UDC 621.313.8: 631.53.027

CHANGES IN pH SALT SOLUTIONS UNDER MAGNETIC FIELD

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The use of electro-technological method makes it possible to increase crop yield, improve the quality and shelf life of products.

For the successful implementation electrotechnologies necessary to establish the mechanism of action of electromagnetic fields on plant cell and identify optimal modes of treatment.

All biochemical processes in plant cells take place in water. Water is used in all chemical reactions, carries nutrients supports elasticity authorities. Plant cells have a similar chemical composition.

Under the influence of the magnetic field changes the rate of chemical reactions and their balance is shifting. This causes a change in pH.

The purpose of research - the establishment of the magnetic field to change the pH of aqueous solutions.

Materials and methods of research. Experimental studies changes in pH salt solutions were carried out on a laboratory setting. The solutions were passed through a magnetic field that is created by permanent magnets.

In the study of the influence of magnetic induction at pH aqueous solutions of governing change of distance between the magnets in the range of 0 - 0.35 Tesla. Tesla magnetic induction measured 43205/1. The velocity of the solution through a magnetic field was 0.6 m / s and temperatures - 20 ° C.

The pH of the solution was determined to magnetic treatment solution and thereafter using ionomer I-160M. By measuring the difference did conclusion about the effectiveness of magnetic treatment.

Experiments performed in threefold repetition, and their reproducibility was determined by criteria Cochran at 5% significance level nom.

The influence of the velocity of the solution at magnetic treatment to change its pH were performed using the method of experimental design. According to a review taking pH change in magnetic processing, the value factors - magnetic induction (X1) and speed of solution (X2).

Limits changes of magnetic induction was determined on the basis of one-factor experiments. The value of the upper, lower and main levels accounted for magnetic induction respectively 0; 0.65 and 0.13 T, to the speed of the solution - 0.4; 0.6 and 0.8 m / s.

In studies used a composite orthogonal centrally plan (table).

Matrix experiment planning at magnetic treatment solutions of salts

Number point	Type point	X_0	X_1	X_2
1	The core of the plan FFE 2^2	+	-	-
2		+	+	-
3		+	-	+
4		+	+	+
5	Star point	+	-	0
6		+	+	0
7		+	0	-
8		+	0	+
9	Center of plan	+	0	0

Experiments performed in randomized order in threefold repetition. Each row of the matrix defined planning dispersion and uniformity of criteria checked by Cochran.

The regression equation found in the form:

$$\Delta БП = b_0 + b_1 X_1 + b_2 X_2 + b_{11} X_1^2 + b_{22} X_2^2 + b_{12} X_1 X_2 . \quad (1)$$

The coefficients of the regression equation and their significance was determined by a known method, and the adequacy of the resulting regression equation was estimated by Fisher criterion.

Results. Under the influence of magnetic field on solutions increases the rate of chemical reactions:

$$\omega_{м} = \omega \exp(\mu(K^2 B^2 + 2KBv_n) N_a / 2RT, \tag{2}$$

where ω - speed chemical reactions without the magnetic field, mol / l · s; μ - reduced mass of particles kg; B - magnetic induction, T; v - velocity of particles, m / s; K - coefficient that depends on the concentration and type of ions and the number peremahnichuvan m / s · T; N_a - Avogadro's number, molecules / mol; R- universal gas constant, J / mol · K; T - Temperature solution C.

Changing the pH is given by:

:

$$\Delta pH = \lg fC_{H_1^+} - \lg fC_{H_2^+}, \tag{3}$$

where f - coefficient of activity; C_H - concentration of hydrogen ions, mol / l.

Expression (3) can be written as

$$\Delta pH = \lg \omega_{H_1^+} - \lg \omega_{H_2^+}. \tag{4}$$

Then with (2)

$$\Delta pH = \frac{2{,}3 \mu N_a K}{RT} \left(\frac{KB^2}{2} + v_n B \right), \tag{5}$$

or

$$\Delta pH = A_1 B^2 + A_2 Bv, \tag{6}$$

where A_1 and A_2 - coefficients.

Experimental depending on changes in pH, potassium phosphate at magnetic processing of magnetic induction at a speed of solution 0.6 m / s is shown in Fig. 1. Changing magnetic induction from 0 to 0,065 T pH of the solution increases, and with further increase of magnetic induction begins to decrease. When a magnetic induction greater than 0.15 T magnetic treatment effect negligible - pH remains virtually unchanged and not more than 0.02 units compared to the untreated sample.

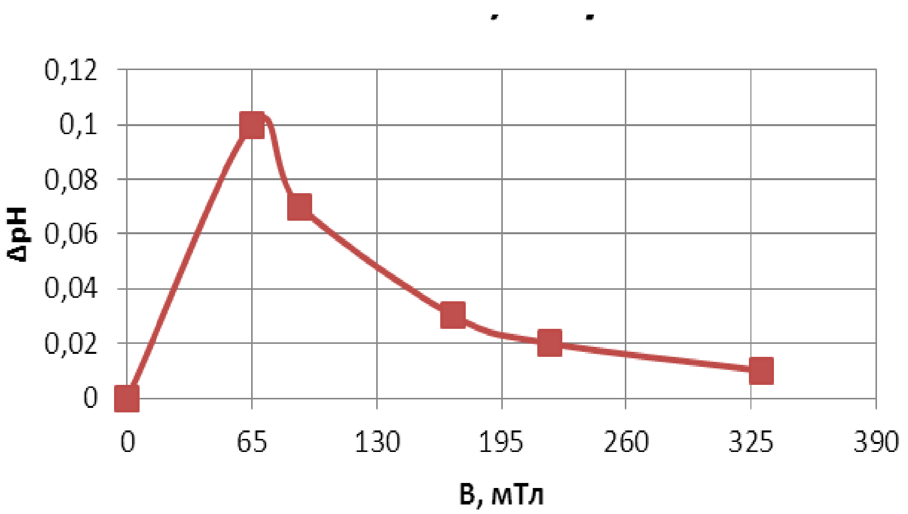

Fig. 1. Dependence changes in pH solution of potassium phosphate of magnetic induction

The results of the multivariate experiment were obtained regression equation, which in physical terms are as follows:

potassium

$$\Delta pH = 3{,}256B - 0{,}769Bv - 16{,}174B^2; \quad (7)$$

calcium nitrate

$$\Delta pH = 4{,}41B - 0{,}769Bv - 23{,}669B^2; \quad (8)$$

magnesium sulfate

$$\Delta pH = 3{,}825B - 1{,}218Bv - 15{,}516B^2; \quad (9)$$

potassium phosphate

$$\Delta pH = 3{,}103B - 0{,}641Bv - 17{,}88B^2; \quad (10)$$

ammonium sulfate

$$\Delta pH = 2{,}004B - 0{,}449Bv - 11{,}966B^2. \quad (11)$$

Changes in pH dependence of magnetic induction and speed at magnetic treatment is shown in Figure 2. Most salt solutions pH changes when a magnetic induction of 0,065 T. Reducing speed processing solution in magnetic it increases the pH.

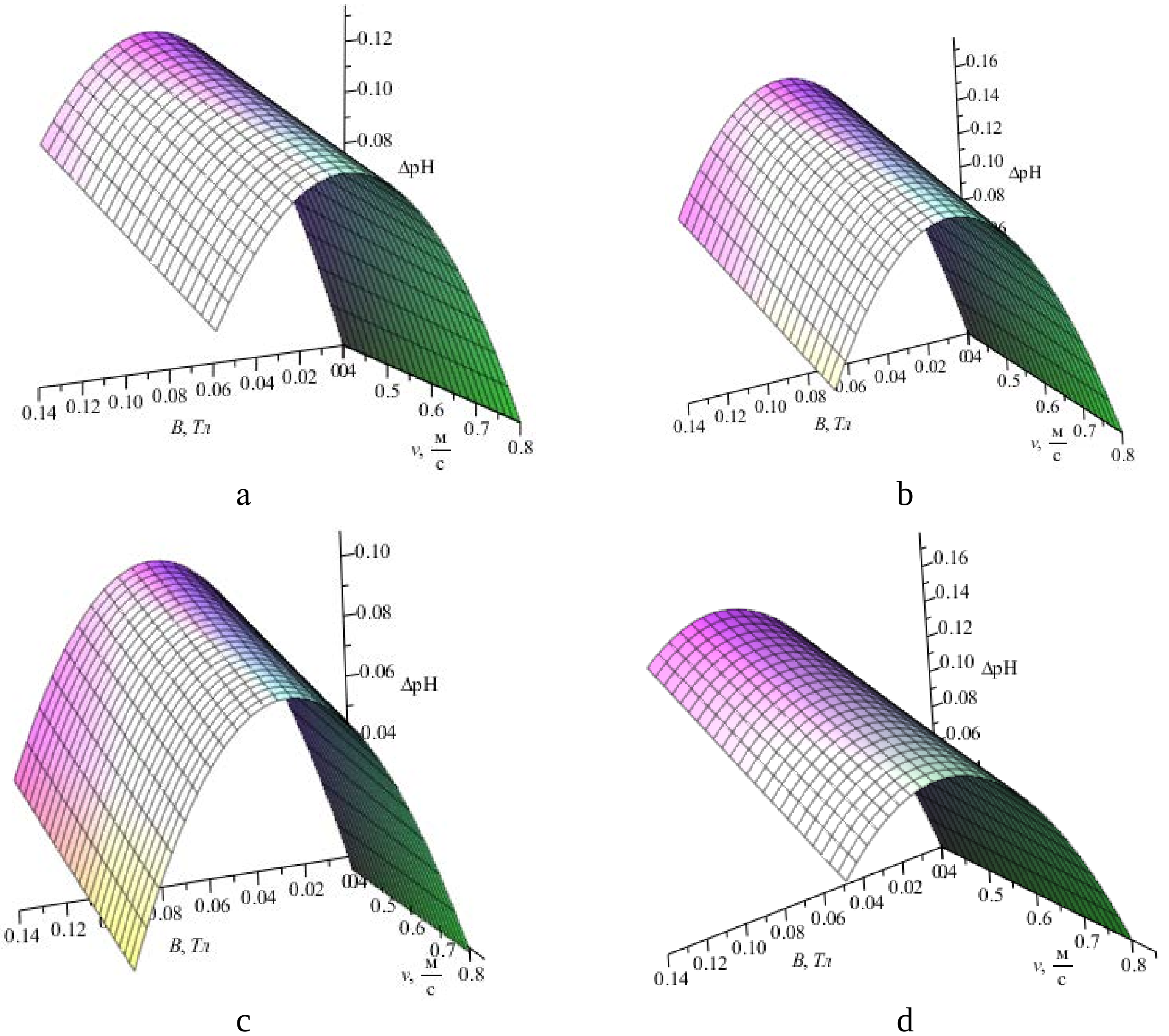

Fig. 2. Dependence of change of pH salt solutions of magnetic induction and velocity of:

a - potassium nitrate; b - calcium nitrate; c - potassium phosphate; d - vagnesium sulfate

The effect of magnetic treatment depends on the chemical composition of the solution, that is, the concentration and composition of ions. In solutions containing ions stabilizers structure of water (Ca^{2+}, Mq^{2+}, SO4^{2-}), he pronounced than in solutions with ions that are "fluff" around him water structure (K^{+}, NO^{3}-).

Thus, our experimental study of changes in pH salt solutions at magnetic treatment confirmed the correctness of theoretical relationships and made it possible to identify the factors that go into these as well.

Conclusion

It is established that changing pH salt solutions depends on the square of the magnetic induction and velocity of the solution. The most effective mode processing occurs at magnetic induction of 0,065 T.