Conceptual Editorial

Food Processing and Pesticide Residues

Food is a basic need of life and its contamination with toxic contents of pesticides is associated with severe effects on the human health. Food safety is globally an area of growing concern due to its direct bearing on human health. The basic needs for food safety are the implementation of Good Agricultural Practices (GAP) and Hazard Analysis Critical Control Points (HACCP), especially for processed produce. Post-harvest operations like storage, drying, processing, packaging, transportation, marketing etc., effect the quality and safety of the food items. During my entire research span, the focus has been on pesticide residues in various food crops, effect of processing and decontamination processes. Some of my experiences based on through research have been shared here.

Food processing including the value addition at domestic and industrial level, offers a suitable means to reduce pesticide residues. Storage as well as household and industrial food preparation processes alter pesticide residues by chemical and biochemical reactions (hydrolysis, oxidation, microbial degradation) and physico-chemical processes (volatilization, absorption).

Food processing *viz.* baking, bread making, dairy product manufacture, drying, thermal processing, fermentation, freezing, infusion, juicing, malting, milling, parboiling, peeling, peeling and cooking, storage, storage and milling, washing, washing and cooking, washing and drying, washing and peeling, washing peeling and juicing and wine making play an important role in the reduction of pesticide residues.

The pesticide residue dissolution may take place during the washing of fruits and vegetables, vinification and boiling, and it is mainly related with the water solubility of the pesticide. Pesticides undergo thermal degradation, vaporization, hydrolysis, polymerization and other reactions upon heating. The degree of pesticide residues penetration into a raw commodity affects its fate further during raw commodity storage, washing, peeling, and drying. Pesticide residues elimination through photo-degradation may occur during food processing like sun drying of fruits and UV irradiation during post-harvest preservation processes. The loss of water during the storage, cooking and drying of raw commodity raw commodity may lead to increase in pesticide residue concentration in the stored or processed commodity. The removal of pesticide residues by washing of raw commodity is achieved through the dissolution of pesticide residues in the running tap water or the rinsing with chemical like detergents, alkaline, acid, hypochlorite, metabisulfite salt, ozonated water etc.) but also through the removal of dust or soil particles adhering to the fruit surface.

Comminution of vegetables through chopping, blending, crushing and similar processes generally do not change the status of pesticide residues but acid sensitive pesticide compounds like ethylene bis-dithiocarbamate (EBDC) fungicide are of great concern as these are easily degraded to the toxic metabolites like Ethylene Thio Urea (ETU), carbon disulphide and ethylenediamine in slightly acidic media like tomato.

The largest reductions in residue levels (70-100%) of almost all the common classes of pesticides are through peeling, juicing, alcoholic beverages production, cooking and the lowest through washing (22- 60%) with tap water. The different drying processes have different effects on pesticide residues on raw commodities and sun light additionally photo degrade pesticide residues.

These processes though, leads to the reduction of any residues left on crops at harvest yet in special cases pesticide residues may concentrate in the final product e.g. production of dry fruits and unrefined vegetable oil or parent compound may be transformed to more toxic compound on raw crop e,g. conversion of methyl parathion to methyl paraoxon. This suggests that effects of post-harvest practices and food processing should also be taken into account on the fate of a pesticide residue during dietary exposure assessments to ensure consumer safety from pesticide residues.

Maximum Residue Limit (MRL) or Tolerance is the maximum concentration of a pesticide residues that is legally permitted in or on a food commodity after following Good Agricultural Practices as set by CODEX or a national regulatory authority. In India, with the implementation of Food Safety and Standards Act (FSSA) 2006, the Prevention of Food Adulteration (PFA) rules are being phased into the Food Safety and Standards Regulations, 2010. The new act authorizes the Food Safety and Standards Authority of India (FSSAI) to specify the limits for use of food additives, crop contaminants, pesticide residues, residues of veterinary drugs, heavy metals, processing aids, mycotoxins, antibiotics and pharmacological active substances and irradiation of food.

Determination of processing effect on pesticide residues is very important for determining fate of residues and possibility of their occurrence above MRL in the final product, although CODEX and FSSAI had established MRLs in most of the raw commodities. However, MRLs for processed and ready to eat food are very rare. Therefore, the importance lies mainly with the processed commodities where pesticide residues could be concentrated upon processing. This situation can be solved by applying processing factor to the specified MRL of pesticide in raw commodity. Processing factor is the ratio of the residue level in processed commodity to the residue level in raw commodity ready for processing. The future research is likely to address many of the research gaps discussed here.

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