**FOOD ADULTRATION AS AN EMERGING ISSUE IN FOOD CHEMISTRY**

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**KEY WORDS: Food, Adulteration, Emerging, Issue and Chemistry**

**Abstract**

**Adulteration is the mixing of other matter of an inferior and sometimes harmful quality with food or drink intentionally to make profit on the detriment of the consumers.**

Adulteration of any kind has been generally been seen as an emerging issue in food chemistry and the society at large. This article describes adulteration, food adulteration, and other types. Adulteration usually refers to mixing other matter of an inferior and sometimes harmful quality with food or drink intended to be sold. As a result of adulteration, food or drink becomes impure and unfit for human consumption. The federal Food and Drug Administration prohibits transportation of adulterated foods, drugs, and cosmetics in interstate commerce, as provided under the Food, Drug and Cosmetic agency. State and local agencies, acting under the authority of local laws, do the same to ban the use of such impure goods within their borders in a particular country. (Sharma A., Batra N., Garg A., Saxena, A. 2017)

It will not normally be present in any specification or declared contents of the substance, and may not be legally allowed. The addition of adulterants is called adulteration. The most common reason for adulteration is the use by manufacturers of undeclared materials that are cheaper than the correct and declared ones. The adulterants may be harmful, or reduce the potency of the product, or they may be harmless. Other causes of food adulteration are:

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| •Availability of too many products in the market |

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| •Poor buying practices of consumers. |

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| •Consumer mentality of bargaining, |

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| •Consumer psyche. |

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| •Availability of adulterants.  An adulterant is a pejorative term for a substance found within other substances such as food, fuels or chemicals even though it is not allowed for legal or other reasons. An adulterant is distinct from, for example, permitted food additives. There can be a fine line between adulterant and additive; chicory may be added to coffee to reduce the cost or achieve a desired flavor—this is adulteration if not declared, but may be stated on the label. Chalk was often added to bread flour; this reduces the cost and increases whiteness, but the calcium actually confers health benefits, and in modern bread a little chalk may be included as an additive for this reason.  Adulteration of food is commonly defined as the addition or subtraction of any substance from food type, so that the natural composition and quality of food substance is affected. Adulterant means any material which is or could be employed for making the food unsafe or sub-standard or mis-branded or containing extraneous matter. Food is declared adulterated if:   * A substance is added which depreciates or injuriously affects it. * Cheaper or inferior substances are substituted wholly or in part. * Any valuable or necessary constituent has been wholly or in part abstracted. * It is an imitation. * It is colored or otherwise treated, to improve its appearance or if it contains any added substance injurious to health.   For whatever reasons its quality is below the Standard |

Adulterated food is dangerous because it may be toxic and can affect health and it could deprive nutrients essential for proper growth and development.

Some of the common adulterated foods are milk and milk products, edible oils, cereals, condiments (whole and ground), pulses, coffee, tea, confectionary, baking powder, non - alcoholic beverages, vinegar, and curry powder.

Generally, if a food contains a poisonous or deleterious substance that may render it injurious to health, it is adulterated. For example, apple ciders contaminated with E.coliO157H7 and Brie cheese contaminated with Listeria monocytogenes are adulterated.

If a food contains a poisonous substance in excess of a tolerance, regulatory limit, or action level, mixing it with "clean" food to reduce the level of contamination is not allowed. The deliberate mixing of adulterated food with good food renders the finished product adulterated

Filth and extraneous material include any objectionable substances in foods, such as foreign matter (for example, glass, metal, plastic, wood, stones, sand, cigarette butts), undesirable parts of the raw plant material (such as stems, pits in pitted olives, pieces of shell in canned oysters), and filth (namely, mold, rot, insect and rodent parts, excreta, decomposition.

**Types of adulteration:**

There are three types of adulteration namely:

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| • | *Intentional adulterants:* Intentional adulterants are sand, marble chips, stone, mud, chalk powder, water, mineral oil and coal tar dyes. This adulteration cause harmful effects on the body. |

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| • | *Metallic contamination:* Metallic contaminations include arsenic from pesticides, lead from water, and mercury from effluents of chemical industries, tin from cans etc. |

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| • | *Incidental adulterants:* Incidental adulterants are pesticide residues, tin from can droppings of rodents, larvae in foods. Metallic contamination with arsenic lead, mercury can also occur incidentally. Pests such as rodents and insects intrude into the food at high degree and produce filth in the form of excreta, bodily secretions and spoilage through microorganisms. The most common incidental adulterants are pesticides, D.D.T and marathon residues present on the plant product. The maximum permissible residue allowed for D.D.T, marathon is 3 ppm. |

Adulteration is either intentional by either removing substances to food or altering the existing natural properties of food knowingly. Unintentional adulteration is usually attributed to ignorance’s, carelessness or lack of facilities for maintaining food quality. Incidental contamination during the period of growth, harvesting, storage, processing, transport and distribution of foods are also considered.

A food is adulterated if it omits a valuable constituent or substitutes another substance, in whole or in part, for a valuable constituent (for instance, olive oil diluted with tea tree oil); conceals damage or inferiority in any manner (such as fresh fruit with food coloring on its surface to conceal defects); or any substance has been added to it or packed with it to increase its bulk or weight, reduce its quality or strength, or make it appear bigger or of greater value than it is (for example, scallops to which water has been added to make them heavier).

The fact that a food is contaminated with pathogens (harmful microorganisms such as bacteria, viruses, or protozoa) may, or may not, render it adulterated. Generally, for ready -to-eat foods, the presence of pathogens will render the food adulterated. For example, the presence of Salmonella on fresh fruits or vegetables or in ready-to-eat meat or poultry products (such as luncheon meats) will render those products adulterated.

Krishna B.S (1997 stated that Ready -to- eat meat and poultry products contaminated with pathogens, such as Salmonella or *Listeria monocytogenes*, are adulterated. For raw meat or poultry products, the presence of pathogens will not always render a product adulterated (because raw meat and poultry products are intended to be cooked and proper cooking should kill pathogens)

Bhaskar, J., Usman, M., Smitha, S and Bhat G.K (2004) opined that Adulteration of milk reduces the quality of milk and can even make it hazardous. Adulterants like soap, acid, starch, table sugar and chemicals like formalin may be added to the milk. Most of the chemicals used as adulterants are poisonous and cause health hazards.

Quality control tests for milk are very important to assure adulterant free milk for consumption. Adulteration of milk reduces the quality of milk and can even make it hazardous.  Adulterants like soap, acid, starch, table sugar and chemicals like formalin may be added to the milk.  Most of the it chemicals used as adulterants are poisonous and cause health hazards.  Adulterants are mainly added to increase the shelf life of milk. Some of the preservatives like acid and formalin is added to the milk as adulterants, thereby increasing the storage period of milk. Generally, water is added to the milk to increase the volume content of the milk.  Some of the common adulterants found in milk and their detection are discussed.

Milk may contain some harmful microorganisms like bacteria along with   some potentially beneficial microbes. Microbiological analysis of milk is carried out to determine the degree of bacterial contamination in milk and   to understand  the chemical changes brought in milk as a result of microbial action.  Pasteurization is done to destroy such harmful bacteria.  If pasteurization of milk is not carried out properly there will be presence of larger count of bacteria in the milk.  Methylene blue Reduction test is used to detect the presence of bacteria in milk. This test works on the principle that the methylene blue indicator is present in an oxidized form, but in the presence of bacteria, leads to the reduction of this indicator in a comparatively short span of time.  The blue color developed on addition of the indicator to the milk will change to white color within a short period indicates the presence of bacteria in the milk and thus denotes improper pasteurization.

The common sugar present in milk is lactose. The fat content of the milk is more compared to the protein content. Table sugar like sucrose is added to the milk to increase the carbohydrate content of the milk and thus the density of milk will be increased. So the milk can now be adulterated with water and it will not be detected during the lactometer test.  Ketose sugar will react with the resorcinol to give a red colored precipitate, indicating the presence of Table sugar in milk.

Milk contains relatively large amount of fat. Addition of carbohydrate to milk increases its solid content. There by reducing the amount of fat present in the milk. Starch is one such component that is added to adulterate milk. The test to detect starch in milk uses iodine solution, addition of which turns the milk solution to blue black color due to the formation of starch –Iodo complex, in the presence of starch.

Generally acids like Benzoic acid and Salicylic acid is used as a preservative in food industry. It is added to milk to preserve and thus increase the shelf life of milk. Presence of these acids can be detected by adding concentrated sulphuric acid   and ferric chloride, which when reacts with benzoic acid and salicylic acid to give buff colored and violet colored reaction products.

Soap is added to milk to increase the foaming of milk and thus to have thick milk.  Addition of such chemicals will cause health problem especially related to stomach and kidneys. Soap can be detected by adding phenolphthalein indicator to the adulterated milk. A pink color will be observed if soap is present as the alkali will be neutralized by the acidity of the milk when phenolphthalein indicator is added.

Formalin is a preservative and can preserve milk for long period of time. Due to its high toxicity, it is considered to cause liver and kidney damage.  Formalin reacts with Sulphuric acid and ferric chloride to give a purple colored ring at the junction of the milk layers, thereby indicating the presence of formalin adulterated in milk.

Ammonium Sulphate is added to the milk as it increases the lactometer reading by maintaining the density of milk.  Ammonium sulphate adulterated milk can be detected by adding sodium hydroxide, sodium hypochlorite and phenol, the reaction of the three reagents with ammonium sulphate results in formation of deep blue colour. The deep blue color is generated when the amine reacts with phenol in the presence of hypochlorite in an alkaline environment, results in the formation of a complex which is blue in color.

Anyanwu R. C. and Jukes D.J (1990) states that the Ministry of Health and Family Welfare is responsible for ensuring safe food to the consumers. Keeping this in view, legislation called "Prevention of Food Adulteration Act should enact. The objective envisaged in this legislation was to ensure pure and wholesome food to the consumers and also to prevent fraud or deception. The Act should be amended regularly with the objective of plugging the loopholes and making the punishments more stringent and empowering Consumers and Voluntary Organizations to play a more effective role in its implementation.

The subject of the Prevention of Food Adulteration is in the concurrent list of the constitution. However, in general, the enforcement of the Act is usually passive.

The laws regulating the quality of food have been in force in the country since. But there was a considerable variance in the rules and specifications of the food, which interfered with inter-state trade.

Therefore, consumer associations and individual consumer should see adulterations of any kind as an emerging issue that may be repeating. They should be aware about the adulteration of food and know the legal provisions to protect the rights of consumer.

The protection of consumers Right is not only the responsibility of the state, it is also responsibility of the each consumers. The consumers must take care by themselves with the help from recognize consumer association and authorities. It is also responsibility of the authorities to give special advertisements to create and educate the consumers on prevention of food adulteration through Newspapers, News channels and other Media agencies.

Finally it is the duty of the consumer that they should be aware and educate themselves and their neighbors about the protection of Rights against food adulteration.

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