

PAR vs. PUR vs. PSR

PUR is the scientific acronym for “Photosynthetically Usable Radiation”.

Morel drew attention to the importance of spectral matching as a function of water depth in the water column and introduced the term photosynthetically usable radiation (PUR).¹

PURE Light™ refers to PUR-efficient light² delivered by BioPhotix Corporation.

¹ Markager, S. and Vincent, W. F. (2001) Light absorption by phytoplankton: development of a matching parameter for algal photosynthesis under different spectral regimes. *J. Plankton Res.*, 23, 1373–1384

² Morel, A. (1978) Available, usable, and stored radiant energy in relation to marine photosynthesis. *Deep-Sea Res.*, 25, 673-688

PAR has been defined as the amount of radiant energy, preferably expressed as quantum units, available within the approximate spectral range from 350 nm to 700 nm (Tyler, 1966).

This definition does not prejudge the usefulness of this energy for microalgae because all photons, regardless of wavelength, must be counted. In order to be efficient in the photosynthetic process, these photons must be absorbed by the algal pigments. Thus one can define the photosynthetically usable radiation (PUR), as the fraction of such wavelength that it can be absorbed by the algae. PUR depends upon the pigment composition of the algal population as well as on the spectral composition of the submarine radiant energy.

Lastly, only a fraction of the absorbed energy is really used in the photosynthetic process. The transformation of absorbed energy into chemical energy is carried out with variable yields. A quantum yield, Φ , has been defined by plant physiologists as the number of CO₂ molecules transformed (i.e., reduced to carbohydrate), per quantum absorbed, or the number of CO₂ moles per Einstein absorbed. The photosynthetically stored radiation, PSR, can be defined as the amount of radiant energy that can be converted into and stored as chemical energy, in the form of organic matter created through photosynthesis. There exists an obvious relationship among these three quantities:

$$PSR < PUR < PAR$$

Comparison of the extreme terms, PSR and PAR, leads to the concept of efficiency of utilization of radiant energy entering the water, by the microalgae.