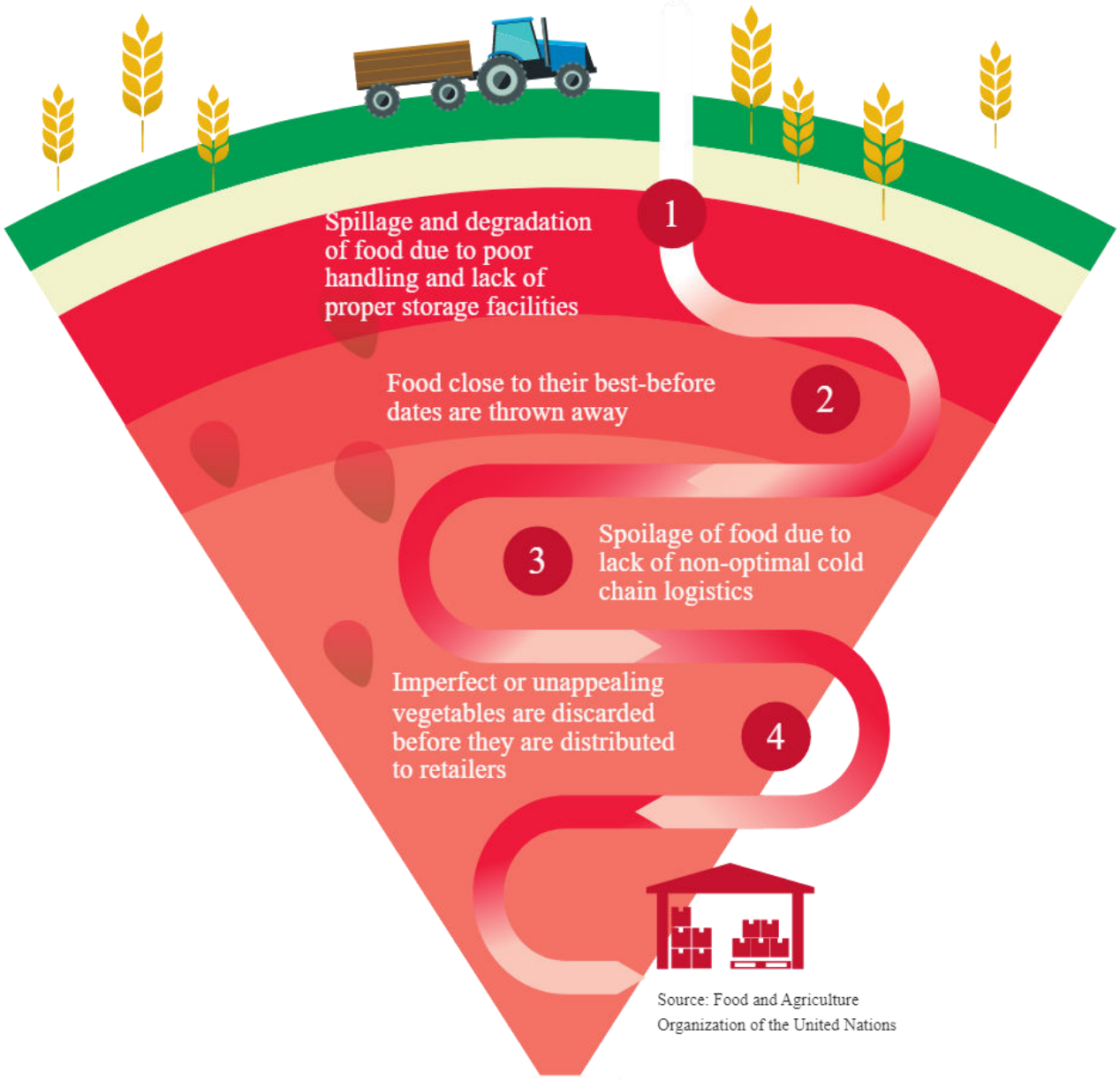
Minimizing of Transport Losses

INTRODUCTION

- The global food supply chain faces significant challenges as a result of population and environmental pressures.
- With the global population predicted to rise from 7 to 9 billion by 2050.
- The supply of food will need to increase by an estimated 77% compared with that in 2007.
- This challenge is compounded by the diminishing availability of both productive agricultural land and clean water, which is influenced by salinity, drought, floods, climate change and competing land uses.
- It is estimated that around 40% of all food intended for human consumption in developed countries end up as waste.

How to minimise food loss during storage and transportation



Source: Food and Agriculture Organization of the United Nations

S4S Technologies: Prolonging the shelf life of food

Around 30 per cent of fruits and vegetables is wasted due to lack of proper storage and handling, delays during the transportation and distribution stages. Indian company S4S Technologies addresses food loss at the start of the food supply chain so that overall waste can be minimized.

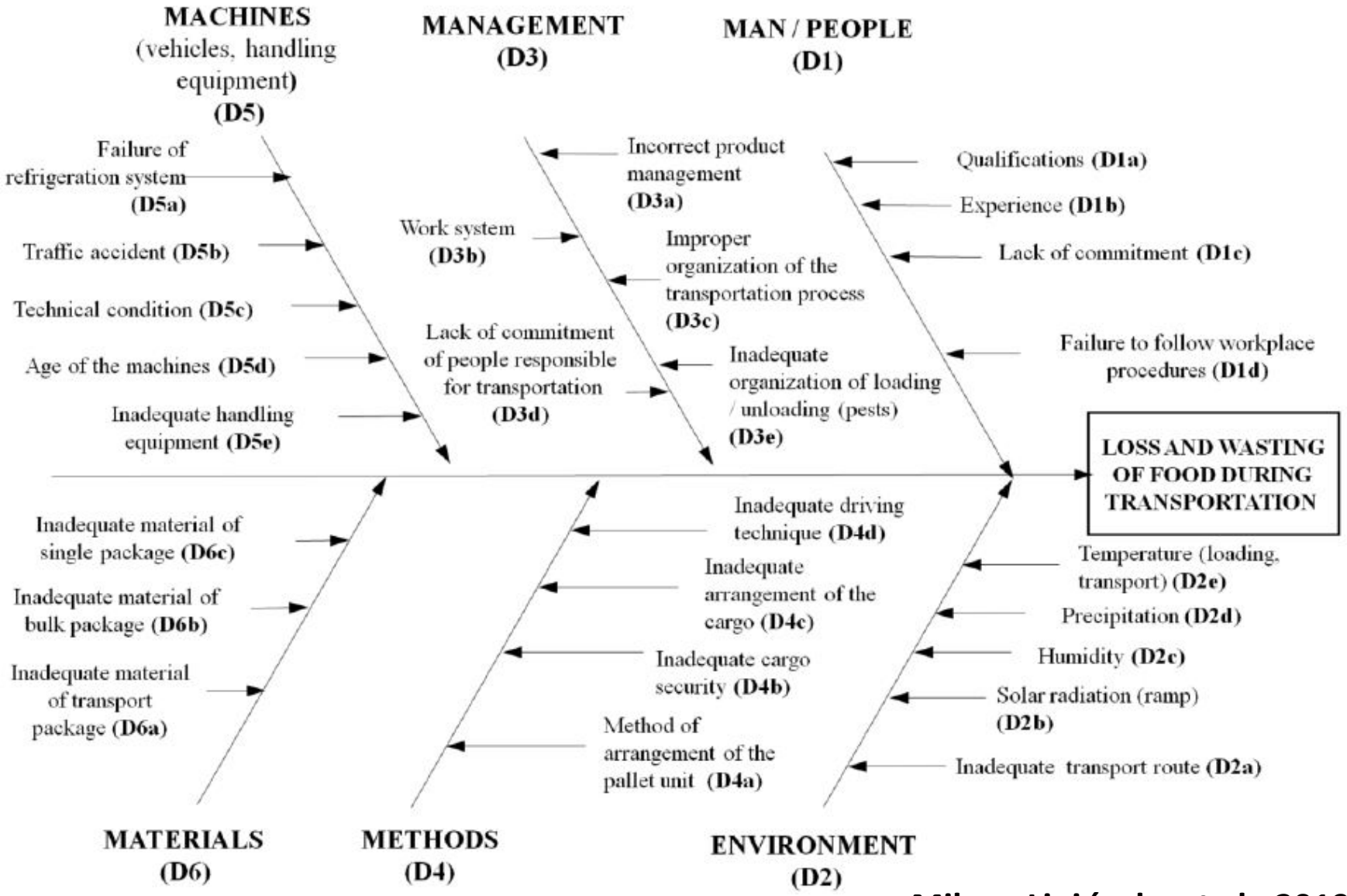
Solar Conduction Dryer

The **DBS (Development Bank of Singapore) Foundation** Social Enterprise Grant Awardee invents and operates food processing machines that dehydrate perishable fruits and vegetables to increase their shelf life to one year without the use of chemicals or preservatives reducing farm losses to less than 5 per cent.

Kee Song: Delivering freshness with its own fleet

As one of the major **poultry suppliers to Singapore's supermarkets**, wet markets, food manufacturers and major online retailers, Kee Song Food Corporation invested in 20 freezer-equipped delivery trucks in addition to a fleet of chiller equipped delivery trucks to ensure that its products, which include frozen and fresh chicken, reach clients at optimal freshness.

Factors affecting losses during transportation



Milena Lipi ´nska et al., 2019

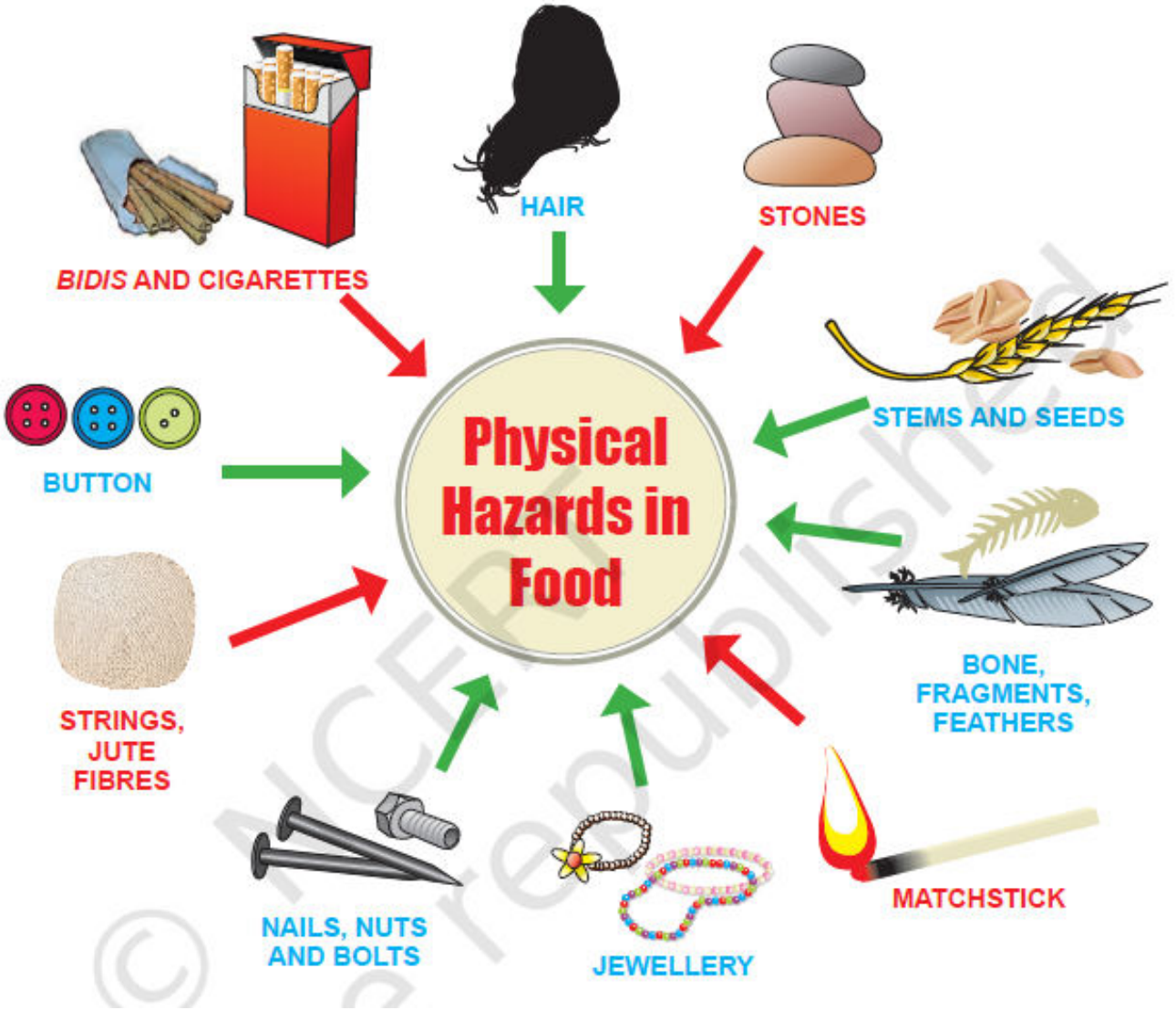
Hazards in handling and storage and their minimization

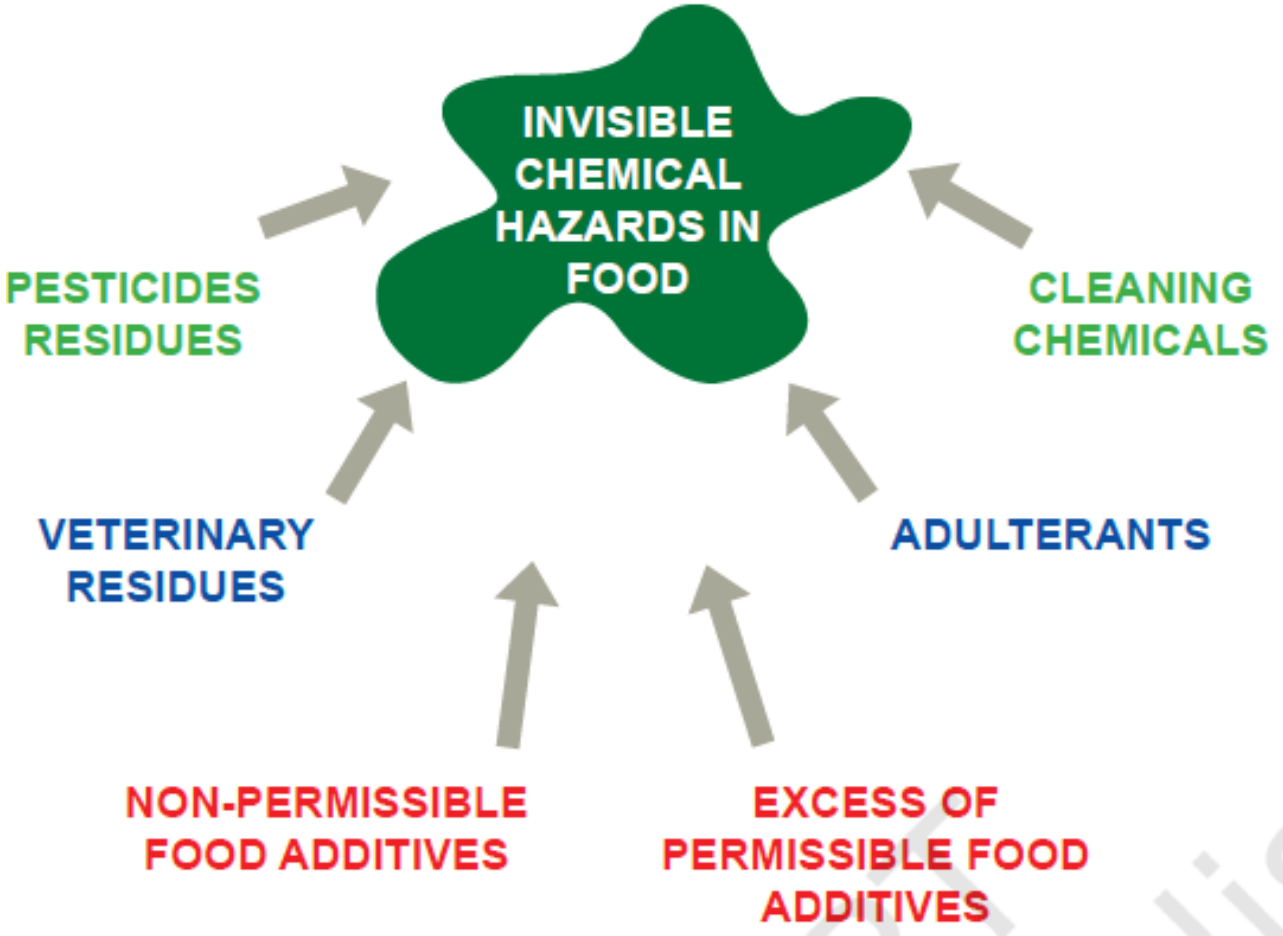
Basic Concepts

Food Safety: Food safety means assurance that food is acceptable for human consumption according to its intended use.

- An understanding of food safety is improved by defining two other concepts- toxicity and hazard.
- **Toxicity** is the capacity of a substance to produce harm or injury of any kind under any conditions.
- **Hazard** is the relative probability that harm or injury will result when substance is not used in a prescribed manner and quantity.
- Hazards can be physical, chemical and biological causing harmful / adverse effects on the health of consumers.

Physical hazard is any physical material not normally found in food, which causes illness or injury and includes wood, stones, parts of pests, hair etc.

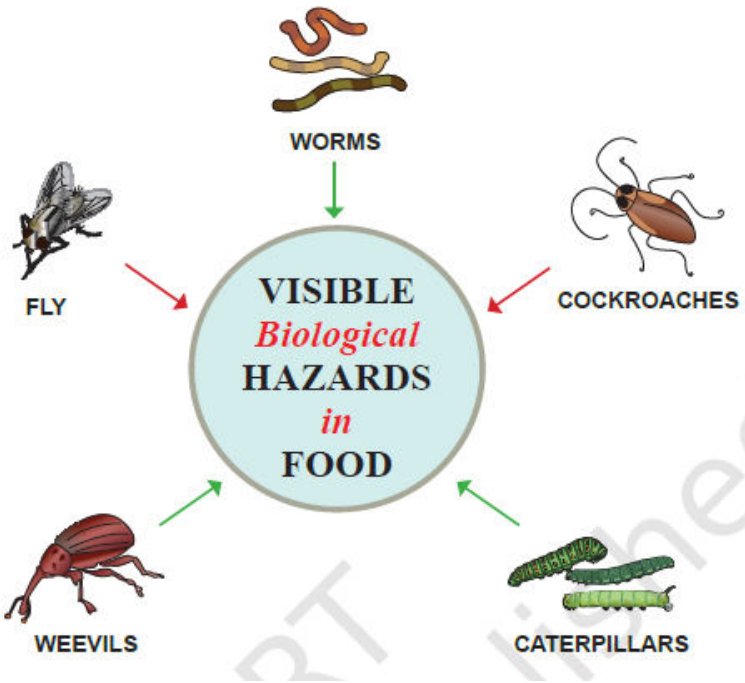


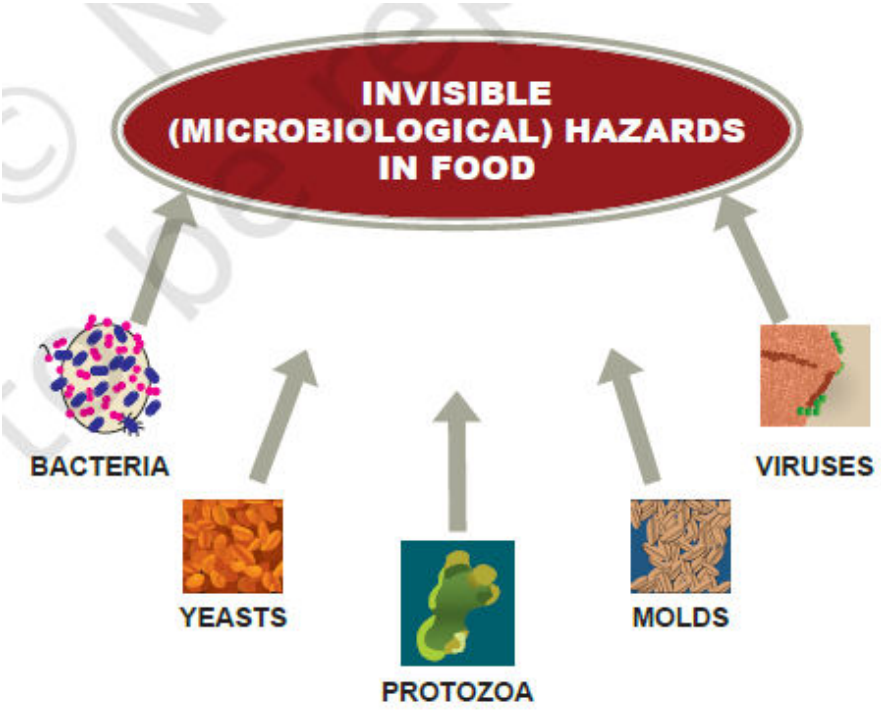


Chemical hazards are chemicals or deleterious substances which may be intentionally or un-intentionally added to foods. This category of hazards includes pesticides, chemical residues, toxic metals, polychlorinated biphenyls, preservatives, food colors and other additives.

Biological hazards are living organisms and include microbiological organisms. Those micro-organisms which are associated with food and cause diseases are termed food-borne pathogens. There are two types of food-borne diseases from microbial pathogens-

- Infections and
- Poisoning.





Food infection /Food Poisoning

- Results from ingestion of live pathogenic organisms which multiply in the body and cause disease. ***Salmonella*** is a classic example.
- This organism exists in the intestinal tract of animals. Raw milk and eggs are also sources.
- Heat destroys *Salmonella*, however, inadequate cooking allows some organisms to survive.
- This could happen when a cook cuts raw meat/poultry on a chopping board and without cleaning.
- *Salmonella* can reproduce very quickly and double their number every 20 minutes.
- The symptoms of *Salmonella* infection include diarrhea, fever and abdominal cramps.

Food intoxication

- Some bacteria produce harmful toxins which are present in food even if pathogen has been killed.
- Organisms produce toxins when the food has not been hot enough or cold enough.
- Toxins in food cannot be detected by smell, appearance or taste. Hence foods which smell and appear good are not necessarily safe.
- One example of such an organism is ***Staphylococcus aureus***. Such organisms exist in air, dust, water. They are also present in the nasal passage, throat and on skin, hair of 50 % of healthy individuals.
- Diarrhea is also one of the symptoms of this contamination.

In the context of food safety, it is important to understand the terms contamination and adulteration.

Contamination: It is the presence of harmful, or objectionable foreign substances in food such as chemicals, micro-organisms, dilutants before/during or after processing or storage.

Adulteration: Food adulteration is the process in which the quality of food is lowered either by the addition of inferior quality material or by extraction of valuable ingredient. It not only includes the intentional addition or substitution of the substances but biological and chemical contamination during the period of growth, storage, processing, transport and distribution of the food products. It is also responsible for lowering or degradation of the quality of food products.

Adulterants: are those substances which are used for making the food products unsafe for human consumption.

Control and minimization of Hazards

Controlling Physical Hazards

Corrective actions

- Risk awareness
- Preventative maintenance (schedule and perform)
- Quality control
- Sanitation and housekeeping
- Inspection (visual, x-ray, metal detection)
- Audits

Controlling Biological Risk

- Implement, control and maintain a reliable pest control plan. Understand it and challenge the provider for explanations. Read, understand and react to the reports. Demand detail.
- Choose qualified and certified providers (labs, microbiologists, pest control, etc.) or the well-known franchise.
- Fully understand where and how microbial and pathogenic contaminations occur. Implement practical preventative measures.
- Monitor all areas and processes within your facility for microbiological contamination.
- Training is a valuable tool against risky practices. Develop and execute best practices and risk-control employee training.

Controlling Chemical Hazards

- Verify quality of incoming chemical and polymeric materials through visual, sensory and analytical testing.
- Consider a random audit program for direct contact materials, especially those sourced from increased risk supply chains.
- Implement and validate an effective plan based on internal and external risk analyses.
- Perform frequent internal audits of the plan and processes. Perform mock incidents to evaluate responses and corrective actions.

Controlling Hazards: Rigid Containers

Microbiological

- Microbiological laboratory analysis of incoming resins, coils, preforms and body stock.
- Do not assume that conversion is an absolute kill step.
- Maintain a practical, reliable, facility-specific internal micro sampling plan

Chemical

- Verify composition of chemicals, additives, adhesives, coatings and inks.
- Implement and verify strict control, storage, usage and testing of contact chemical-based materials.
- Audit raw materials and finished products including laboratory analysis, ccontrol and audit supply chain.

Physical

- Proper inspection and maintenance of conversion equipment.
- Audit finished packages for sharp seams/seals and surface protrusions.
- Maintain and inspect extruders, molds and nozzles.
- Metal detection or high-speed camera inspection where possible.
- Implement safety procedures and appropriate process control for glass.

Controlling Hazards: Flexible Films

Microbiological

Maintain a practical, risk-based micro-evaluation program for facility, process and materials

Chemical

- Carefully control and analyze adhesives, inks and other liquid chemical- based conversion materials
- Carefully monitor ink and coating application and curing with strict adherence to manufacturer instructions and guidelines
- Strict control of sanitation and process control.
- Audits, sampling plans, sensory and laboratory analysis of films and resins
- Analysis of embedded active compounds for adherence to spec limits.

Physical

- Frequent inspection of finished rolls and process equipment.
- Wear-part change outs at required intervals.