout fillets

### 2.2. Psychrophilic bacteria

The PB counts determined during the storage of *Oncorhynchus mykiss* fillet samples treated with spearmint essential oil are presented in Figure 2. The PB counts of the fillet employed in the study were determined between  $2.51 \pm 0.03$ - $5.76 \pm 0.23 \log \text{CFU g}^{-1}$ . The control group PB counts was determined as  $2.58 \pm 0.03 \log \text{CFU g}^{-1}$  at the beginning of the storage, and at the end of the storage (6<sup>th</sup> day), the count reached as  $5.24 \pm 0.58 \log \text{CFU g}^{-1}$ . In the 1% spearmint essential oil group, it was determined that the PB counts was  $2.52 \pm 0.03 \log \text{CFU g}^{-1}$  on day 0 of storage, and it was  $5.57 \pm 0.23 \log \text{CFU g}^{-1}$  on the 12<sup>th</sup> day, the last day of storage. In previous studies, PB counts reported for fillets treated with cinnamon essential oil [16] and other herbal essential oils, such as black cumin [17] were similar to the present study findings.



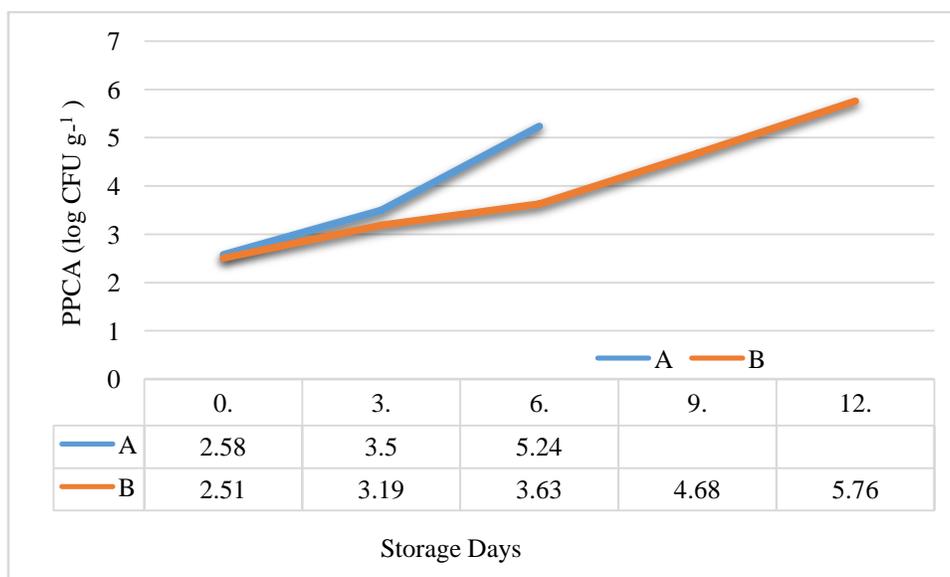


Figure 2: The changes in the PB counts of spearmint essential oil treated trout fillets

### 2.3. Yeast-Mold

The Yeast-Mold counts determined during the storage of the experimental trout fillet samples are presented in Figure 3. The Yeast-Mold counts of the control group fillets was  $2.57 \pm 0.04 \log \text{CFU g}^{-1}$  on day 0<sup>th</sup>, the Yeast-Mold counts exhibited a steady increase during storage to  $5.01 \pm 0.44 \log \text{CFU g}^{-1}$  on day 6<sup>th</sup>. In the samples treated with 1% spearmint essential oil, the lowest flavor score was determined on day 0<sup>th</sup> of storage ( $2.18 \pm 0.16 \log \text{CFU g}^{-1}$ ). The increase was consistent throughout the storage period. The highest score was determined as  $5.69 \pm 0.14 \log \text{CFU g}^{-1}$  on day 12<sup>th</sup> of storage. Karaton Kuzgun and Gürel İnanlı, [18] reported that they was determined as  $5.96 \pm 0.54$ - $6.93 \pm 0.32 \log \text{CFU g}^{-1}$  in the chitosan coating enriched with different essential oils. This finding was consistent with the present study findings.

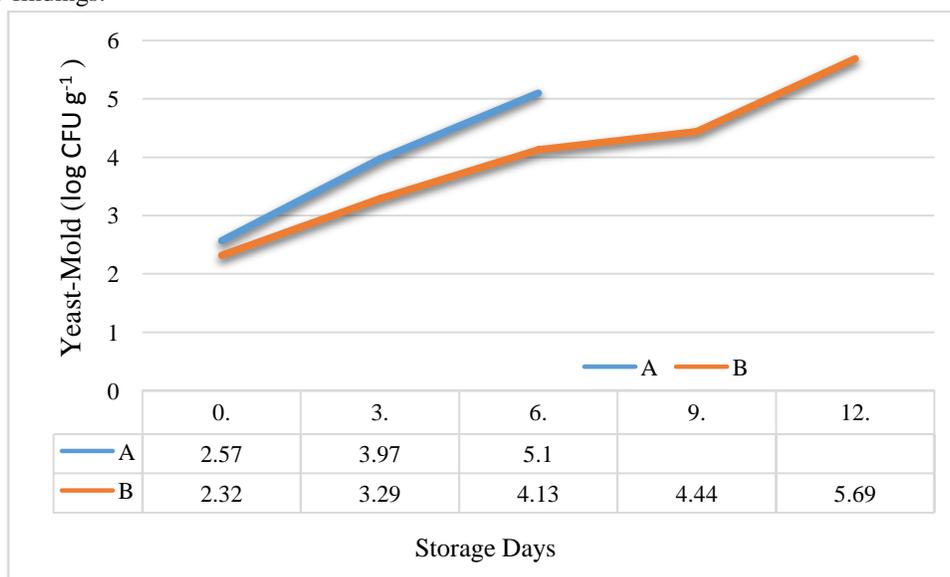


Figure 3: The changes in the Yeast-Mold counts of spearmint essential oil treated trout fillets



### 3. Conclusion

In conclusion, it could be suggested that a natural antimicrobial and antioxidant, spearmint essential oil improved the microbiological properties of *O. mykiss* fillets and could be utilized to preserve other food products. The study findings underlined the necessity of further studies on consumption of food products and seafood prepared with natural preservatives.

### References

- [1]. Tassou CC., Drosino EH., Nychas GJE., 1995. Inhibition of resident microbial flora and pathogen inocula on cold fresh fish fillets in olive oil, oregano, and lemon juice under modified atmosphere or air. *J Food Protect*, 59, 31-34.
- [2]. Boyacıoğlu, D., 1994. Geçmişten günümüze gıda biyoteknolojisi uygulamaları, II Gıda Mühendisliği Kongresi, Kimya Mühendisleri Odası ve Gaziantep Üniversitesi Gıda Mühendisliği Bölümü, Gaziantep.
- [3]. Çaklı, Ş. & Kışla, D., 2003. Su Ürünlerinde Mikrobiyal Kökenli Bozulmalar ve Önleme Yöntemleri. *Ege Üniversitesi Su Ürünleri Dergisi*, 20(1-2): 239-245.
- [4]. Mol., S., Özturan, S., 2009. Sous-vide teknolojisi ve su ürünlerindeki uygulamalar. *Journal of FisheriesSciences.com*, 3(1): 68-75 DOI: 10.3153/jfsc.com.2009010
- [5]. Çoban, Ö., 2010. Bazı esansiyel yağların tütsülenmiş ve vakum paketlenmiş gökkuşağı alabalığı (*Oncorhynchus mykiss*) filetolarının raf ömrüne etkisi. Fırat Üniversitesi, Fen Bilimleri Enstitüsü, Su Ürünleri Avlama ve İşleme Teknolojisi Anabilim Dalı Doktora Tezi, Elazığ, Türkiye, 135.
- [6]. Jirovetz, L., Buchbauer, G., Shahabi, M., Ngassoum, M.B., 2002. Comparative investigations of the essential oil and volatiles of spearmint *Perfum. Flav.*, 27 pp. 16-22.
- [7]. Dorman, H.D. Koşar, M. Kahlos, K. Y. Holm, R., 2003. Hiltunen Antioxidant properties and composition of aqueous extracts from *Mentha* species, hybrids, varieties, and cultivars *J. Agric. Food Chem.*, 51, pp. 4563-4569, 10.1021/jf034108k
- [8]. Maffei, M., Codignola, A.M., 1986. Fieschi *Mentha spicata* Essential oil from L. (spearmint) cultivated in Italy *Flav. Fragr. J.*, 1;105-109, 10.1002/ffj.2730010303
- [9]. Zheljzakov, V.D., Cantrell, C.L., Astatkie, T., Ebelhar, M.W., 2010. Productivity, oil content, and composition of two spearmint species in Mississippi *Agron. J.*, 102, pp. 129-133, 10.2134/agronj2009.0258
- [10]. Mokhtarihah G., Ebadi M.T., and Ayyari M., 2020. Qualitative changes of spearmint essential oil as affected by drying methods, *Industrial Crops and Products*. <https://doi.org/10.1016/j.indcrop.2020.112492>
- [11]. Franzios, G. Mirosou, M. Hatziapostolou, E. Kral, J. Scouras, Z.G. Mavragani P. 1997. Tsipidou Insecticidal and genotoxic activities of mint essential oils *J. Agric. Food Chem.*, 45, pp. 2690-2694, 10.1021/jf960685f
- [12]. Kanatt, S.R., Chander, R., Sharma A., 2008. Chitosan and mint mixture: a new preservative form eat and meat products *Food Chem.*, 107, pp. 845-852, 10.1016/j.foodchem.2007.08.088
- [13]. Lawrence, B.M., 2006. *Mint: The Genus Mentha*. CRC Press, Boca Raton, FL.
- [14]. Halkman, A.K. (2005). *Merck Gıda Mikrobiyolojisi Uygulamaları*, Başak Matbaacılık, Ankara.
- [15]. Karaton Kuzgun, N., (2014). Farklı esansiyel yağlar ve kitosan ile hazırlanan filmlerle ambalajlanmış *Luciobarbus socinus* filetolarının 2±1°C'de raf ömrünün araştırılması, Doktora Tezi, 116.
- [16]. Ojagh, S.M., M. Rezaei, S.H., Razavi, S.M.H., Hoseini, 2010. Effect of chitosan coatings enriched with cinnamon oil on the quality of refrigerated rainbow trout. *Food Chem.* 120:193–198.
- [17]. Özpolat, E., Duman M., 2016. Effect of black cumin oil (*Nigella sativa* L.) on fresh fish (*Barbus grypus*) fillets during storage at 2 ± 1 °C. *Food Sci. Technol, Campinas*, 37(1): 148-1.
- [18]. Karaton Kuzgun, N., Gürel İnanlı, A., 2018. The investigation of the shelf life at 2 ± 1 °C of *Luciobarbus socinus* fillets packaged with films prepared with the addition of different essential oils and chitosan. *Journal of food science and technology*, 55(7):2692-2701.

