The light intensity of the system varies with depth and density of the algae. At higher depths, the light intensity must be increased to provide an even growth throughout the system.

Furthermore, the PBR must be aerated and mixed to prevent sedimentation. Aeration is necessary to allow each cell to receive equal amounts of light and nutrients. The aeration of the system is important due to its introduction of carbon dioxide. Carbon dioxide is necessary as the algae will not photosynthesize without it. The figure below describes the photosynthesis reaction where HV is the light energy captured and $C_6H_{12}O_6$ is synthesized sugar.

$$6CO_2 + 6H_2O + HV \text{ ---> } C_6H_{12}O_6 + 6O_2$$

Figure 1: Photosynthesis

Since plants cannot obtain all the energy required from sunlight, they use stored food as energy. Plant cells store food in their mitochondria where it is converted to energy by cellular respiration. In photosynthesis, light energy is captured by the algal chloroplasts and is used to synthesize sugars from carbon dioxide and water. Algal cells are autotrophic as they use sunlight as a source of energy and carbon dioxide as a carbon source.

Algae also require optimal temperatures of between 20 and 24°C for growth; however, this varies with the species used. Salinity of the water is also a contributing factor for algal growth. Algae are quite tolerable to salinity changes but, the optimal salinity has been found to be between 20 and 24g/L, which is slightly less than the natural habitat value.

For PBRs to produce algal biomass, certain strains of microalgae must be used. Some strains produce more biomass under certain conditions than others. For that reason, a good strain of microalgae for use in a PBR is one that produces a high lipid yield. An alga that has a high lipid yield is good as its biomass can be further processed into biofuel.