SUMMARY AND CONCLUSIONS
Phycobilisomes are ordered structures composed of chromophoric phycobiliproteins and colourless linker polypeptides located on the thylakoid membranes of cyanobacteria. Complementary chromatic adaptation is a phenomenon where modulation in the synthesis of phycobiliproteins takes place in certain cyanobacteria containing PE as an effect of light quality. It has also been reported that photomorphogenesis occurs in these cyanobacteria under similar light qualities. Another important observation made in cyanobacteria was the degradation of phycobiliproteins as well as linker polypeptides within the PBsomes during nutrient starvation. Thus, PBsomes play two important roles in cyanobacteria as: 1. light harvesting antennae and 2. nutrient reserve material. However, information on synthesis and regulation of PBS components and photomorphogenesis under different light qualities is rather very scanty in non-chromatic adapting cyanobacteria. Hence, we have chosen *Spirulina platensis* to observe for any changes occurring in the PBS composition and photomorphogenesis. The present study also dealt with the effects of sulfur starvation on PBS components with reference to nitrogen starvation.

Quality of light, namely green, red and white lights affected the newly discovered phycobiliprotein (PXB,
phycobiliviolin type of pigment) in the non-chromatic adapting cyanobacterium *S. platensis*. It was observed that in the normal grown cells under white light, the PXB containing polypeptide occupied 11% of the PC III subparticles and was not detected with either PC I or PC II. However, cultures grown under green light exhibited an increase in the synthesis of this polypeptide, while red and white light conditions did not cause any change. Thus, under green light, quantity of PXB chromophore was found to be 30% in PC III subparticles. When α and β subunits were isolated from *S. platensis*, it was seen that the PXB type of chromophore was present on α subunits but not on β-subunits. Results also indicated that some of the PC particles in this cyanobacterium contained PXB chromophore and the rest contained PCB chromophores. Quantity of PC and APC under the light qualities mentioned did not undergo major changes in *S. platensis*. However, there was a partial modulation in PC levels, while APC remained constant.

The PBS composition of cells grown under green, red and white light conditions also did not show any significant modulation in the synthesis of phycobiliprotein subunits. The group III linker polypeptides responsible for assembly of PC rods and their attachment to APC cores also did not undergo any change. These results along with the equal
sedimentation of PBsomes during sucrose density purifications from cells grown under different light qualities may indicate that all three samples of PBsomes are intact and not dissociated. However, there was a loss of 56.5 kDa linker polypeptide from PBsomes of red and green light grown cultures. It was also observed that the high molecular weight anchor polypeptide (94.0 kDa) underwent in vivo proteolytic degradation. But, the 56.5 kDa polypeptide could not have been a degraded product of the anchor protein as this polypeptide appeared to be missing from PBsomes under red and green light conditions, even though the anchor protein in these PBsomes was subject to a higher degree of proteolysis.

Fluorescence emission spectra of PBsomes isolated from green and red light grown cells had shown an impairment of energy transfer. Thus these PBsomes were seen to be uncoupled. The uncoupling of PBsomes from red and green light grown cells may show a role for 56.5 kDa in the energy transfer within PBsomes of *S. platensis*. From the results of fluorescence emission spectra, we may propose that this linker polypeptide be present at the proximal end of PC rods in PBsomes. In such a case, the loss of this polypeptide from this location could cause an inefficient transfer of energy from PC rods to the APC core, thereby resulting in
the loss of energy at 650 nm. Thus, from the investigation, it may be seen that the 56.5 kDa linker polypeptide belonging to group II linker polypeptides of PBsomes throws a faint ray of light in the structural and functional aspects of PBsomes. Group II linker polypeptides have been reported in many cyanobacterial PBsomes, but their role has not been elucidated till date.

Apart from the changes occurring in the functional and polypeptide composition of PBsomes under green and red light, photomorphogenesis also was observed in *S. platensis*. One of the notable characteristics observed was that of the formation of hormocysts under red light. Hormocysts were either single or 2-6 celled structures, with a thick coat of stratified envelope and mucilage and lacking motility. Hormocyst formation was initiated by the presence of necridia between vegetative cells. It has been well reported that hormocysts are perennating structures formed from hormogonia moving away from vegetative trichomes. In conclusion, the light quality experiments indicated that red and green light conditions caused a stress on the synthesis and articulations of PBsomes and cell morphology.

Another aspect of synthesis and regulation of PBsomes is the role of these structures as nutrient reserve material. Studies have been extensively conducted on
nitrogen starvation in cyanobacteria and to our knowledge starvation for sulfur, an essential component of sulfur amino acids has not been studied in depth. Hence, the present study undertook sulfur starvation effects on *S. platensis* and compared these results with those of nitrogen starvation.

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Results have indicated that drastic morphological changes as those occurred due to light quality were not observed in *S. platensis* under nutrient starvation. However, microscopic examination of *Spirulina* cells revealed emptying of cellular contents because of nitrogen and sulfur starvation. Absorption spectra of PBsomes and phycobiliprotein quantitations have indicated that PC was preferentially degraded than APC. A 34.5 kDa linker polypeptide was found to be degraded concomitantly with PC.
during nutrition starvation. It appeared that certain specific and similar factors are being involved in the degradation of these polypeptides during both nitrogen and sulfur starvation. As suggested by earlier studies, the loss of 34.5 kDa linker polypeptide in the present study also caused spectral changes in PBsomes isolated from nutrient starved cells. SDS-PAGE of PBsomes isolated from nitrogen and sulfur starved cells have shown that some additional polypeptides have been associated with them. However, the composition of these additional polypeptides differed in PBsomes isolated from nitrogen and sulfur starved cells. At present, it is difficult to state as to what are the roles of these additional polypeptides in PBsomes. But, one may envisage that these polypeptides could be degradative products of anchor protein or altogether different species of proteins belonging to cell membranes and/or cytoplasm. Non-impairment of energy transfer in PBsomes of nutrient starved cells and the loss of 34.5 kDa linker polypeptide in these PBsomes may indicate that this polypeptide is involved in stacking of PC discs and thus present on the peripheral side of the PC rods. These results may also further show that the PC rods in nutrient starved _S. platensis_ PBsomes are short in length than the control cells and thereby have not caused impairment of energy transfer within them.