CHAPTER 9

GENERAL DISCUSSION
Information on type of adulterants that are used are available especially by way of popular articles and books (Jacob, 1976, Chadha, 1989, Sengupta and Baru, 1994) as well as from the official statistics (Anon, 1992d). However, authentic information on the subject is difficult to find out in the Indian context. It is in this direction an attempt was made to elicit information from the analysts who had considerable experience in food analysis. The response to the questionnaire was satisfactory from southern region compared to northern states, perhaps this indicates the extent of state of art of the implementation of prevailing food laws currently vogue in India.

The exercise carried out has brought out three major attributes of food adulteration in India. For the first time high risk commodities for adulteration have been scientifically identified. These include edible oils, spices and milk. A comprehensive list of individual foods and adulterants detected in each one of them has emerged from the present study (Table - 3.3). Based on the exercise carried out during the present study it is now possible to classify adulterants in the following five categories:

1. Coaltar dyes,
2. Cheaper agricultural produce including cheaper oils,
3. Chemical additives
4. Various extraneous matters ranging from chalk to colophony resin
5. Environmental contaminants such as mycotoxins. Metal contaminants, pesticide residues as well as veterinary drug residues (Table - 3.4).

Although attempts have been made earlier to indicate the various adulterants in foods (Jacob, 1976, Chadha, 1989) above systematic grouping of the different class of adulterants has emerged from the present study. Such a classification would be of considerable interest for both consumers who are becoming increasingly aware of their rights and the food control authorities who enforce the legislation and the trading community in understanding the problem of food adulteration.

During the recent years the trend all over the world had been to give priority for various environmental contaminants such as aflatoxins and pesticide residues (Bhat, 1991). However, in Indian context the traditional prevention of food adulteration act has been laying emphasis on quality parameters and detection of adulterants such as Argemone, castor etc. (Anon, 1992a). The unscrupulous traders in India, in order to escape the mandatory regulations have been resorting to newer forms of adulteration. The infrastructure that are available in food control laboratories of state, who by law have been provided with responsibility of overseeing the implementation of PFA Act are not sufficient to deal with the fresh challenges. In addition due to technological advances and changing
environmental conditions new adulterants are likely to be encountered in food. It is in this context an attempt was made to find out the newer adulterants/contaminants that are of contemporary relevance.

During the period of study several newer adulterants were identified, which include *Lens esculenta* (from Turkey), *Vicia sativa* (from Australia), indigenous *Leucaena leucocephala*, veterinary drug residues, ultramarine blue orthonitro aniline etc.

In order to identify a newer adulterant a variety of approaches such as (1) taking valuable experience of the analysts working in the State Food Laboratories (2) Scanning the technical enquiries received from consumers (3) scanning the newspaper reports (4) and investigating the foodborne diseases, were followed. It was found that a combination of these rather than a single approach is essential to detect new adulterant. This calls for a continuous interaction between the various State Food Laboratories and the research laboratories in order to identify newer food adulterant.

The detection of newer adulterants are not only important from domestic trade point but also have repercussions in the international trade. The instance of importing to India from Australia the toxic weed *Vicia sativa*, misbranded as Australian lentil/split 'blench fleur' red legume, red dhal/red lentil, testifies such an apprehension. The regulatory authorities need to be armed
with appropriate methods for the detection of such newer adulterants besides having a data base (Bhat and Raghuram, 1992, Bhat and Raghuram, 1993). That constant vigilence is needed is exemplified the fact that the Indian traders tried to dispose of the Australian red lentils after processing. The processing was essentially meant to change the colour of the *Vicia sativa* samples from red to yellow. The experiments carried out by subjecting the red lentil to pressure cooking without water indicated that the red colour of the sample was changed to yellow much more resembling red gram dhal. It was possible to identify the adulterant only because of the detection of β-cyanoalanine.

In the newer world economic order where there is increase of international trade the detection of newer adulterants gets greater importance in view of the facts that often developing countries are used as dumping grounds for disposing of substandard or inferior quality foods (Tate and Enking, 1992).

A food item that has been considered as a part of normal dietary in particular country when exported to another country who are not aware of the cultural practices associated with that particular food could consider it as newer adulterant. Lentils are such examples. Although the lentils are used since time immemorial as part of the diet in mediterranean region specially in Turkey. They are supposed to have caused foodborne illnesses in certain
individuals (Sulser & Sager, 1976). Lentils contain an unusual toxic amino acid. The traditional cultural practice in Turkey involves boiling the pulse in the water and discarding excess water may be to render it nontoxic. However, when such a pulse exported to another country like India where the existing cultural practice do not allow the discarding of water thereby retain the toxin as such with pulse would lead a red/yellow lentil branded as a newer adulterant.

Abundant, easy and free availability of certain seeds like Leucaena leucocephala a plant rechristened as 'subabul' and aggressively propagated because of certain desirable agronomic properties is a tempting factor for the seed powder to be used as newer adulterant. Here again an indepth knowledge of the plant, its unusual cconstituents is essential to detect it as an adulterant with bengal gram (Cicer arietinum) flour which is consumed normally in India.

All the food commodities sold within India should conform to the quality parameters prescribed under the prevention of Food Adulteration Act Appendix B specifications. These quality parameters were made with the intention of protecting the consumers from health hazards arising out of adulteration. However, the quality parameters may not be sufficient to safeguard the health of the consumers. This point has been highlighted by the major foodborne disease outbreak reported from Kashmir, which
caused due to consumption of foods prepared from adulterated wheat flour (Bhat, et al. 1987). At present as per prevention of Food Adulteration Act only primary agricultural commodities are screened for fungal contamination, while for the processed products like atta (wheat flour) maida (refined wheat flour) no standards are fixed.

This highlights the need for prescribing quality parameters even for fungal contamination in processed products. The present study to explore the possibility of specifying the quality parameters has found that the presence of ergosterol in the food samples indicates either the adulteration with fungal contaminated raw material or fungal contamination. As such this could be included as one of the quality parameters under prevention of Food Adulteration Act.

Rheological properties of wheat dough are important quality parameters to check suitability of wheat flour for particular food product like bread, biscuit or cookie. The present study indicates for the first time that the rheological properties of wheat dough in combination with Ergosterol detection could prove as a useful method for detecting the newer adulteration of making flour with admixtures of fungal infected wheat with good wheat. This instance highlights the need for newer approaches in developing methods for newer adulteration.
Apart from major foodgroups like cereals and pulses, spices were also found to contain newer adulterants. The study has identified ultramarine blue as the newer adulterant in dry ginger. It is being used to pass off inferior quality dry ginger as good one by enhancing the physical appearance. Ultramarine blue is an inorganic dye and it is known that inorganic dyes like copper sulphate lead chromate are harmful when ingested. However, there are no reports implicating the use of ultramarine blue in food commodities. For the first time the study indicated that significant proportion (94%) samples analysed were adulterated.

Ultramarine blue was reportedly used as food colour (Budavari, 1989) earlier but presently permitted in salt meant for animal consumption in USA (Marmion, 1984). Although no toxicological evidences are available to indicate its toxicity, studies need to be undertaken to generate data and till that time care need to be taken not to allow its usage. It is pertinent to mention here that although the matter was placed before JECFA (WHO, 1978) it was not taken for discussion because of lack of information of its use as food colour. Since now definite evidence has been provided for its usage in foods there is a need to evaluate the ultramarine blue for acceptable daily intake.

The use of silver foils for decorating the sweetmeats in India has been practiced for long. High price of silver
has lead to the replacements of silver foils by aluminium foils. The market survey carried out in Hyderabad indicated that 20% of the foils sold in market were indeed aluminium foils. A survey on use of foils in sweets indicated that about 16% sweets were having aluminium foils. The amount of aluminium per gram sweet varied from 10 ug to 69 ug.

The role of aluminium in the causation of Alzheimer's disease and in people suffering from kidney problems has been well documented (Klein, 1990). The significance of aluminium in such conditions is obvious. The usage of aluminium foils in other foils such as Betal leaf (pan), small balls of supari, tobacco etc. are on the increase hence a vigilence need to be kept in this front.

The various modern industrial processes bring its own hazards in the field of contamination. An accidental contamination encountered during the course of study period points the newer hazard. In a vanaspati manufacturing unit due to a minor breakdown of the machinery in the neighbouring plant ortho-nitro aniline leaked and entered the edible oils meant for hydrogenation. Ortho-nitro aniline is a highly toxic dye intermediate ingestion of which could be fatal. It is pertinent to mention that consumption of rapeseed oil denatured with aniline has caused major epidemic in Spain, killing over 800 people and affecting another 20,000 population (WHO, 1992a).
The rapid technological progress made in food technology is sometimes misused by unscrupulous traders for making newer adulterants/adulterations. Besides, the traditional adulteration hitherto practiced like simple addition of water to milk, mixing cheaper oils with expensive edible oils, newer adulterations with the modern technologies are coming into practice. The regulatory laws that are currently prevalent under prevention of Food Adulteration Act are good enough to detect simple adulterants (water, castor oil, argemone oil etc.). There are several examples of the latter category of adulterants that are encountered during the present study. Steam processing of Australian Vicia sativa to change the colour from red to yellow. The technology developed for preparing aluminium foil which almost looks like silver foil. In the prevention of Food Adulteration Act newer quality parameters need to be introduced if a vigilence has to be maintained on adulterants.

One of the emerging problems arising in the food contaminants in veterinary drug residues. Although the problem of veterinary drug residues is known for the last 40 years. The problem of veterinary drug residues is being highlighted in developed countries during the last few years. The survey on the usage of veterinary drugs carried out for the first time revealed that the peri-urban areas the usage is as high as 85% and indiscriminate use of antibiotics such as oxytetracycline as a drug specially to
buffaloes was observed. In another survey on the extent of contamination of milk with antibiotic residues revealed that milk obtained from individual farmer were contaminated with oxytetracycline. Contamination of milk with antibiotic residues in peri-urban areas of India is even more than in the United States of America where only 63% (Brady and Katz, 1988) were contaminated compared to 72% detected in India. Considering the fact that the detection limit was only 0-2 ug/ml of milk compared to sensitive detection methods used in the US study. The extent of problem appears to be more higher in selected section of population in India. However, there is no need for alarm since a large percentage of urban Indian consumers depend for milk supplied from organised dairies where the veterinary drug residues contamination in milk is less. It is due to the fact that the milk in the organised dairy get pooled in addition to the milk being collected from rural areas where the extent of veterinary drug use in milch cattle is less.

Although the presence of veterinary drug residue in general can be detected by finding out microbial zone inhibition test in petridish, more precise detection could be done only if the nature of inhibitory substance is made known. This could be achieved by the type of procedure followed i.e. to find out the veterinary drugs used and carry out analytical studies to find that particular compound. Although in the present state of Indian prevention of Food Adulteration Act this method of finding
out the exact nature appear difficult to implement a close coordination between the laboratory based analytical chemist and field based food inspector could solve the problem. It is pertinent to mention here both groups appear to be wide apart, they are indeed reporting directly to the same state food health authority (Gopala Krishnamurthy, 1985).

In India in the past there were several adulterants/contaminants being directly linked to causing food poisoning/food borne disease outbreaks. Well known eg. include epidemic dropsy, enterocërgotism. Aflatoxic hepatitis, veno occlusive disease, triorthocresyl phosphate poisoning, paralytic shellfish poisoning (Bhat, 1991). Despite this it is generally considered that adulterants are more a cause of economic offence than of health significance. Accidental discoveries of unique foodborne diseases described during the present study namely ulceration of tongue due to consumption of Ponceau 4R colour mixed with aniseed and typical 'Food poisoning' vomiting and diarrhoea due to consumption of rancid biscuits, both in the children, are unique examples of newer adulterations being responsible for disease outbreaks. It is not uncommon in India, to just refer to these illnesses as ordinary food poisoning without going into detailed examination. In the absence of definite recorded evidences available in the literature (Concon, 1988a, Bryan, 1978, Sanders, 1981), it is unreasonable to expect food control laboratories routinely engaged in analysis of mandatory samples being
answerable to the judiciary to carefully examine such outbreaks and find out the exact cause of the such illness by finding the adulterants. These episodes strengthen the view that the close interaction between research laboratories and routine Food Testing Laboratories to have a continuous interaction.

CONCLUSIONS

Due to variety of reasons such as the proliferation of urban areas, breakdown of joint family system into nuclear families, increased women workforce doing duties away from home, increased popularity of urban street foods, raising food costs invariably lead to increased problem of food adulteration. The vast changing demographic profile without concomitant increase in the number of food inspectors for food safety monitoring the problem of food adulteration is likely to increase by 2000 AD. A thorough understanding of type and nature of adulterants, various analytical procedures, carefully handled animal experiments are absolutely essential to meet these challenges. Appropriate risk management techniques including risk assessment and risk analysis and risk communication are absolutely essential to ward off the challenges of adulterants and contaminants. The traditional Indian prevention of Food Adulteration Act need to be changed to meet global and domestic challenges.
A proper understanding and implementation of recent concepts of ISO 9000 (Hedman, 1994) ISI 14,000 and the quality awareness, the concept of hazard analysis critical control point (HACCP) (Vail, 1994) will go a long way in minimizing the economic and health challenges posed by adulterants and contaminants.

The present study although has indicated the nature and extent of adulteration specially with the newer adulterants, the exact pattern of food adulteration at national level is yet to be unravelled. There is a considerable scope for carrying out a nation wide survey on the extent of the problem in addition to the mandatory food control exercises carried out by the statutory bodies. In addition a proper risk assessment of the problem of food adulterants more from the health implications than the economic consideration has to be carried out. A variety of foodborne diseases though may not be involving fatalities could be attributed to food adulterants which needs an indepth study. There is a need to carry out appropriate toxicological studies, evolving simple methods of detection, methods for detoxification/decontamination. The amount of various adulterants that are being ingested needs to be quantitated through valid and carefully undertaken diet surveys only then the task of totally understanding the problem of adulteration would be at least partially accomplished.