CYCLIC AND LINEAR ELECTRON FLOW IN PLANTS REVEALED BY JTS-10 SPECTROMETER

PRINCIPLE:

Photosynthetic process on raw material such as leaves, algae's has been widely investigated via fluorescence measurements, especially on PSII.
JTS-10 has the capacity to reveal fast oxidation and reduction kinetics through **absorbance** measurements, in all the visible and Infra Red wavelength ranges, without restrictions. The time resolution of the method can vary from 10µs to several seconds to minutes.
The aim of this note is to show how a cyclic vs linear electron flow can be easily revealed using JTS-10. Examples can be found in the literature following the same method (Joliot et al.).
In linear mode, the electrons are transferred from water to NADP and then to the Benson and Calvin cycle (figure 1).
In electron flow mode, the electron flow occurs between PSI and Cyt b_6f complex (figure 1).

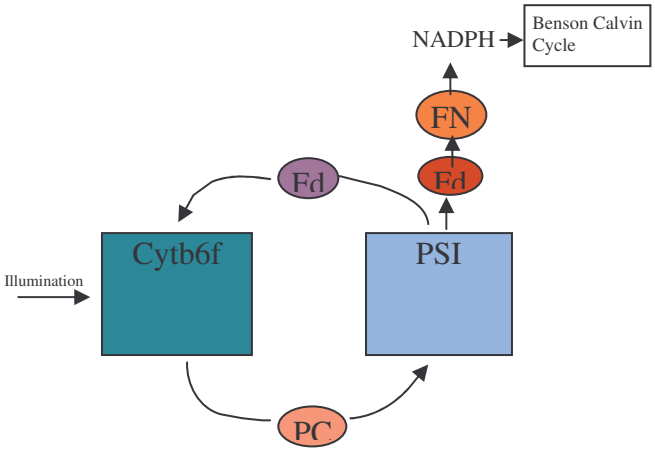

***Figure 1**: Simplified modelisation of linear and cyclic electron flows in a photosynthetic membrane*

Example of application.

All experiments were realized using a JTS-10 spectrometer from Bio-Logic (Claix, France)

In this example, the spectrometer was configured with an exciting light peaking at 720 nm to induce an excitation of PSI only with a detecting light of 705 nm. Cut-off filters are placed in front of the measuring photo diode to detect the light up 695 nm. For such applications, interferences between probing and actinic lights during the measurement are avoided thanks to a special « pulse dark method », unique to JTS-10.
The curves plotted (figure 2) were realised under the same conditions on a dark adapted young spinach and on a light adapted young spinach (pre-illumination at 630nm during 3 minutes to activate the Benson Calvin cycle)

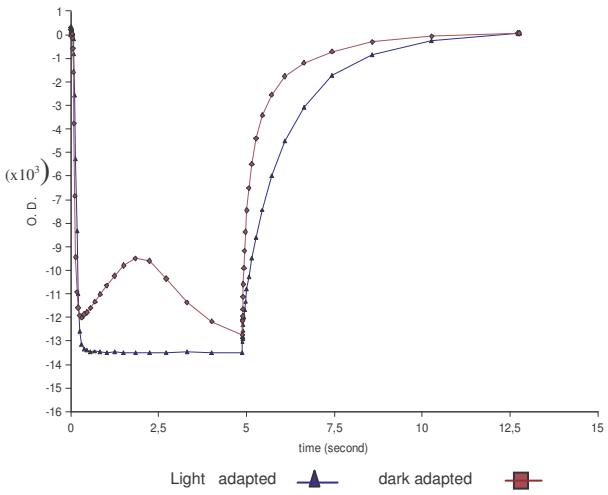

***Figure 2**: absorbance changes on a light and dark adapted leaf at 705 nm.*

On the dark adapted leaf, the calvin benson cycle is not activated, the cyclic electron flow is enhanced and a competition between reduction and oxidation of P700 is traduced by signal variations during the illumination with the actinic light.
On the light adapted leaf, the calvin benson cycle is activated enhancing the linear electron flow during the illumination.

Advantages of Bio-Logic JTS-10 spectrometer:

- A single setup for fluorescence and absorbance measurements.
- A highly sensitive instrument and noise limited
- An incomparable modularity with its external and interchangeable actinic and detecting lights.
- An excellent time resolution: 10 µs with a distribution of probing pulses comprised between 10µs to several minutes

References:

- P. Joliot, A. Joliot, Quantification of cyclic and linear flows in plants, Proc. natl ac sc. of USA, (2005), vol.102, n°13, 4913-4918

- P.Joliot, A. Joliot, Cyclic electron flow in C3 plants, BBA 1757 (2006) 362-368

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Please visit our website to know more about JTS-10 specifications:

http://www.bio-logic.info

You can also contact one of our application specialists.

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