Middle East Journal of Science

https://dergipark.org.tr/mejs **MEJS**

e-ISSN:2618-6136

Research Article

DYNAMIC SUBSTANCE RESEARCH IN DOMESTIC AND IMPORTED BLACK TEA SOLD IN TURKEY

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Abstract: *Tea is a popular product known worldwide with health benefits for consumers. For centuries, it has been considered a safe and healthy beverage. Although the tea plant has many beneficial effects on human health, the chemicals that can be found in the tea plant can cause negative effects on health. Recently, the use of dyes in teas comes to the fore among imitations or adulterations made in foods recently. These substances pose a health risk. The purpose of this study; sold in the province in Turkey's Southeast Anatolia and Eastern Anatolia regions and to assess the presence of dye in domestic and imported tea. In the study (Mardin; 7, Şırnak; 3, Van; 15, Diyarbakir; 13, Siirt; 9, Batman; 4, Gaziantep; 14, Kilis; 4 and Şanlıurfa; 10) Iran, Sri Lanka, India and originating in Turkey A total of 79 samples were taken from the black teas and a wool yarn dyeing analysis with (GMMAY S: 94-107) method was performed to look for dyes. The analyzes were carried out in an advanced private laboratory with European Union accreditation. According to the analysis results, no dye was detected in any of the tea samples. According to these results, it was concluded that no dyestuff is used in the harvesting, processing, drying, and packaging stages of local and imported teas sold in the Southeastern Anatolia and Eastern Anatolia regions. Turkey determined to make the presence of dyes in general in the domestic and imported tea in other regions such analysis is required.*

Keywords: *Black tea, Dyestuff, Iranian tea, Sri Lanka tea, Turkish tea.*

Received: July 8, 2021 *Accepted: September 16, 2022*

1. Introduction

Tea is an aromatic beverage prepared by pouring hot or boiling water over the dried leaves of the plant known as *Camellia sinensis*. With a history of 5000 years, tea is among the most consumed beverages all over the world after water [1-3]. In the world, the tea plant is grown from about 42 degrees of latitude in the northern hemisphere, where the precipitation is abundant and the climate is warm, to 27 degrees of latitude in the southern hemisphere. China, India, Sri Lanka, Kenya, Vietnam, Indonesia, SSBC, Japan, Myanmar, Turkey, Bangladesh, Iran, Argentina, Uganda, Tanzania, Malawi, Thailand, Nepal, Rwanda, Burundi, and Ethiopia are from countries where tea plants are grown general [4]. 80% of tea production is made in India, China, Sri Lanka, Indonesia, Kenya, Turkey, and Japan [5-6]. The phenolic compounds found in the tea plant have many beneficial effects on human health such as antioxidant, antimicrobial, anticancer, anti-inflammatory, antiviral, lowering cholesterol, lowering blood pressure, reducing the risk of cardiovascular disease, and reducing the risk of osteoporotic fractures elderly [7-10]. However, the presence of harmful pollutants such as heavy metals, mycotoxins, and pesticide residues in the tea plant can have negative effects on health [11-12]. In addition to these

harmful substances, it is also claimed that dyes are used as food additives in order to make the color of the tea plant look beautiful when it is put into water, obtain standard color, and produce faster color. The Ministry of Agriculture and Forestry also reported in the official gazette on 13.01.2020 that dyestuff, which is a food additive, was detected in 11 tea brands [13].

Food additive refers to substances that are not consumed as food alone but are expected to be a component of that food either directly or indirectly, as a result of being added to food during technological production stages such as production, treatment, processing, preparation, and packing. Food dyes, which are among food additives, are of special importance today. Food dyes are substances that give or restore color to foods, that are not consumed as food in general, and aren't used as a specialty component of food [14]. The reasons for adding dyes to foods; are to protect the color naturally found in food, to create a technological standard color in food, to give different color tones to the food, and to hide low qualities in food [15].

As a result of the widespread use of food dyes in foods and their legalization with legislation, many methods have been developed to detect these substances in foods. In the analysis of water-soluble synthetic organic dyes used in foods; methods such as wool thread dyeing method, paper chromatography (PC), thin layer chromatography (TLC), column chromatography (CC), gas chromatography (GC), high-pressure liquid chromatography (HPLC) are used [16].

When coloring agents are required to be used in foods, the doses determined by Joint Expert Committee in Food Additives and Contaminants (JECFA) and Codex Alimentarius must be followed. Many harmful effects on health occur when these doses are not followed or when exposed to dyes for a long time. Dyestuffs have genotoxic, carcinogenic, and neurotoxic effects on the body. In addition, it causes, allergic reactions, skin rashes, and asthma. It is reported to cause hyperactivity in children [17-22] As stated in the Turkish Food Codex Regulation on Food Additives, it is not allowed to use any coloring substance in tea. Therefore, before the tea is offered for consumption, imitation or adulteration is made when coloring substances are added consciously, provided that they create a standard color in the product technologically and do not hide their low quality. The purpose of this study, Located in Turkey's Southeast Anatolia and Eastern Anatolia regions that are sold provinces in domestic and imported teas, is to determine whether there is a dye and whether there is any imitation and adulteration. and adulteration.

2. Materials and Methods

2.1. Collection of samples

Within the scope of the study, Mardin; 7, Şırnak; 3, Van; 15, Diyarbakir; 13, Siirt; 9, Batman; 4, Gaziantep; 14, Kilis; 4, and Şanlıurfa; 10 to be a total of 79 black tea samples, were collected (Figure 1). Collected teas from Iran, Sri Lanka, and India and originated in Turkey. Tea samples were taken from city markets and coffee shops in sterile sample bags and brought to the laboratory. Samples were kept in a dry and cool environment until analysis.

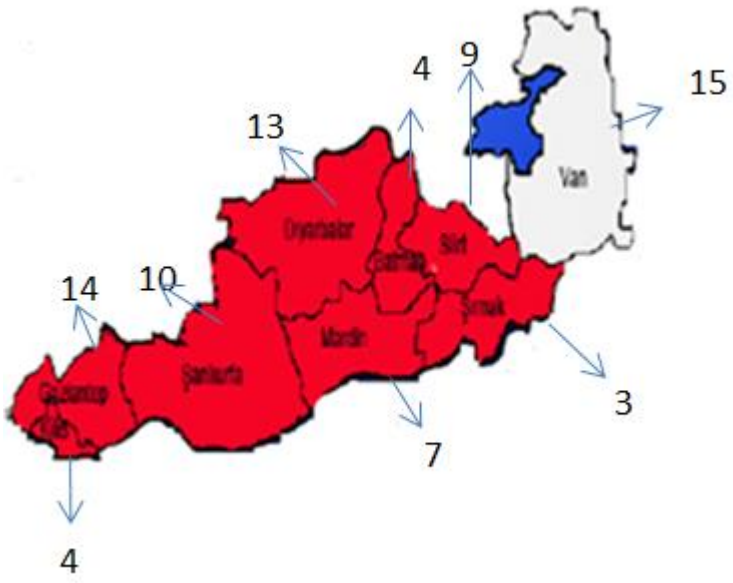

Figure 1. Cities and number of samples

2.2. Analyzing samples

Analyzes were carried out in an advanced private laboratory accredited by the European Union (Environmental Food and Industrial Laboratories Group). In this laboratory, wool yarn dyeing analysis was carried out according to the (GMMAY S: 94-107) method for the determination of dyestuff in teas.

Dyeing wool yarns method

This method is based on the principle that acidic dyes in aqueous acetic acid solution and basic dyes in ammonia solution dye degreased white wool. The method is based on two principles. one.; Synthetic dyes are mostly hydrophobic and adhere insolubly to wool, so they cannot be removed by washing in water. 2. Natural dyes found in foods are mostly hydrophilic because they are phenolic derivative compounds and because they can dissolve in water, they leave the wool during washing. These two different behavior patterns are used in the process of distinguishing natural and synthetic dyes from each other.

2.2.1 Preparation of wool yarns

In order to degrease the raw wool yarns, it was extracted with petroleum ether in a soxhlet device. The woolen threads were left to dry. After drying, 5% NH_3 solution was added and kept in a water bath at 80°C for 1 hour. Then the woolen threads were washed generously with pure water and left to dry. The dried wool threads were kept in a glass container for use [16].

2.2.2 Dyeing of wool yarns

The tea sample was dissolved in distilled water in a beaker. 10% $KHSO_4$ solution was dropped until the solution was pH 2. Then, some degreased wool threads were placed in the environment. In order for the dyes in the environment to be absorbed by the wool yarns, each was placed in a 60°C water bath and kept for half an hour. Then the woolen threads taken in the beaker were washed with distilled water. As a result of the washing process, if the dyes were not retained by the woolen yarns, the dye was considered present. If the paint flows and leaves the wool, it is considered as no paint [23]. As a result of washing, the wool threads that did not run off dye were placed in a beaker and 10 ml of 5% NH_3 solution was added and heated in a water bath for 30 minutes. If the dye does not separate from the

woolen yarns, it was accepted as a natural dye. If the dye was separated from the woolen threads, it was accepted as a synthetic dye [16].

3. Results and Discussion

As a result of the analyzes, dyes were not detected in any of the 79 tea samples as shown in Table 1.

Table 1. Dyes results in tea samples

City of Sample Taken	Number of Samples	Colorant	Analysis Method
Mardin	7	*(N.D.*)*	GMMAY S:94-107
Şırnak	3	*(N.D.)*	GMMAY S:94-107
Van	15	*(N.D.)*	GMMAY S:94-107
Diyarbakır	13	*(N.D.)*	GMMAY S:94-107
Siirt	9	*(N.D.)*	GMMAY S:94-107
Batman	4	*(N.D.)*	GMMAY S:94-107
Gaziantep	14	*(N.D.)*	GMMAY S:94-107
Kilis	4	*(N.D.)*	GMMAY S:94-107
Şanlıurfa	10	*(N.D.)*	GMMAY S:94-107

(*No Detected)

Food dyes, which are a group of food additives, are defined by the International Food Codex Commission (The Codex Alimentarius) as "a substance added to color or add color to foods". However, although the codex prohibits some dyes and the use of dyestuffs for some foods, these prohibitions are abused and used for imitation and adulteration in foods. Despite these properties, they are considered to be health risks due to their possible carcinogenic and teratogenic effects. In earlier Turkey and other countries the tea, associated with the dye residue wasn't observed in a scientific study. As a result of this study consumed in Turkey's domestic and imported tea, it has been no detected dye residue. In contrast to the results of this study, teas imported into Turkey It is claimed that artificial dye was added. It is claimed that this dye is aniline, the dye obtained by distilling hard coal. It is said that aniline is not distinguished in tea. Because it oxidizes and turns brown when exposed to oxygen and because it has a pleasant odor [24]. Without any analysis, it has been understood that this information, which was told only on estimation, had no scientific basis, but was speculation. In addition, the Ministry of Agriculture and Forestry reported in the official gazette on 13.01.2020 that dyestuffs were detected in 11 tea brands [13]. Since this date is later than this study, we could not analyze the teas belonging to the relevant companies. We chose the most preferred companies in the tea originating in Turkey. No paint residue was found in these. The list announced by the Ministry was in line with the results of this study.

4. Conclusion

The results of this study express a clear finding that imported teas do not contain dyes. The fact that tea brands with dyestuffs announced by the Turkey Ministry of Agriculture and Forestry are completely domestic production and the results of our study on imported teas, It has put an end to the speculation that there are dyes in imported teas until now. In fact, the most important point that causes such speculation is the fact that imported teas, known as illegal tea, give a lot of color during the brewing process. The fact that imported tea has eaten a smuggled label and gives almost twice as much brew during brewing than domestic teas has raised suspicion about whether dyes are added to these teas. Of

course, it is quite possible for such a suspicion to occur. But, it is interesting that no formal answer to this question has been given to this day. This work we have done puts an end to speculation. We think that the reason why imported teas are brewed more is related to the extraction rates and sludge coefficient of these tea types and we recommend that a further study be conducted on this subject.

Acknowledgments
This work was financially supported by Harran University Scientific Research Projects Unit (Project Number: HUBAP- 19016). A small part of the data in this study was presented at the "International Tea Congress, 2022" event.

Compliance to the Research and Publication Ethics
This study was carried out in accordance with the rules of research and publication ethics.

Conflict of Interest
The authors declare no conflict of interest.

Author's Contributions
Kasım TAKIM: Conceptualization, Data curation, Investigation, Project administration, Resources, Supervision, Writing – original draft, Writing– review & editing.
Mehmet Emin AYDEMİR: Formal analysis, Conceptualization, Data curation, Investigation, Methodology, Software, Writing– original draft.

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