

Contaminants In Food and Beverages

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Various Stages at which contaminants get mixed up in Food and Beverages

- At Production level
- At Storage Level
- At packaging level
- At Transport level

At Production level

A. Plant originated food materials

- i. Seeds,
- ii. Food grains,
- iii. Vegetables,
- iv. Fruits etc

For agricultural products , we need


- a) water
- b) Soil
- c) Fertilizers
- d) Pesticides
- e) Insecticides

B. Animal originated food materials

- i. Meat,
- ii. Fish,
- iii. Milk

C. Processed Foods

- i. Edible oils,
- ii. Squashes, Syrups, Soft Drinks, Juices etc.



At Storage Level

- i. Preservatives
- ii. Disinfectants
- iii. Additives



At packaging level

Packaging Material

- i. Polymers: pvc, polythene, plastic, thermo coal, rubber,
- ii. Card board:
- iii. Paper waste.
- iv. Tin and Metallic containers
- v. Aluminium foils etc.


Degree of contamination depends on

- i. Solubility,
- ii. Time,
- iii. Temperature,
- iv. Humidity




At Transport level

i] Air Pollution



a] Oxidation



- ii] Containers
Bags and Boxes
- iii] Handling of Food
Material

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Street Food and drinks ? & Adulterated Food ?

Common Hazards and Common Precautionary Measures

Our food & our future?

Common airborne contaminants in the home

Food processing plants demand the highest standards of cleanliness and sanitation, mirror finish with no faults for contaminants to collect into. This environment requires a unique combination of construction skills, clean work habits and exacting standards .

Thank you

**PREPARATORY WORKSHOP ON
CONTAMINANTS
IN FOOD AND BEVERAGES**

1ST WORKSHOP

DATE: 16TH JAN. 2007

FOOD ADDITIVES

Presentation by **D.R.AMBAVADEKAR**

FOODS

- NATURAL
- ORGANIC
- NOVEL
- FUNCTIONAL
- PROCESSED
- FABRICATED
- CONVENIENCE
- FRESH
- SEMBLANCE(ATRACTIVE)

- TRADITIONAL
- NUTRITIOUS
- DELICIOUS
- PURE & REFIENED
- VEG.
- NONVEG
- FAST
- JUNK
- SNACK

WHY CHEMICAL FOOD ADDITIVES ?

- THEY ARE PURER
- MORE CONCENTRATED
- MORE CONSISTENT IN QUALITY
- ECONOMICAL
- SAFE TO HANDLE [CONVENIENT]

DEFINATION
BY NATIONAL RESEARCH COUNCIL/ NATIONAL ACADEMY
OF SCIENCES

- A substance or a mixture substances of substances other than the basic food stuff which is present in the food as a result of any aspect of production, processing or packaging

Types of food additives

- UNINTENTIONAL /INDIRECT /INCIDENTAL
- FERTILISERS
- PESTICIDES
- INSECTICIDES
- HERBICIDES
- FUNGICIDES
- HORMONES
- HEAVY METALS
- RESIDUES OF DRUGS
- REMAINS (Plastic, Glass, paper)

- INTENTIONAL /DIRECT
- PRESERVATIVES
- ANTIOXIDANTS
- SEQUESTRANTS
- ACIDULANTS
- SURFACE ACTIVE AGENTS
- STABILIZERS
- BLEACHING AND MATURING AGENTS
- NATURAL SUPPLEMENTS
- COLOURS
- ARTIFICIAL SWEETENERS
- FLAVOURS
- ANTICAKING AGENTS
- EMULSIFIERS

WHY INTENTIONAL FOOD ADDITIVES ?

- Improve or maintain nutritional quality- vit.A, D to margarine.
- Improve shelf value and curtail wastages- Ca-propionate in bread.
- Make food readily available everywhere any time (year round) – citric acid in fruit juices.
- Maintain food quality characteristics – corn starch in sugar to avoid lumping.
- Facilitate fast and convenient preparation of food -phosphate in instant pudding.
- Make food more attractive and appealing - use of artificial colors and flavors.

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Factors encouraging development and use of chemical food additives

- **Population growth**
- **Urbanization**
- **Labor cost**
- **Public health concerns**
- **Special diets**
- **Convenience food**
- **Fresh food year round**
- **Flavourful, ethnic and snack food**

food additives

- **Preservatives** – prevents spoilage - Ca-propionate in bread sorbic acid in cheese, Na –benzoate in soft drinks
- **Antioxidants** - prevents rancidity- BHA, BHT
- **Sequestrants** – metal scavengers-EDTA, Citric and adipic acid
- **Acidulants** – controls PH, enhance Flavors : phosphoric, lactic, citric acids.
- **Surface active agents**: emulsifiers, wetting agents - lubricants monoglycerides , diglycerides
- **Stabilizers and Thickeners** : in gravies, cake toppings, chocolates.
- **Bleaching agents and Maturing agents** : benzoyl peroxide, borates, iodates
- **Natural supplements** :enhance food value– Vit. A,B,C,D, Iodine , lysine
- **Colourants** : turmeric, amaranth, tartrazine, carmine, erythrosine
- **Non-nutritive Sweeteners** : Saccharin, Cyclamates, Aspartam
- **Flavors** : Vanillin (vanilla), ethyl butyrate (pineapple) , methyl anthranilate (grape)

Risk analysis of some specific food additives

1. **The potential harm** -health hazards causing toxic effects like:
 - Tumorigenesis:- development of tumors (malignant / nonmalignant)
 - Teratogenesis :- development of congenital defects.
 - Mutagenesis :- modification in genes and chromosomes

1. **The degree of risk**- significant due to prevalence of food additives and limitation in technology. Hence safety evaluation of food additives is critical and essential.

- **Safety Evaluations involves:**
Additives are expressed in terms of ADI-Acceptable Daily intake for man as tolerance designation. ADI is based on body weight, as the amount of food additive that can be taken daily in a diet over a lifetime without risk.

Results of Safety evaluations

Sr.no	Additive	use	Benefits	Risks
1	Sodium Nitrate & Sodium Nitrite	preservative	additive for cured meat products inhibits growth of clostridium bacterium.	forms N-nitrosamines which is carcinogenic and mutagenic-tumors in liver & stomach, binds with DNA.
2	Diethyl pyrocarbonate	preservative	In fruit juices, wine, beer	Reacts with amino acids & proteins forms Ammonia. DEP reacts with ammonia at PH 4-9 to form urethane (ethyl carbonate) it is carcinogenic.
3	BHA & BHT (BHA-ADI-0.3 mg/kg of body wt.) (BHT-0.125 mg/kg body wt.)	antioxidant	Antimicrobial activity against pathogens & viruses	Goes in liver produce peroxide which is carcinogenic & mutagenic causes stomach cancer.

Results of Safety evaluations

4	Phosphoric acid	Inorganic Acidulant	In cola type of soft Drinks& canned food.	Excess intake reduce optimum Ca : P ratio & Osteoporosis-brittle bones
5	Brominated vegetable oils	Emulsifying agent	In soft drinks To give it a clear appearance	It deposits brominated fat on heart – toxic effect.
6	Potassium bromate (KBrO ₃)	Bleaching & maturing agent in flour	In baked bread	Deposits bromate residues – kidney stones (ozonated)

Results of Safety evaluations

7	Saccharin	Calorie free artificial sweetener (300 times sweeter)	In variety of products. Daily dose As per WHO- 0-45 to 4.5 mg/kg body wt. daily.	Tumor in bladder in rats in excess dose.
8	Cyclamate Ca or Na salt of Cyclamic acid	Sweetener (30 times more sweet than sugar)	Variety of food products. Daily WHO dose 4-10 mg/kg body wt.	Cancer of bladder in Rats
9	Monoosodium glutamates	Flavor enhancer	Freezes non veg foods, dry soup& cheese spreads	In adults produce Chinese Restaurant Syndrome- burning sensation in neck back Headache, chest pain Safe for adults.

TOXIC EFFECTS OF FOOD ADDITIVES

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T.Y.B.Sc. (Zoology)



What is a Food Additive?

An additive is added to a food product either intentionally, to produce a desired effect or unintentionally through processing, storage or packaging.



Direct food additives are those that are added to a food for a specific purpose in that food.

Indirect food additives are those that become part of the food in trace amounts due to its packaging, storage or other handling. For instance, minute amounts of packaging substances may find their way into foods during storage.

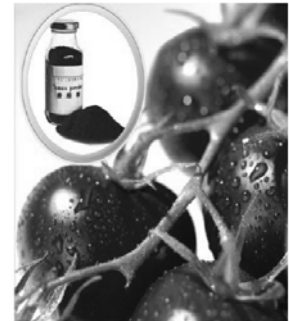


List of Some Food Additives & Their Effects On Human Body

1. E102

TARTRAZINE

- **What :** Colouring containing synthetic azo dye.
- **Found :** In soft drinks, packet desserts, fruit flavored cordial, pickles.
- **Effects :**
 - Provoke migraine.
 - Itching.
 - Blurred vision.



- *Purple patches on the skin.*
- *Irritability.*
- *Restlessness.*
- *Inattention and wakefulness in young children.*
- *It has immunosuppressive effects.*

2. **E110**

SUNSET YELLOW

- *What : Coloring containing synthetic azo dye.*
- *Found : In cereals, bakery items, crumbed foods, sweets, snack foods, ice cream, drinks and canned fish; also in many medications.*
- *Effects :*
- *Eczema.*



- *Swelling of the blood vessels.*
- *Nasal congestion.*
- *Behavioural problems and wakefulness in children.*
- *It is able to cross the placenta and is potentially dangerous to asthmatics.*

3. **E123**

AMARANTH

- *What : Colouring containing synthetic coal tar dye and azo dye.*
- *Found : In jelly crystals, packet cake mixes, fruit-flavoured fillings.*
- *Effects : Over activity in children.*
- *It has immunosuppressive effects.*



4. **E127**

ERYTHROSINE

- *What : Colouring containing synthetic coal tar dye.*
- *Found : In glace & canned red cherries, strawberries quick custard mix, biscuits, packet trifle mix.*
- *Effects:*
- *It can cause phototoxicity (sensitivity to light).*



- *Large dietary intakes of this additive could affect the thyroid.*
- *It has estrogen-like growth properties and could be a significant factor in human breast cancer.*

5. E211

SODIUM BENZOATE

- **What :** Preservative.
- **Found :** Used in soft drinks, fruit drinks, toppings & maple syrup.
- **Effects :**
- Asthma.
- Gastrointestinal symptoms.
- Behaviour problems in children.



6. E220

SULPHUR DIOXIDE

- **What :** Preservative.
- **Found :** Used in dried fruit, soft drinks, cordials, fruit drinks, beer, wine, sausages, other processed meats, hot chips, instant mashed potato, prawns.
- **Effects :**
- Asthma and skin rashes especially in young children.
- Irritability and occasionally death.



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- **Effects :**
- Irritability
- Restlessness
- Inattention and sleep disturbance in children
- Migraines
- Skin rashes
- Gastrointestinal upsets

8. E320 **BHA**

(BUTYLATED HYDROXYANISOLE)

- **What :** Antioxidant used as a preservative in oils and fats.
- **Found :** Fried foods, softened butter, dairy blends, margarine, hot chips, frozen chips, crisps, biscuits, ice-cream cones.



- **Effects :**
- Eczema.
- Irritable bowel symptoms.
- Migraine.
- Irritability.
- Restlessness.
- Inattention.
- Wakefulness and depression.

9. E621

• MONOSODIUM GLUTAMATE

- *What : Flavor enhancer (MSG).*
- *Found : Snack foods, instant noodles, biscuits, prepared meals, sauces, gravies, stocks and stock cubes, canned tuna, many frozen foods.*



- *Effects:*
- *Migraine.*
- *Asthma.*
- *Eczema.*
- *Irritable bowel symptoms.*
- *Heart palpitations.*
- *Dizziness.*
- *Nausea.*
- *Attack-type symptoms.*
- *Not permitted in foods intended specifically for infants and young children.*

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- *Effects :*
- *Headache.*
- *Mood alteration.*
- *Insomnia .*
- *Fatigue and dizziness .*
- *Gastrointestinal symptoms and allergic reactions.*
- *Linked to brain tumours.*

HOW TO AVOID

- *Don't eat products containing sugar substitutes such as saccharine and aspartame.*
- *Avoid products with a long shelf life – the better they do on the shelf, the worse they are for your body.*
- *Don't eat partially hydrogenated or hydrogenated trans fats.*

- *Avoid products that have been enriched. They have been completely devitalized during processing.*
- *Avoid food that has been genetically modified or engineered. Nearly all processed food contains GMOs.*
- *Avoid products made with ingredients euphemistically described as "natural flavoring" or "natural coloring."*

- *Avoid products with added sugar – watch for words with "-ose" endings such as glucose.*
- *Incorporate a multi-vitamin into your health regimen.*
- *If you've had a history of eating products high in sugar and are concerned about diabetes, incorporate disease-fighting products such as garlic, vitamin E, and aloe vera into your diet.*

Contamination of meat, milk and eggs

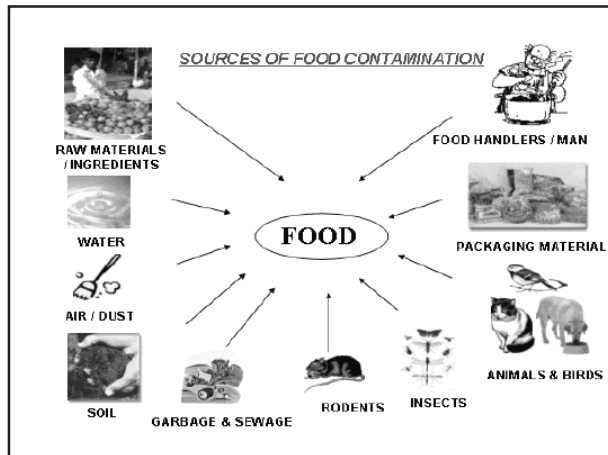
Presented
By
Purva Acharekar

Toxic Shock



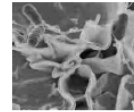
Contamination of

Meat	With	Bacteria
Milk		Antibiotics
Eggs		Hormones
		pesticides
		Dioxin



Bacterial contamination

- causes- Improper handling, preparation or storage
- Ex.- Salmonella
- E.Coli
- Campylobacter
- Clostridium botulinum
- Listeria monocytogens



Symptoms

Nausea
Abdominal pain
Vomiting
Diarrhea
Fever
Headache

Measures for avoiding contamination of food.

- *GAMMA IRRADIATION.*
- *ELECTRON BEAM IRRADIATION*
- *X-IRRADIATION.*
- *AWARENESS.*



CONTAMINATION OF MEAT.

Use of Antibiotics

1. To promote rapid growth in animals
2. To prevent them from dying from the diseases.

Effects

1. Daily exposure to low doses of arsenic can cause cancer, dementia, neurological problems, and other ailments in humans.
2. Evolution of new strains of antibiotic-resistant superbacteria

Antibiotic contamination

Eating Meat Means Eating Poison—Literally !!

We do know the effect of one of these antibiotics because it includes a known poison. Roxarsone, an antibiotic commonly used on factory farms, contains arsenic, which helps to kill off parasites in the animals' feed.³⁵ The problem is that some of the arsenic stays in the animals' flesh, so every time we eat meat, we're getting a dose of this poison as well. According to a study published by the USDA, most meat contains toxic arsenic, and chicken flesh contains four times more arsenic than other meats

CONTAMINATION OF EGGS



CONTAMINATION OF EGGS.



Eggs Contamination

The risk of eggs being contaminated with harmful bacteria and causing illness is very low. The odds of becoming ill from consuming eggs is no greater than with any other perishable type of food and the risk is often less than many foods. It is estimated that only 0.005% (1 in 20,000) of eggs may be contaminated with the salmonella bacteria, but even with a risk this low, it is wise to cook eggs to the proper doneness to ensure safety. Proper cooking kills the salmonella bacteria in any eggs that may have it.

Measures concerning contamination of eggs.

- Pasteurization.
- Proper storage.
- Other methods.

Hormone

- *Cows are injected with hormones to make them grow larger and produce more milk,*

Effects

- *Disturb the natural balance*
- *Disrupt the development of brain and sex organs*
- *Premature sexual development*
- *Ovarian cyst*
- *Early sexual development in young girls*
- *Gynecomastia- enlarge male breast*

Pesticides

- *Crops to farm feeds*
- *Accumulate in bodies of animals over a time*
- *Causes birth defects and cancer*

Dioxin

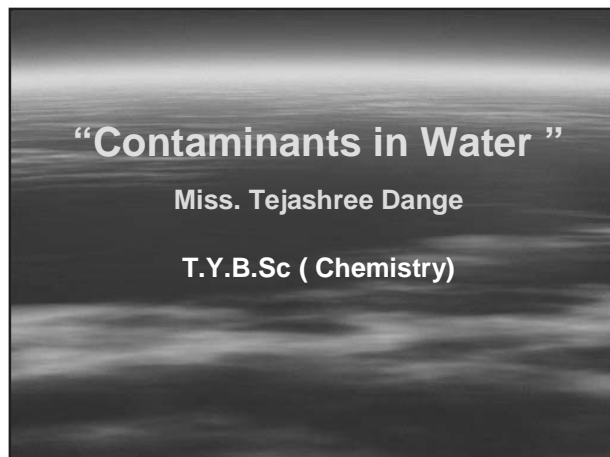
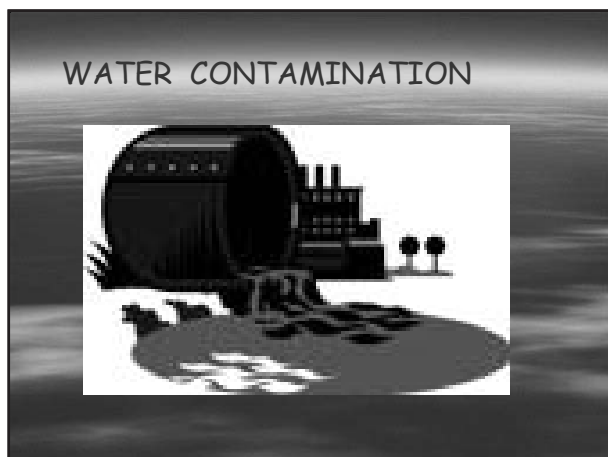
- *Source- ,byproducts of industrial and combustion processes including household fires*
- *Food high in animal fat such as milk,meat fish and eggs are the main source of dioxin and PCB*
- *Effects-cancer, damage to immune and reproductive system*

Cross Contamination

Cross contamination is also important to guard against. Various types of foods should be kept separate from each other during storage and preparation. Never store ready to eat foods next to raw eggs, raw meats, or raw fish. Germs from perishable food items may contaminate the ready to eat foods. If cutting boards are used in your kitchen, it is a good idea to use one for meats and a different one for fruits and vegetables. Never use the same knives and utensils for preparing multiple food items unless they are washed before using them on a different item. The knife that was used to cut raw beef should not be used to chop a hard-cooked egg unless the knife has been thoroughly washed first. It is also important to wash your hands often during food preparation to avoid transferring harmful bacteria from one food item to the next. If you were handling raw meat, for example, you would want to wash your hands thoroughly before chopping vegetables to reduce the risk of transferring bacteria from the meat to the vegetables.

Additional Points to Consider Concerning Contamination

- *It is best not to separate egg whites and yolks by splitting open the eggshell and passing the contents between the two shell halves. The egg may become contaminated if bacteria are present on the shell. Bacteria may be present on the shell even after it is cleaned and the shell may also become contaminated from other food sources that it may come in contact with. Do not use the two halves of the shell for removing bits of the shell from an egg mixture and never use the shell halves to measure other foods for a recipe.*
- *Salmonella may be found not only in eggs, but in other foods such as chicken, cheese, orange juice, tomatoes, and alfalfa sprouts. It can be spread quite easily from one food to another, which is why it is important to guard against cross contamination during food preparation.*
- *Cross contamination can occur when bacteria are transferred from one food to another, from contaminated kitchen equipment to food, or from people to food.*
- *The number of incidents of people becoming infected from salmonella in eggs has steadily declined during the past few years. This is due mainly to quality control measures on the farm, in processing facilities, and during shipping to food stores and also because of increased awareness of proper food handling procedures by food service personnel and consumers.*



SOURCES

- o Municipal sewage
- o Pesticides and fertilizers from agricultural fields
- o Sediment
- o Lead pipes
- o "Natural" contamination such as arsenic or radon that occurs in water as a result of leaching or release of the contaminant from rock
- o Spills and leaks of petroleum products
- o Mining waste

EFFECTS

- Pathogens (germs) - make people sick, especially those with weakened immune systems
- Lead- cause brain damage in infants and children
- Trihalomethanes-liver damage
- Arsenic, radon, the rocket fuel perchlorate and other carcinogens or otherwise toxic chemicals

PREVENTION

- Water pipes must be sound and well-maintained
- Preservation of trees
- Lakes, streams, reservoirs and wells must be protected from pollution
- Modern treatment facilities are a must
- Legislation

Contaminants in Beverages

Presented by
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PESTICIDES IN BEVERAGES

12 major cold drink brands contain a prominent environmental organization based in New Delhi. deadly cocktail of pesticide residues.” Mirinda lemon was named as the drink with the highest levels of pesticides.

Down To Earth, an Indian Science and Environment magazine has found that 12 major cold drink brands sold in and around Delhi contain a deadly cocktail of Pollution Monitoring Laboratory (PML) of the Center for Science and Environment (CSE).

Laboratory Tests Alarming

A total of 36 soft drinks samples of 12 brands were tested for 16 organochlorine pesticides, 12 organophosphorus and four pyrethroid pesticides most commonly used in India

Market leaders Coca-Cola and Pepsi had almost similar concentrations of pesticide residues. Total pesticides in all PepsiCo brands on an average were 0.0180 mg/l (milligramme per litre), 36 times higher than the EEC limit for total pesticides (0.0005 mg/l). Total pesticides in all Coca-Cola brands on an pesticide residues. The results are based on tests conducted by the Polluaverage were 0.0150 mg/l, 30 times higher than the EEC limit.

While contaminants in the 'Dil mange more' Pepsi were 37 times higher than the EEC limit, they exceeded the norms by 45 times in the 'Thanda mat lab Coca-Cola' product.

Mirinda Lemon topped the chart among all the tested brand samples, with a total pesticide concentration of 0.0352 mg/l. PML also tested two soft drink brands sold in the US, to see if they contained pesticides and found that they did not have them.

Laboratory Tests Alarming

All samples contained residues of four extremely toxic pesticides and insecticides: lindane, DDT, malathion and chlorpyrifos. In all samples, levels of pesticide residues far exceeded the maximum residue limit for pesticides in water used as 'food', set down by the European Economic Commission (EEC). PML also tested two soft drink brands sold in the US, to see if they contained pesticides and found that they did not have them.

Supply Of Water

Ground Water is extracted

The use of land for agriculture and the practices followed in cultivation greatly affect the quality of groundwater

Intensive cultivation of crops causes chemicals from fertilizers (e.g. nitrate) and pesticides to seep into the groundwater, a process commonly known as leaching

The high nitrate content in groundwater is mainly from irrigation run-off from agricultural fields where chemical fertilizers have been used

➤ Supply of water

- Most detergents and washing powders contain phosphates,
- The various substances that we use for keeping our houses clean add to water pollution as they contain harmful chemicals
- Waste water from manufacturing or chemical processes in industries contributes to groundwater pollution.

HOW TO CONTROL-CONTAMINATION

- Rules & Regulations should be strict
- Chemical Industries should install proper effluents treatment facilities
- Minimizing the use of chemical fertilizers
- The individual and the community can help minimize

