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RESEARCH ARTICLE

CHEMICAL (NON-BIOLOGICAL) CONTAMINANTS IN FOOD AND THEIR MOVEMENTS IN FOOD CHAIN

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Abstract

Food contamination may be a global food safety issue. There are many potentially toxic substances within the environment which can contaminate foods consumed by people. A circular food system is one within which waste material is processed to recover plant nutrients and returned to the soil to enable the assembly of more food, instead of being diverted to landfill or incineration. The approach could also be accustomed reduce energy and water use in food production and contribute to the sustainability of the system. this text brings together information on several chemical contaminants at different stages of the food supply chain, their possible sources. the most aim is to spot factors that might impede the transition towards a secure, reliable and efficient circular food system.

Introduction:-

Food Safety is increasingly viewed as a vital public health issue within the developed and developing countries. The rapidly changing and globalizing food economy and also the concerns and commitments of a large range of stakeholders about food production and security, food safety and quality, and also the environmental sustainability of agriculture have prompted international organizations to determine standards for the safe production of fresh crops that may be safely consumed. Fertilizers, agrochemicals and pesticides, when utilized in higher quantities than needed, become contaminants to food, feed and environment. Ayurvet Research Foundation (ARF) a public public trust, undertakes various initiatives for the sustainable integration of livestock and agriculture for the good thing about farmers and society at large. Major interventions of the Organization's are conducting research within the areas of food safety, agriculture, hydroponics, AMR, animal health and nutrition, medicinal plants, soil and water health, waste to wealth management etc. Study was undertaken to collect information on several chemical contaminants at different stages of the food supply chain, their possible sources.
The chemical contamination of food has emerged as a significant concern with potential health hazards in their wake. Majority of the food contamination occurs through present toxins and environmental pollutants or during the processing, packaging, preparing, storage, and transportation of food. a couple of third of the food produced globally goes to waste every year [1]. This loss is fundamentally unsustainable thanks to the water, energy and material consumption required for the assembly, processing, storage and transport of food that's not productively used [2]. The waste matter management hierarchy puts reuse because the preferred option if food continues to be qualitatively adequate for human consumption, meaning excess food should be diverted to people that need it, whenever feasible [3]. The U.S. Department of Agriculture estimated that 11.8 percent, or 15 million households,

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had problems providing enough food in 2017 [4]. When excess food at any stage of the food system can't be diverted to people in need, the following most suitable choice is to feed it to animals. Even with the simplest systems in situ to develop an efficient food system, there'll always be some fraction that's not acceptable consumption. This material should be recycled and reused to reduce the environmental burden and permit for recovery of a part of the resources initially utilized in its production, processing and transport [5], creating a more circular food system.

There are three differing types of food contamination - chemical, physical and biological. All foods are in danger of becoming contaminated, which increases the prospect of the food making someone sick. Chemical contamination includes inorganic and organic substances and should originate from a large range of sources (Figure 1 shows the pathway of contaminants through the environment).

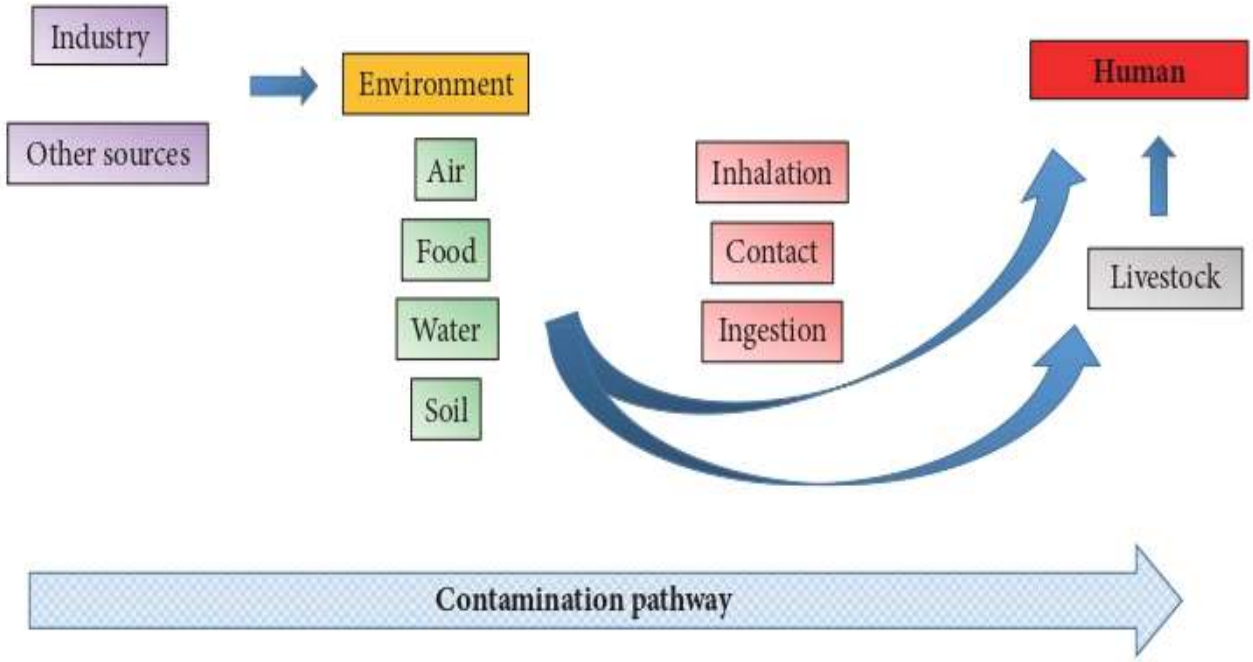

FIGURE 1: Sources of environmental contaminants in human foods.

Chemical contamination

Chemical contamination refers to food that has been contaminated by some kind of chemical substance. Because chemicals may be very useful when cleaning within the kitchen or for other purposes, they will easily contaminate food. There are chemicals that occur naturally in foods, like toxins in some fish, and in some cases, minimal chemical contamination may not actually result in illness. However, the food handler should always remember of the presence of chemicals in food and take all reasonable precautions to create sure that chemical contamination doesn't happen. Figure 2 shows Food system with possible sources of chemical contamination within the food chain).

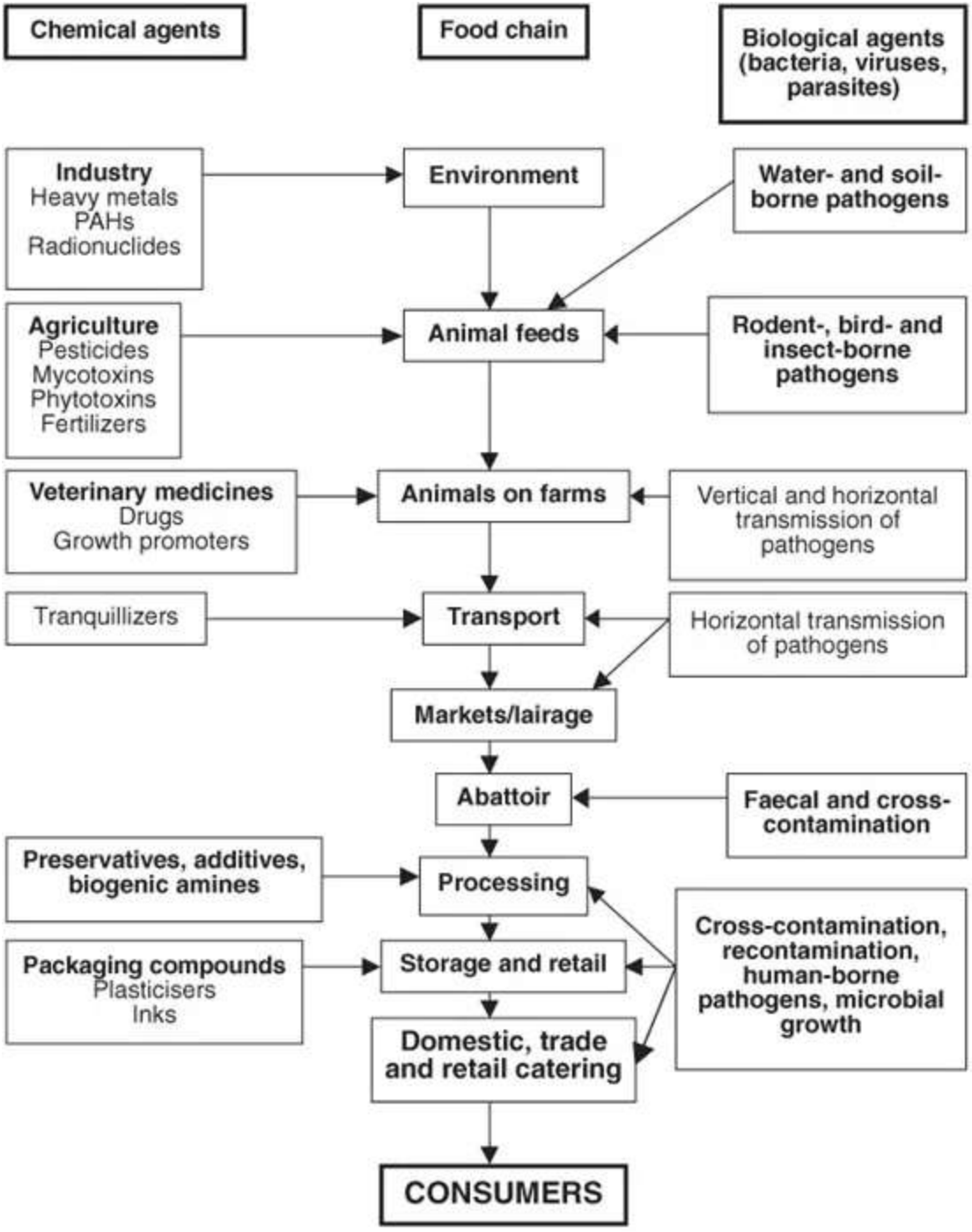

Fig. 2:- Food system with possible sources of chemical contamination in the food chain.

Chemical Contamination of Food: - There are following sorts of chemical contamination in food.

Industrial chemicals

Industrial chemicals and cleaning products include detergents, sanitizers and other chemical products that use for analysis or other purpose. Some industrial chemicals like Acrylamide, Benzene, Chloropropanols, Ethanol, Ethyl carbamate, Furan, Heterocyclic aromatic hydrocarbons, Nitrosamines, Polycyclic aromatic hydrocarbons (PAH's),Semicarbazide are use for food processing.

Agricultural chemicals

Agricultural chemicals include herbicides, pesticides and fertilizers that will be present on fruit and vegetables. Always wash fruit and vegetables – whether or not the item contains a cutis or rind, we are still at risk of transferring chemicals from the skin to the within once we take the merchandise. Chemical contaminants within the agricultural industry include a spread of compounds. they will be found in fertilisers applied to crops, pesticides and herbicides used for weed and pest control, and antibiotics and steroid hormones for animal health and growth. Chemical contaminants may eventually make their way into an adjacent waterway through direct application, by spray drift, or via wastewater discharges from effluent ponds and surface runoff from the land. the utilization of chemicals can have long run effects on water quality. Decreased dissolved oxygen (DO) levels.

Preservatives

Preservatives are ingredients added to food to form it last longer or taste better. Example preservatives include sulphites in wine and nitrates utilized in meat. Adding an excessive amount of preservative to a food may be harmful to human health. High concentration of chemicals present within the edibles poses serious health risks.

Present toxins

Naturally occurring chemical toxins are chemicals that are produced or contained naturally within shellfish, seafood or plants. These toxins might not cause any harm to the organism that produces them but will be harmful to humans. Naturally occurring chemical toxins are chemicals that are produced or contained naturally within shellfish, seafood or plants. These toxins might not cause any harm to the organism that produces them but may be harmful to humans. Paralytic Shellfish Poisoning is an example of an illness caused by consuming a present toxin.

Heavy metals

Heavy metals are conductive elements having a density greater than, 4.5 g/cm3 [6]. Some heavy metals are essential micronutrients with beneficial impacts on growth as long as their con- centrations remain low, however at high concentrations, heavy metals are toXic to plants, animals and humans [7].In aquatic systems, heavy metals are redistributed throughout the water column and sediment, and should accumulate in fish and other edible aquatic biota [8]. Likewise, in terrestrial systems, contaminants may be absorbed and accumulate in edible and non-edible plant tissues during growth. Cadmium (Cd) is very mobile, poorly adsorbed to soil and phytoavailable. Baked cod, pan cooked boeuf, pan cooked liver (beef/calf), and canned tuna were the foods with the very best heavy metal concentrations.

Halogenated compounds

Organohalogenated contaminants are usually synthetic organic chemicals with one or more halogens (chlorine, bromine, iodine and fluorine) substituted for hydrogens within the molecule. Many halogenated compounds are classified as persistent organic pollutants or POPs. POPs are immune to environmental degradation (chemical, biological and photolytic) and thus have a protracted half-life [9]. samples of POPs include esticides like organochlorine pesticides (OCPs), industrial chemicals like poly- brominated diphenyl ethers (PBDEs), and hexabromocyclododecane (HBCD), and by-products of business processes, like dioXins and furans. These contaminants are persistent and ubiquitously present within the environment [10], and plenty of are related to endocrine disruption, cancer and other toXic impacts [11].

Pesticides

Pesticides are chemicals that prevent insects, weeds, and fungi from damaging crops. Farmers use them to extend the quantity of crops they're ready to produce. Exposure to large quantities of a pesticide may cause poisoning. Symptoms of poisoning may appear immediately or after some hours [12]. There are quite 1000 pesticides used round the world to confirm food isn't damaged or destroyed by pests. Each pesticide has different properties and toxicological effects. Many of the older, cheaper (off-patent) pesticides, like dichlorodiphenyltrichloroethane (DDT) and lindane can remain for years in soil and water. These chemicals are banned by countries who signed the 2001 Stockholm Convention – a global treaty that aims to eliminate or restrict the assembly and use of persistent organic pollutants [13]. The toxicity of a pesticide depends on its function and other factors. for instance, insecticides tend to be more toxic to humans than herbicides. the identical chemical can have different effects at different doses (how much of the chemical someone is exposed to) [14]. Adverse effects from these pesticides occur only above a specific safe level of exposure. When people get contact with large quantities of pesticide, this could cause acute poisoning or long-term health effects,

including cancer and adverse effects on reproduction. Pesticides are among the leading causes of death by self-poisoning, specifically in low- and middle-income countries [15].

Prevention and control

There are various regulations to manage the amount of several chemicals within the food. Unhealthy additives and adulterants are legally not allowed to be used. However, effective surveillance and response systems are required to stop chemical hazards from entering the food supply and posing harm to the health. The FDA prescribes the minimum levels of chemicals that are allowed in food, like pesticide concentration shouldn't go on top of the limit assigned .Sometimes errors should still occur in following the determined concentration and guidelines. Some countries are highly obsessed on agriculture, leading to high levels of pesticides seeping into the contaminating of food. Non-regulated chemicals are of specific concern and more research has to specialise in contaminants that escape human detection. Also, individual consumer concerns are essential as they will play a fundamental role in managing their health. Moreover, the recognition and widespread use of internet also allow consumers to hunt information online and reduce the health risks related to food contamination incidents. Furthermore, the general public have to keep a healthy degree of skepticism about the contaminated food products and avoid consuming the accused food products until scientific evidence justifies immediate action.The food industries must accept the necessity to be more honest and upfront in producing safe commercial food products still as protecting the general public from food contamination.

Conclusion:-

The above review presents the sources of several classes of contaminants that can enter our food system. Each stage of the food system has unique contamination sources and mechanisms. Our review of the available literature produced the following insights:

1. Heavy metals were largely introduced at the production stage, although processing and packaging were also significant sources of some metals for some foods. Metals can persist and increase in concentration in the final products from treatment systems, while their mobility decreases.
2. For halogenated organics, the production stage produced the highest level of contamination for PCBs, PBDEs, DDT, PFOA and PFOS. Some may also be introduced in packaging and from food contact papers. Many persist in the final products of the treatment system. While the diversity of this class of contaminants and differences in chemical properties prevent broad generalizations about their fate during processing and treatment, the potential for many of these compounds to persist and bioaccumulate inherently represents a risk to any food system.
3. Pathogens are largely introduced during the processing stage for meat products, and the production stage for vegetables. Handling at retail and consumer sites can also introduce pathogens. Thermo-philic temperatures effectively kill pathogens during treatment. However, high temperatures must be reached throughout the compost pile, and operation of AD systems in this temperature range can be unstable.
4. Consumers can further limit their intake of pesticide residues by peeling or washing fruit and vegetables, which also reduces other foodborne hazards, such as harmful bacteria.

Repeated land application of treated food waste residuals can result in accumulation of contaminants if they are present in the feedstocks. Contaminants can be taken up by plants and accumulate in a circular food system, jeopardizing its safety. Thus, contamination at any stage represents a threat to the system as a whole. To maintain a sustainable circular food system, careful management of the system is needed to reduce the level and frequency of contamination of food, and research into the fate of contaminants during treatment, methods for simple, inexpensive and accurate monitoring, and policy options to protect the system are needed.

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