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Response:

The Government of Kerala directed the Kerala State Council for Science Technology and Environment (KSCSTE) to monitor endosulfan persistence in soil, water and blood samples in selected areas of Kasaragod district and its impacts on human health and environment vide G.O. (MS) No. 1550/20/10/HFW, dated: 09.04.2010. The soil, sediment and water samples were collected from specific sampling points of the affected panchayaths. The sampling points were fixed by taking into account the drainage morphometry, topography and hydrological parameters, and also according to the direction of the Endosulfan Victims and Remediation Cell constituted by the Government of Kerala. A technical cell was constituted by KSCSTE with specific terms of reference. The technical cell entrusted laboratories of the Centre for Water Resources Development and Management (CWRDM), Kozhikode and the Salim Ali Centre for Ornithology and Natural History (SACON), Anakatty, to study the endosulfan residues in various environmental samples of Kasaragod. Standard procedures were adopted in collecting the samples and analyses were done based on a standard protocol developed and approved by the technical cell. Repeated sampling of water/soil/sediments in the area was done to ensure consistency and accuracy. Split sample analysis was done in the laboratories of CWRDM and SACON, which helped minimize any errors. The results of the study were periodically discussed and reviewed by the technical cell.

The gas chromatograph used for the analysis had been calibrated; verification and validation of methods was periodically done to eliminate errors during the analysis. The details are provided in our paper. Repetition/confirmation of results which supplement the analysis of samples were done for quality control. Also, the study employed analysis of water/soil/sediment analysis using gas chromatography (GC) in CWRDM as well as in SACON for validation. The Water Quality Division Laboratory of CWRDM is an NABL accredited laboratory for the analysis of general water quality parameters (T-2846, dated 24.2.2014). We followed standard procedures reported by journals with high impact factors, World Health Organization (WHO) and USEPA for the detection of endosulfan[1–7]. WHO recommends the determination of endosulfan by GC combined with electron capture detection[8]. USEPA also recommends GC with electron capture detector (GC-ECD) for the determination of organochlorine pesticide residues, including endosulfan[9–11]. Canadian Water Quality Guidelines[12] for the protection of aquatic life also recommend detection of endosulfan using GC-ECD.

Though aerial spraying of endosulfan was stopped in 2000, there is no proper evidence about the year in which endosulfan usage was completely discontinued. The values reported in our paper are not just assumptions based on the last date of aerial spraying of endosulfan. Proper analysis and interpretation of data were carried out to find the concentration of endosulfan in the collected samples. Endosulfan in the selected samples was found to be persistent for 1.5–2 years based on our study which began in 2010. The study conducted by NIOH and CWRDM cannot be compared since the sampling locations are entirely different. The sampling locations in our study are predominantly in the depositional environment like the confluence of tributaries, valleys and ponds where organic concentrations are also relatively high. The above sampling stations are quite different from what was followed by earlier workers. The persistence of endosulfan is reported based on the date of start of our study. The results were also further validated and cross-checked with the monitoring done by SACON. It is quite possible that manual application of endosulfan might have continued in the area even after stopping aerial spraying in 2000. There can be a chance of re-application of endosulfan in the areas of the affected panchayats, where endosulfan might have been stored and not completely destroyed. Similarly, the retention of endosulfan residues in the matrix of clay-rich laterite soils which are predominant in the area is also possible. We admit that the average rainfall given in our paper is a typographical error. The correct figure is as pointed out. The high value of organic matter content, 17.36%, was confirmed by repeated analysis. It is clearly mentioned in our paper that there was specific evidence of the presence of decayed vegetation in the sampling area. Several published works have already proven the fact that organochlorine pesticide residues are persistent in the environment and long-term exposure can cause severe health problems[13–16].

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Rejoinder to the reviewer's comment on '*Bioenergetics, Thermodynamics and Plant Physiology*'

As the author of the book, I think it would be prudent to clarify some of the mistaken notions about the book[1]. The primary objective of the book is to establish the physical principles behind the plants' physiological transformations. In this connection it is to be mentioned that thermodynamics govern the basic principles of plant physiology. From this viewpoint, I am therefore giving a rejoinder for the review.

The objection regarding the interpretation of the energy transactions primarily in terms of entropy is not tenable here. It has never been interpreted as the energy transaction in terms of entropy. Rather, in chapter 2 of this book, the First Principle of thermodynamics on work and energy transformation has been dealt with; in chapter 3, the Second Law of thermodynamics on entropy and plant physiological processes has been included, and in chapter 4, plant metabolism in terms of entropy and free energy has been elaborated. The role of free energy has been explicitly described in the processes of energy transformation in plant functioning. It is to be mentioned that free energy deals with the system only, while entropy deals with both the system and its surroundings. In addition, it has also been described that the transformation of a system from 'disorder' to 'order' cannot be explained by the change in entropy with the present perception about the entropy. It is explained in terms of the Law of Maximum Entropy enunciated by Rod Swenson in 1988, in which he stated that 'a system will select the path or assemblage of paths out of available paths that minimizes the potential or maximizes the entropy at the fastest rate given the constraints'. In my opinion, the basic principles written in the book have been largely overlooked by the reviewer.

The review reads 'The parallel to the Bible runs through and we understand that to begin with, all seas were red due to halobacteria…'. Nowhere in this book, has it been mentioned that the early sea was 'Red'. To the contrary, the relevant chapter (chapter 9) has emphasized the probability of the early sea being *purple* due to abundance of Halobacterium with bacteriorhodopsin.

The 'sea was not saline to begin with' as mentioned in the review needs rechecking. Many accepted estimates of the early ocean's salinity provide that it ranged between 1.2 and 2 times present-day salinity.

The comment 'The author may not be familiar with the accepted notations like uniport, symport, etc.' is undesirable. Perhaps the reviewer did not go through the book properly. Any reader may refer to chapter 8 of the book in general and figure 8.9 in particular to get an idea of these proteins in ion transport.

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