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Detection of Mustard Oil Adulteration in Kanpur City

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Abstract

Mustard oil, derived from Brassica plant seeds, is a common culinary and medicinal oil known for its unique chemical composition, including fatty acids such as erucic acid, oleic acid, linoleic acid, and alpha-linolenic acid. However, its widespread adulteration with cheaper oils, like sesame and argemone oil, has raised concerns regarding its quality and safety. This study aimed to detect adulteration in mustard oil samples collected from grocery shops in Kanpur City, India, and evaluate the presence of common adulterants using chemical tests. The primary objective was to identify and quantify the adulteration of mustard oil with sesame and argemone oil using qualitative chemical methods, thereby assessing the purity and safety of mustard oil available in the local market. Six mustard oil samples (MO1-MO6) were collected from different grocery stores in Kanpur city. Chemical reagents used for the tests included nitric acid, hydrochloric acid, and furfural. The pH of most mustard oil samples deviated from the expected range of 5-6, suggesting possible adulteration. The Baudouin test confirmed the presence of sesame oil in five out of six samples, while the argemone test identified argemone oil adulteration in three samples based on color changes. The study highlights significant adulteration in mustard oil sold in Kanpur City, with sesame and argemone oils being the most common adulterants. The findings underscore the need for stronger regulatory measures and increased consumer awareness to ensure the safety and quality of mustard oil.

Keywords: Mustard oil, Chemical composition, Adulterants, Detection of adulterants.

INTRODUCTION

Mustard oil is one of the ancient spices, and its use dates back to around 3000 BC, as evidenced by archaeological findings from the Indus Valley Civilization.[1] Mustard oil plays a significant role in this context, encompassing traditional practices, health sciences, agriculture, and culinary arts. Its importance is affirmed through Ayurveda, cultural rituals, and its influence on Indian cuisine and rural economies[2]. In Ayurveda, mustard oil is recognized for its therapeutic benefits and is used for various medicinal purposes due to its warming and invigorating properties. Mustard oil, derived from the seeds of mustard plants, is a complex mixture of various chemical constituents[3]. There is a wide variation in the composition of mustard oil depending on the type of mustard plant (e.g., Brassica juncea, Brassica nigra, or Brassica alba) and the extraction method used.

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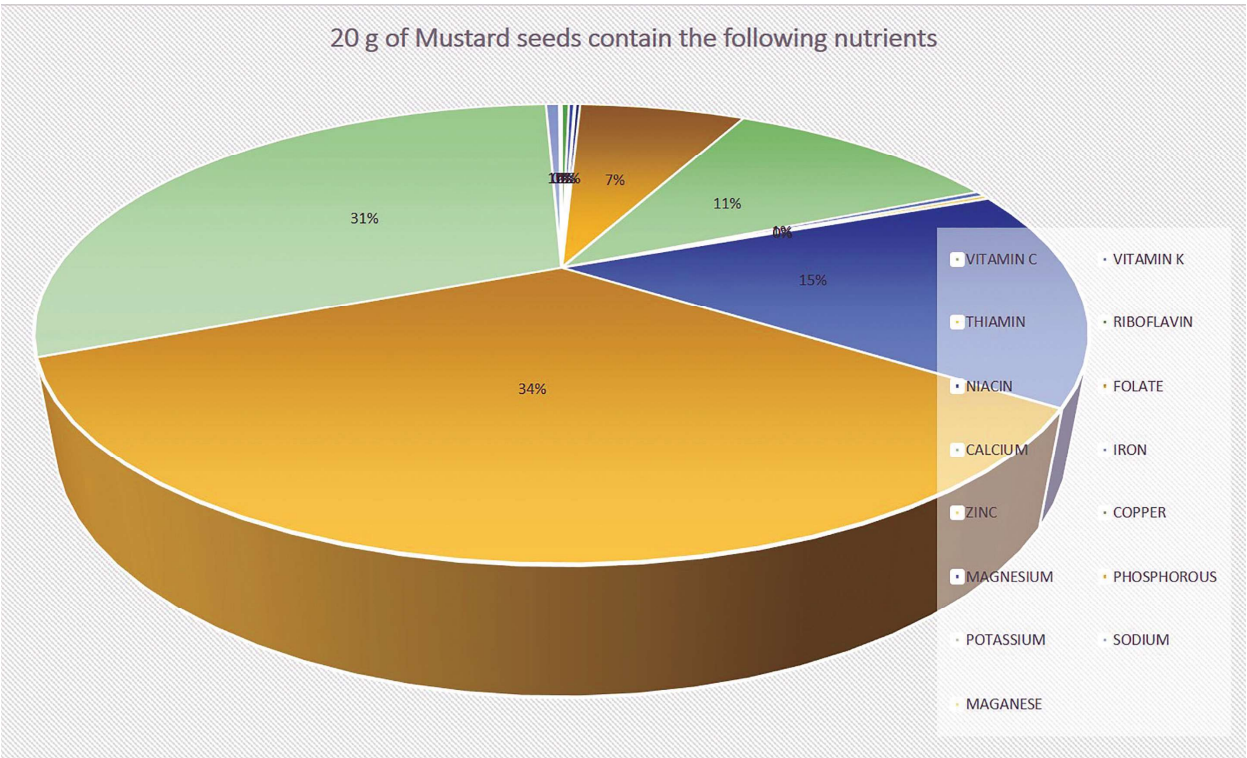

Fig. 1: 20g of Mustard Seeds contain the following nutrients

Chemicals constituted in Mustard oil are three types of fatty acids are present. Monounsaturated Fatty Acids (MUFA) have erucic acid (40-50 %) and oleic acid (20-25 %) to enhance oxidative stability, Polyunsaturated Fatty Acids (PUFA) have Linoleic acid (Omega-6) 15–20% Alpha-linolenic acid (Omega-3) 5–10%[4] known for its anti-inflammatory properties and Saturated Fatty Acids (SFA) have Palmitic acid Stearic acid. A monounsaturated fatty acid with a long carbon chain, erucic acid contributes significantly to mustard oil's composition. It influences the oil's viscosity and stability.[5]

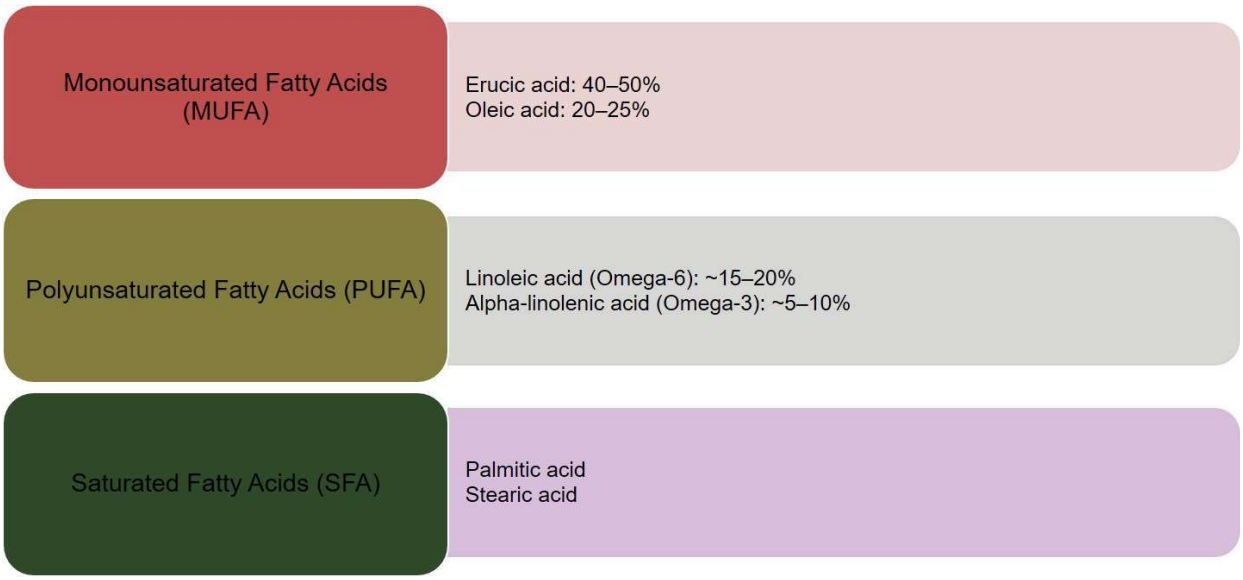

Fig. 2: Chemical constitute of Mustard oil

Adulterations of high-price oil with low-price oil are a form of adulteration.[6-8] Substituting cheaper oil for lower prices usually respects the economic point[9] of view. Mustard oil adulteration[10] with argemone oil is a common adulteration.[11,12]

MATERIALS AND METHODS

Mustard oil samples (branded/non-branded) were collected from the local market areas of Kanpur city to detect adulterants. Some chemical methods for the detection are given below.

Materials: Nitric acid, Hydrochloric acid, furfulal (LR Grade).

Methods

Collections of Samples: Six samples of Mustard oil were collected from different grocery shops in Kanpur city, Uttar Pradesh, and named accordingly as MO1, MO2, MO3, MO4, MO5, and MO6.

Qualitative test for the detection of adulterants in Mustard oil: By using laboratory chemicals, we carried out by adapting standard procedures.

Mustard oil has a strong and pungent Odor, and it has a distinctive, slightly spicy taste. Adulterated mustard oil may have a milder or neutral smell and taste. Techniques for Mustard oil adulteration detection are explained in Fig 3.

pH test: pH strips test the pH of Mustard oil samples

Baudouin test for sesame oil adulteration: To perform a Baudouin test sample mixed with furfural and hydrochloric acid. The color change indicated the presence of sesame oil.

Argemone test: Mustard oilmixed with concentrated hydrochloric acid. The color change indicated the presence of argemone oil.

RESULT AND DISCUSSION

Adulteration in Mustard Oil

pH Test: Pure Mustard oilgenerally has a pH ranging from 5 to 6, indicating a slightly acidic nature. It's worth noting that the pH may vary due to factors like the Mustard oilgrowing conditions, processing techniques employed, and the presence of additives or contaminants.

In Figure 3, Displays a pH of around 6 samples. This deviation from the typical pH range for Mustard oilraises concerns regarding possible adulteration or contamination with alkaline substances, affecting its taste, aroma, and overall quality.

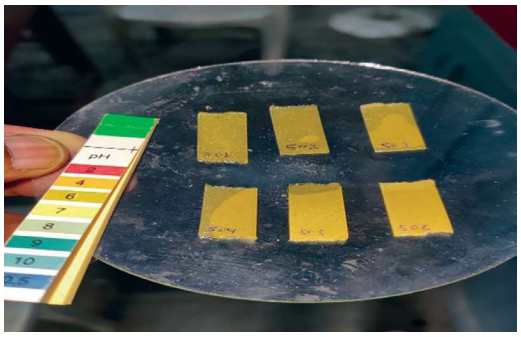

Fig. 3: pH test for Mustard oil samples

Baudouin test for sesame oil: Sesame oil is detected in all samples of Mustard oil, including MO1, MO2, MO3, MO4, and MO5. However, this test appears in the MO2, MO3, MO4, MO5 sample Figure 4.

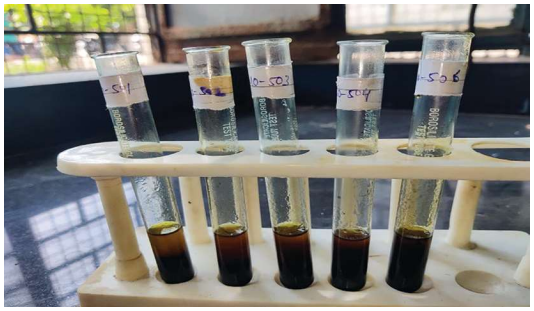

Fig. 4: Baudouin test for sesame oil in Mustard oil

Argemone oil detection in Mustard oil: The detection of argemone oil adulteration can be identified by specific chemical tests, such as the nitric acid test Figure 5. MO1, MO3, and MO5 show a pink color, indicating the presence of argemone oil in Mustard oil samples while the samples MO2 and MO4 did not show a pink color, indicating the absence of argemone oil in Mustard oil samples.

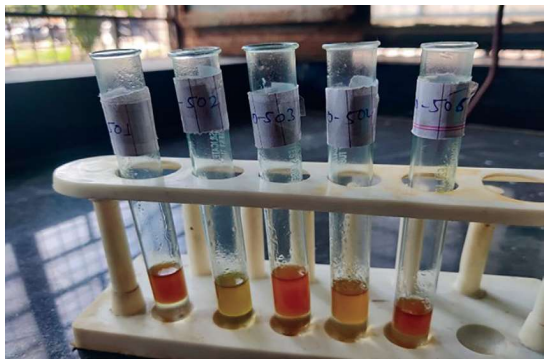

Fig. 5 Detection of argemone oil adulteration in Mustard oil

CONCLUSION

In the above work, these chemical tests help to identify adulterants in mustard oil, ensuring compliance with food safety standards and protecting consumers from potentially harmful impurities. This study underscores the importance of collaborative efforts between regulatory bodies, manufacturers, and consumers to ensure the availability of pure and safe mustard oil in Kanpur City.

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