

## PHOTOLUMINESCENT CHARACTERISTICS WHEAT SEEDS OF DIFFERENT RIPENESS

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**Abstract:** the spectral luminescent properties of wheat seeds during their maturation. The maxima of the excitation characteristics obtained when the synchronous scanning are approximately at the wavelengths 362, 424 and 485nm. Seed milky stage in the spectrum of the excitation is dominated by the maximum of 362 nm, and for the more Mature seeds along with 424 nm is a clear peak 485 nm. Such parameters as Stokes shift, the maximum value of the spectra, the integral values do not have a clear connection with the degree of ripeness of the seeds.

**Keywords:** spectra of excitation, the photoluminescence spectra, wheat seeds, ripeness.

## ФОТОЛЮМИНЕСЦЕНТНЫЕ ХАРАКТЕРИСТИКИ СЕМЯН ПШЕНИЦЫ РАЗЛИЧНОЙ СТЕПЕНИ СПЕЛОСТИ

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**Аннотация:** исследованы спектральные люминесцентные свойства семян пшеницы в процессе их созревания. Максимумы характеристик возбуждения, полученных при синхронном сканировании, находятся примерно на длинах волн 362, 424 и 485нм. Для семян молочной спелости в спектре возбуждения преобладает максимум 362 нм, а для более спелых семян наряду с 424 нм становится заметным максимум 485 нм. Такие параметры как стоксов сдвиг, максимальные величины спектров, интегральные значения не имеют однозначной связи со степенью спелости семян.

**Ключевые слова:** спектры возбуждения, спектры фотолюминесценции, семена пшеницы, степень спелости.

The creation of the system of objective control of plant products is a promising direction of development of agricultural production. Such systems can be built using opto-electronic devices that measure luminescent characteristics and parameters. It is possible to create methods of objective control of seed maturation of plants. The methodology necessary knowledge of the characteristics and parameters of excitation and luminescence. Fluorescent analysis finds application in various fields of science and technology in the study of the structure and properties of various materials [1, 2], while photoluminescence methods is one of the leading places [3].

For experiments were selected batch of wheat seeds of the cultivar "Scepter" with varying degrees of ripeness. By using a synchronous scanning technique [4] have determined the spectra of the excitation (Fig. 1).

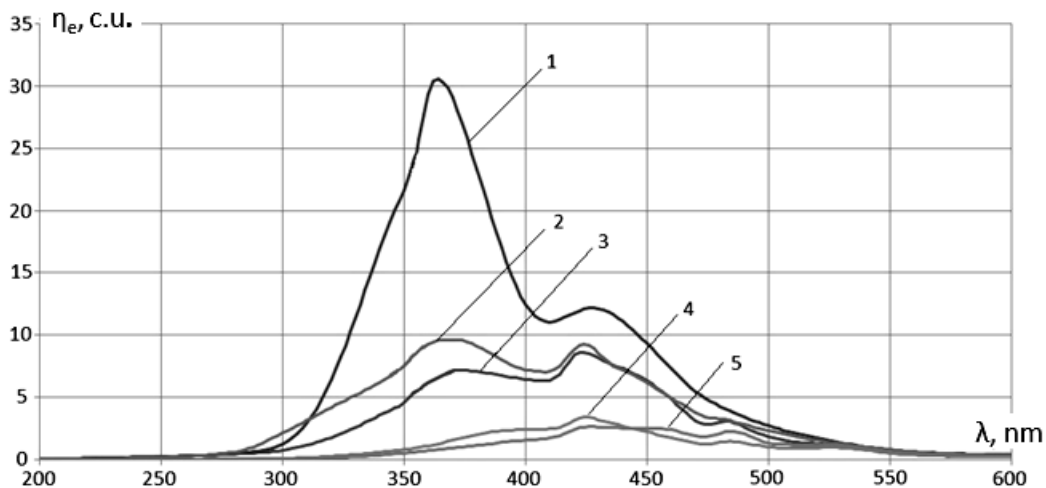


Fig. 1. The spectral characteristics of the excitation when the synchronous scanning for the seeds: 1 - the milk stage, 2 - milky-wax ripeness, 3 - wax ripeness, 4 - fourth period 5 - fifth period

The highs of the received dependences are approximately at the wavelengths 362 nm, 424 nm and 485 nm. For seeds milk and milky-wax ripeness in the spectrum of the excitation is most pronounced high peaks 362 and 424 nm. Moreover, the relative integral of 362 nm peak is largest for seed milky stage, and then it decreases, falling for a fifth up to half maximum 424 nm. On the contrary, the peak of 485 nm is almost negligible in the first period, but by the fifth increases its relative value more than 2.3 times.

Measured spectra of excitation and luminescence of selected seeds of each maturity. The results of measurements carried out statistical processing, where they spent averaging 20 spectra. The results are presented in Fig. 2 - 6.

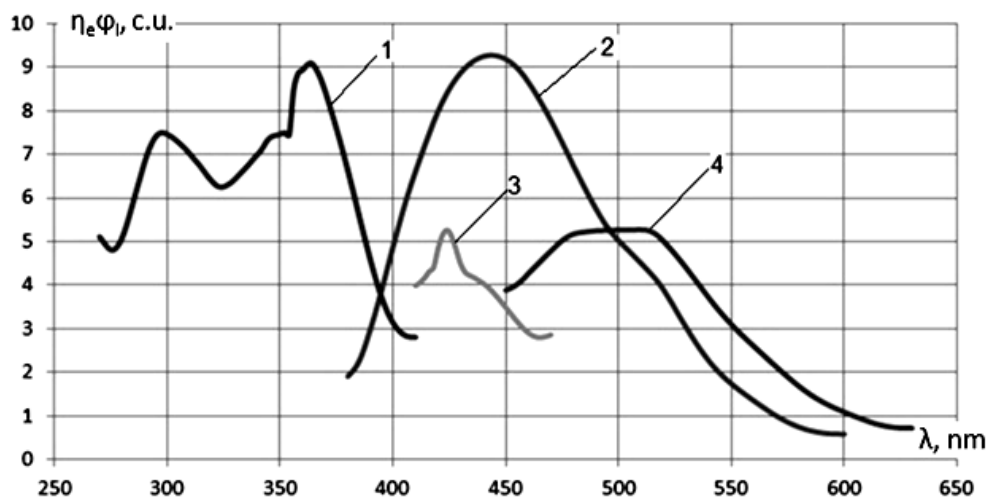


Fig. 2. The spectral characteristics of excitation 1,3 and luminescence 2, 4 spectra of wheat seed milky stage

It should be noted that the peak excitation of the 423 nm and the corresponding luminescence characteristic of the fully ripe seeds. When more precise scanning becomes noticeable peak excitation  $\lambda=292$  nm, but the spectrum of the luminescence is not affected. The presence of two luminescence bands typical for the seeds of milk, milky-wax and wax spilota.

At the stage of wax ripeness, there is only a peak of 423 nm (Fig. 4).

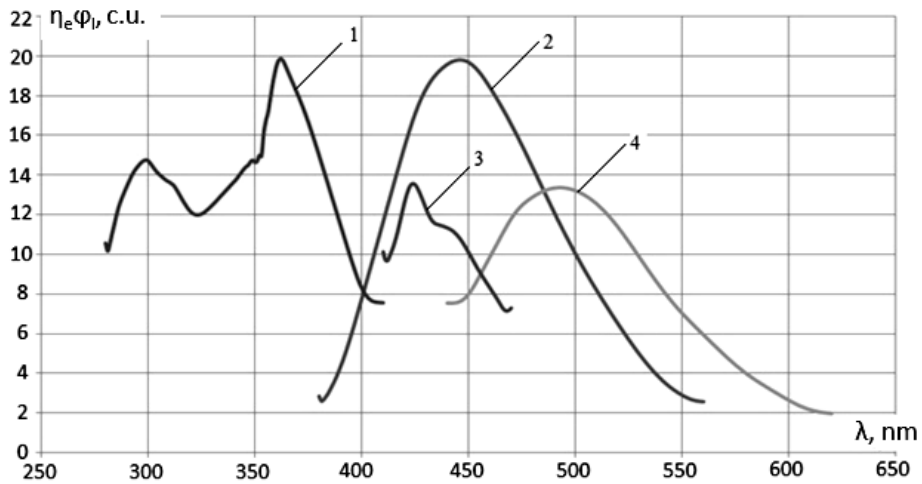


Fig. 3. The spectral characteristics of excitation 1, 3 and luminescence 2,4 spectra of wheat seeds of milk-wax ripeness

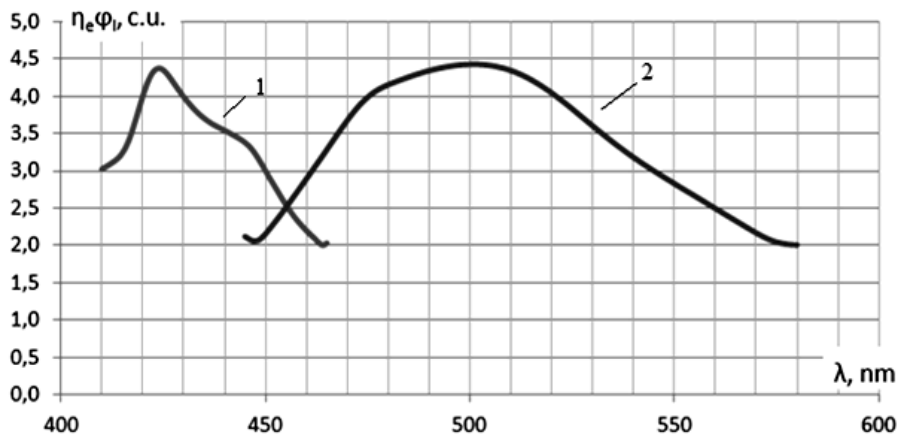


Fig. 4. The spectral characteristics of the excitation 1 of the luminescence 2 of wheat seed wax ripeness

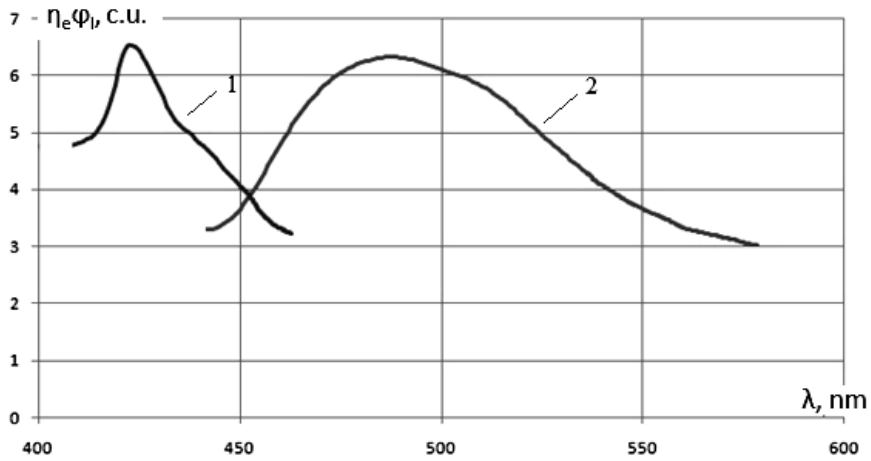


Fig. 5. The spectral characteristics of the excitation 1 of the luminescence 2 of seed of wheat of 4-th term

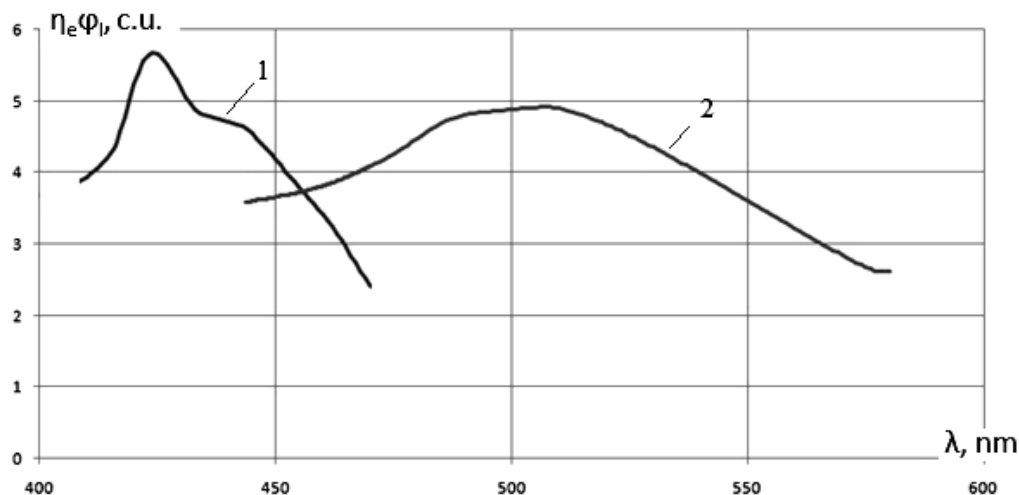


Fig. 6. The spectral characteristics of the excitation 1 of the luminescence 2 of wheat seeds 5-th period

Excitation spectrum of ripe seeds is located in the region 410-470nm and has a major maximum at 424 nm; the luminescence spectra located in the region of 440-570nm with a maximum in the range 490-510 nm. Such parameters as Stokes shift, the maximum value of excitation spectra and luminescence and their integral values have no clear connection with the degree of ripeness of the seeds. Based on the obtained results the most appropriate one is to determine the degree of ripeness of seeds the ratio of the levels of fluorescent signal at excitation wavelengths  $\lambda_1=362$  nm and  $\lambda_2=485$  nm, respectively. When reducing this ratio is less than one seeds can be considered ripe. The obtained results can form the basis for the creation of optical-electronic system control the ripening of crops.

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