

Effect of Potassium Humate on Photosynthesis

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Vliv K-humátu na fotosyntezu

Na několika systematicky různých vodních rostlinách jsem sledoval přímé a krátkodobé působení humátu na fotosyntezu. Z pokusů na rodech *Potamogeton*, *Nuphar* a *Vallisneria* vyplývá, že intenzita fotosyntesy listů ovlivněných humátem a listů kontrolních zůstává stejná, že tedy humát při krátkodobé aplikaci fotosyntezu neovlivňuje. Shodné výsledky jsem dostal i u řasy *Scenedesmus obliquus*, kde se rozdíly začaly projevovat až po několika dnech působení. Nelze ani v těchto případech mluvit o ovlivnění vlastního pochodu fotosyntesy, humát tedy působí na fotosyntezu pouze nepřímo.

The data in the literature show that, even if not directly measuring photosynthesis following the application of humus substances, authors assume an increase in photosynthesis as they generally observe an increase in chlorophyll content. I attempted here to answer the question whether humus substances affect photosynthesis only indirectly or also directly.

Water plants were used for the experiments; leaves of higher water plants (*Potamogeton lucens* L., *Nuphar luteum* Sm., *Vallisneria spiralis* L.) and algae (*Scenedesmus obliquus* (TURP.) Kütz. culture no. 125) from the Collection of Autotrophic Organisms of the Czechoslovak Academy of Sciences.

Photosynthesis was estimated continuously by the electrochemical method measuring dissolved oxygen in 0.01 M NaHCO₃ at a constant potential of the mercury drop electrode, against a zinc reference electrode. The measurements were carried out in a special apparatus at constant temperature (20° C) and under illumination with fluorescent tubes (1300 Lx) with the possibility of

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parallel estimation of photosynthesis of 10 leaf samples or of a suspension of algae. The description of the apparatus and working procedure will be published later. Differences in the photosynthesis of the control and of the material treated with potassium humate at a concentration of 100 mg./l. for leaves and 10 mg./l. for algae were estimated immediately after adding humate, and later after 8, 16, 24, 40, 56 and 80 hours, with algae also after 120, 180 and 240 hours.

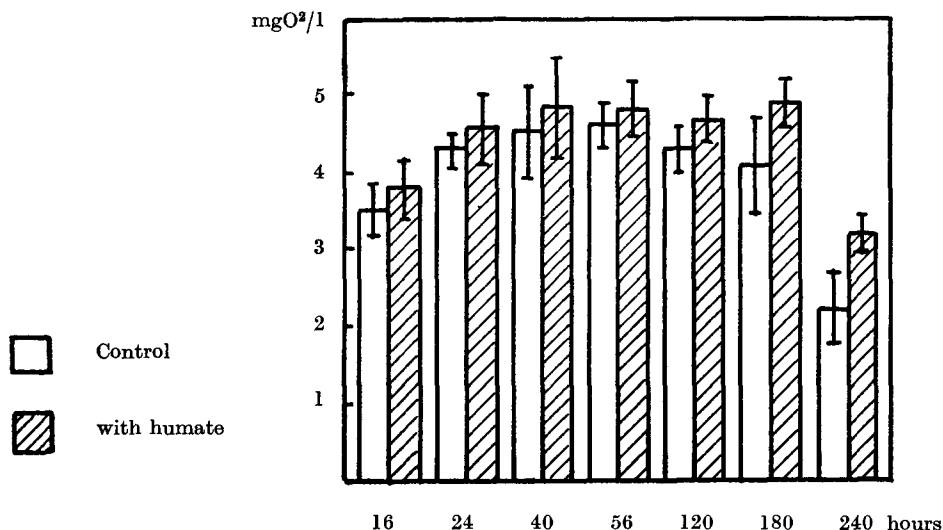


Fig. 1. Increments of oxygen content after 50 min. of photosynthesis after treatment with humate for 16—240 hours, in *Scenedesmus obliquus*.

The intercepts show $\pm$ sx at $P = 0.05$ (the difference is insignificant up to 120 hours and significant at 240 hours).

In studying the intensity of photosynthesis of leaves of higher plants no significant difference could be found in any of the variants between the controls and the humate-treated leaves. Hence it may be concluded that during short-time treatment humate does not affect photosynthesis. In an orientation experiment with *Vallisneria* grown either in pure sand or with the addition of humate a certain difference, even if small, could be observed.

Not even in the simple organism represented by the unicellular alga *Scenedesmus* could any differences be established. Even here, during short-time treatment with humate, no difference between the control and the humate variant could be established. Differences in the intensity of photosynthesis became apparent only after 3—5 days, depending on the age of the culture. After 10 days, when the experimental series was closed, the difference was very pronounced. A typical course of an experiment is shown in Fig. 1.

It could be concluded on the basis of the experiments that algae cultivated in a humate solution for a longer period of time would display higher photosynthesis than the controls. This was confirmed here as the difference actually appeared at the beginning of the experiment and increased with time.

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Влияние К-гумата на фотосинтез

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На нескольких систематически разных водяных растениях мною изучалось прямое и косвенное влияние гумата на фотосинтез. Из опытов на родах *Potamogeton*, *Nuphar* и *Vallisneria* вытекает, что интенсивность фотосинтеза листьев, подверженных воздействию гуматом, и листьев контрольных остается одинаковой, следовательно, гумат в случае кратковременного воздействия фотосинтез не изменяет. Сходные результаты мною получены на водоросли *Scenedesmus obliquus*, где различия начинают проявляться только несколько дней спустя. Следовательно, и в этих случаях нельзя говорить о влиянии на собственный процесс фотосинтеза, и вытекает, что гумат влияет на фотосинтез только косвенным путем.