EDITORIAL 2(4)

With this last issue of 2^{nd} volume of IJTS, we have crossed another milestone of great significance. This special publication focuses on a very important issue of pesticide residues, which impinges upon human health *versus* cost of minimizing crop losses for tea growers. I am grateful to the Gus editor Dr. P.K. Seth Director, Indian Toxicology Research Center for his labor of love in editing this special issue

Pesticide residues have lately assumed a high profile in the media. Pesticides contaminate bottled soft drinks & mineral water, ground water, day-to-day items of food and even mothers' milk. This special issue looks at safe levels of this necessary evil. Dr Seth in his opening paper on human health has dwelt upon the dangers that pesticide residues in an item of mass consumption like tea could entail. The paper has emphasized the need for minimizing pesticide load on tea, He has also pointed to the need of protective gear for the workers who spray pesticide to protect the tea crop from pests and diseases.

The paper by T.C. Choudhury on fixation of minimum residue limits points to a tug war between the tea growers in the producing countries and the public health protagonists in the consuming countries. While the former need pesticides to control over a thousand species of pests, diseases and weeds, the latter do not want any of it in the tea they dink. This paper lists the pests diseases and weeds that reduce crop yields and must be kept under check by spray of toxic chemicals. The paper describes the principles of fixing MRLs by the consuming countries, which become the goal posts for the producing countries. Hence both parties must work together in fixing the tolerance limits by integrating the varying stipulations by the regulatory agencies of major importing countries *viz USA (*.EPA), EEC (Codex) and Japan. The author pleads for pesticide residues fixation only on the basis of field data and degradation metabolite studies under good agriculture practices (GAP), and not on other, extraneous considerations. The author voices the concern of the tea producers for considering pesticide residue levels in tea brew rather than in dry tea.

Writing about the degradation kinetics of pesticide residues on the surface of tea leaves after spray, Chen Zong-Mao brings to attention the role of the very large leaf surface area of tea per unit dry weight as compared to other crops, and that the manufacture of tea is done without washing the leaves. Both these factors are responsible for very large pesticide deposits, which would have played havoc if pesticide spray did not undergo a natural reduction. Degradation of pesticides residues is characterized by initial rapid degradation followed by a slower rate of pesticide loss. The processes of degradation comprise of photo degradation, evaporation, washing by rain and dilution by plant growth. The author has developed methods to forecast the quantum of pesticide residues in dry tea leaves under different levels of the abovementioned factors. The predictive model was tested to forecast pesticide residues on tea leaves and was found valid in the environmental range of 25 to 35 degrees north latitude within China. Perhaps, similar approach should also be validated for other tea-producing countries.

In a comprehensive review of the fate of pesticides deposited on tea leaves Adarsh Shaker focuses on the wide variations in MRL levels fixed by different agencies *viz.,* EU, EPA, Codex, which may differ by as much as 200 times in individual chemicals. Hence, there is a need for harmonization of pesticide residue limits, which should be agreed to by all the stakeholders.

The main factors that determine the pesticide load are the characteristics of chemicals, by the prevailing field conditions; the process of manufacturing and finally preparing tea infusion, including the brewing time and temperature. Lipophyllic compounds get attached to the waxy layer in leaf cuticle while systemic pesticides are translocated to other plant-parts after absorption. Both of them protect the chemical from exposure to degradative processes. The half-life of most of the pesticides varies widely but is generally less than two days. Further, the pesticides on leaf surface are degraded and environmental factors as is mentioned by Chen Zongmao, by growth dilution, photolysis by sunlight, rainfall elution, evaporation and pH. All these influences have been critically examined and quantified for different pesticides in this paper.

The steps in processing of tea leaves to black tea or green tea bring about a remarkable reduction in the level of pesticides in the ultimate product. The final drying step, which requires more than 100 degrees temperature, has the highest influence. Most of the pesticides residues undergo distillation during water loss and severe thermo degradation with the very high temperatures used for tea drying.

The author makes a strong case for analyzing tea brew as the yardstick for setting pesticide residue limits rather then the current MRLs in the made tea. The brew contains only 40-60% pesticide load of dry tea and is the ultimate product for human consumption.

Repeatable analytical results by using reliable methods of residue analysis are essential for all concerned to accept the findings. Mithyantha has described the methods of analysis of pesticide residues. His paper outlines the methods of extraction, cleanup and determination by using sophisticated mass spectroscopy with different attachments for different groups of molecules. However, the results need to be validated before being accepted by all concerned.

We hope to follow up this special issue on pesticide residues with another special issue on bio-pesticides used in tea to achieve minimum level of pesticide residues on made tea and brew in particular.

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