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ROLE OF HYDRONIUM IONS IN BIOLOGICAL EFFECTS OF WEAK COMBINED MAGNETIC FIELDS

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It was revealed that effects of low level of magnetic field's noise (less than $4\mu\text{T}/\text{Hz}^{0.5}$) on gravitropic reaction of cress-roots depend on MF frequency. The peak of effects corresponded to cyclotron frequency of Ca^{2+} ions for the static component of combined magnetic field equal to $40\mu\text{T}$. This peak split up into three frequency modes ($f_1 = 31.3\text{Hz}$, $f_2 = 32.5\text{Hz}$ and $f_3 = 34\text{Hz}$). The frequency f_1 corresponds to Ca^{2+} ion (the theoretical value is 31.6Hz), the frequency f_2 corresponds to hydronium ion H_3O^+ (the theoretical value is 32.9Hz), and frequency f_3 relates OH^- ion (the theoretical value is 35Hz). Taking into account the influence of combined magnetic field on the hydronium ions and the Del Giudice hypothesis the main doubts about the existence of ion cyclotron resonance may be discard. Hydronium ions are unusual because they have a long free path. It was revealed that the combined magnetic field tuned for the cyclotron frequency of hydronium ion changed pH of pure water. Such changes have to lead to biological effects.

Key words: gravitropic reaction, combined electromagnetic field, cyclotron frequency, hydronium ion.

INTRODUCTION

Many hypotheses [1-4] were proposed after Liboff's discovery that combined magnetic field influenced on biological objects through ion cyclotron resonance. But all these hypotheses had some deficiencies. They couldn't explain the big free path of ion in the liquid. It is well known that the main liquid in the alive system is the water. Liboff's idea cannot explain long free path in liquid. It is well known, that the main liquid in alive systems is the water. Besides it has been proved until now that the water in biological system consisted from two phases. The first one was the usual water, the second one was the EZ water. This was the water in which it was ordered [5, 6]. Taking into account the influence of combined magnetic field on hydronium ions (H_3O^+) and also Del Giudice's hypothesis may throw away doubts about the possibility of ion cyclotron resonance. The hydronium ions are unusual because they have a long free path length.

MATERIALS AND METHODS

In earlier works we noticed that well reproducible magnetic conditions is the key factor in magnetobiological researches. The method of obtaining such conditions was described by us in details [9-13]. In most of these works the many layers μ -metal shields were used. The static or combined magnetic field was created inside of them by means of coaxial

solenoids. It was shown, that in spite of good decreasing of static component of the Earth's magnetic field (until to 1000 times), the artificial creation of magnetic field inside the μ -metal shield led to the increasing of magnetic noise's level connected with current flowing in solenoids.

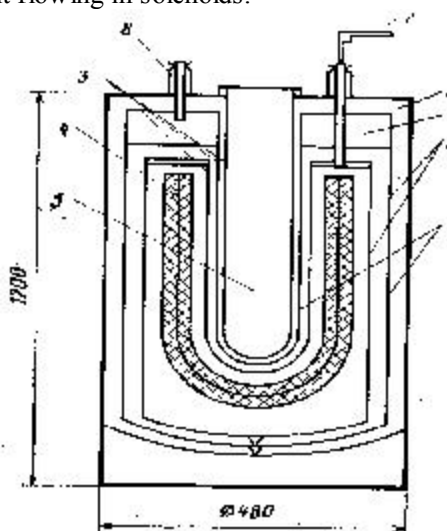


Fig.1. 1 – volume for liquid helium, 2 – external cryostat for helium, 3 – isolating cryostat, 4 – superconductive magnetic shield, 5 – Warm work volume, 6 – upper flange, 7 – the tube for flooding of liquid helium, 8 – the tube for flooding of liquid nitrogen, 9 – nitrogen screens of isolating (3) and external helium cryostats.

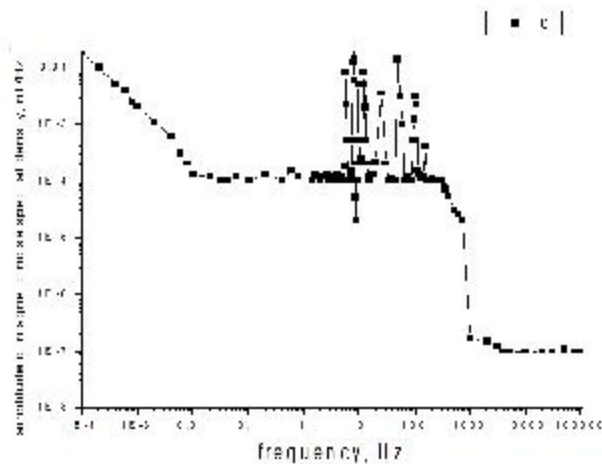


Fig. 2. The dependence of magnetic noise's spectral density on frequency inside the warm volume of superconductive shield (the leaden shield was used) on the frequency. The measurements were fulfilled by means of SQUID – magnetometer. The curve corresponded to the remained magnetic field 5 nT when the field has been pushed out at most.

It is possible to decrease the level of magnetic fields essentially only by using the superconductive magnetic shield with warm volume (fig.1). We may freeze the magnetic field from $5\mu\text{T}$ until $43\mu\text{T}$ in this shield. The amplitude of magnetic field spectral density of such a shield is shown on fig.2. As can be seen from fig.2 we can decrease the magnetic field noise level down to $0.2\text{ nT/Hz}^{0.5}$ at the frequency 50 Hz for bold leaden shield. This is approximately 100 times less than for μ -metal shield. The $1/f$ region moved down to 0.01 Hz instead of 0.5 Hz for μ -metal shield.

It is well seen from the fig.2 that both the frequencies of building oscillation (5.6 and 9.5 Hz), and Shuman's frequencies (7.8, 12.5 and 23 Hz and frequencies 50, 100 and 150 Hz) were presented.

Two-days germinated seeds were located in the remained field. Static and alternative components of artificial magnetic field was created by means of solenoids, located inside the superconductive shield. The seeds were germinated so that the roots were straight without curvatures [9 – 13].

The roots were located parallel to the Earth that is perpendicular to the gravitation force and the direction of combined magnetic field. The roots were located in wet thermo stable chamber. The humidity was 100%, the temperature change was not more than 0.2° during the day.

RESULTS AND DISCUSSION

The frequency f_1 corresponded to the Ca^{2+} ion (theoretical value 31.6 Hz), the frequency f_2 corresponded to the hydronium ion H_3O^+ (theoretical value 32.9 Hz), the frequency f_3 corresponded to OH^- ion (theoretical value 35 Hz) (Fig.3).

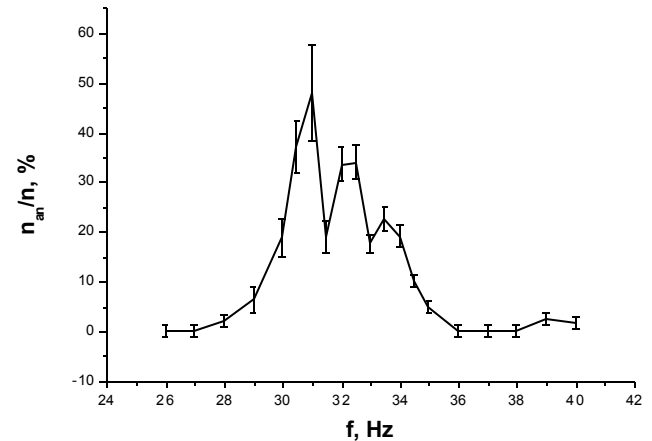


Fig. 1. The dependence of the part of the roots with anomalous gravitropic reaction on frequency near the cyclotron frequency of calcium ions.

On fig.4 the graph of dependence of pH on the time of exposition in combined magnetic field tuned for hydronium ions is shown on fig.4. As one can see from the fig.4 after approximately 5 minutes after the combined magnetic field action pH of pure water decreased from 7 down to 6. The effect was observed in 75% of cases.

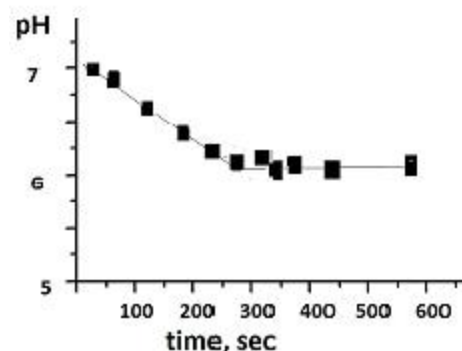


Fig. 4. Dependence of pH on time of exposition in combined magnetic field tuned for hydronium ions

Direct participation of hydroxonium ions in gravitropic reaction may explain non simple results obtained by us before. The observation of gravitropic reaction by different methods (during growing on vertical plane and in the wet air) the water ions had different direction of moving during they absorbed. This fact may lead to different biological effects [4,14]. And the hydronium ions moving may have different directions in EZ zone and depends both on the direction of hydronium ions moving and on the initial root's direction.

The decreasing of water pH indicates on the increasing of quantity of protons in pure water.

CONCLUSIONS

The peak in frequency depended MF-effects on roots gravitropic reaction corresponded to the cyclotron frequency of hydronium ions.

The decrease of pH in pure water was revealed during exposure this water to combined magnetic field with alternative component that tuned to the cyclotron frequency of hydronium ions.

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РОЛЬ ІОНІВ ГІДРОКСОНІЯ У БІОЛОГІЧНИХ ЕФЕКТАХ СЛАБКИХ КОМБІНОВАНИХ МАГНІТНИХ ПОЛІВ

Богатина Н.І., Шейкіна Н.В.

Було виявлено, що вплив слабких шумових магнітних полів (менше $4\mu\text{T} / \text{Hz}^{0,3}$) впливають на гравітропічну реакцію крес-коренів в залежності від частоти МП. Пік впливу відповідала циклотронної частоти іонів Ca^{2+} для статичного компонента комбінованого магнітного поля, рівної $40\mu\text{T}$. Цей пік розщеплюється на три частотних смуги ($f_1 = 31,3 \text{ Гц}$, $F_2 = 32,5 \text{ Гц}$ і $f_3 = 34 \text{ Гц}$). Частота f_1 відповідає іону Ca^{2+} (теоретичне значення $31,6 \text{ Гц}$), частота f_2 відповідає іону гідроксонію H_3O^+ (теоретичне значення $32,9 \text{ Гц}$) і частота f_3 відноситься до іону OH^- (теоретичне значення 35 Гц). Іони гідроксонія незвичайні, тому що вони мають тривалий вільний пробіг. Було виявлено, що в магнітне поле, що налаштована на циклотронні частоти іона гідроксонію змінюється рН чистої води. Такі зміни рН повинні приводити до певних ефектів біологічного впливу МП.

Ключові слова: гравітропічна реакція, комбіноване електромагнітне поле, циклотронна частота, іон гідроксонію.

РОЛЬ ИОНОВ ГИДРОКСОНИЯ В БИОЛОГИЧЕСКИХ ЭФФЕКТАХ СЛАБЫХ КОМБИНИРОВАННЫХ МАГНИТНЫХ ПОЛЕЙ

Богатина Н.И., Шейкина Н.В.

Было выявлено, что влияние слабых шумовых магнитных полей (менее $4\mu\text{T} / \text{Hz}^{0,3}$) влияют на гравитропическую реакцию кресс-корней в зависимости от частоты МП. Пик влияния отвечал циклотронной частоте ионов Ca^{2+} для статического компонента комбинированного магнитного поля, равной $40\mu\text{T}$. Этот пик расщепляется на три частотных полосы ($f_1 = 31,3 \text{ Гц}$, $F_2 = 32,5 \text{ Гц}$ и $f_3 = 34 \text{ Гц}$). Частота f_1 соответствует иону Ca^{2+} (теоретическое значение $31,6 \text{ Гц}$), частота f_2 соответствует иону гидроксония H_3O^+ (теоретическое значение $32,9 \text{ Гц}$) и частота f_3 относится к иону OH^- (теоретическое значение 35 Гц). Ионы гидроксония необычные, потому что они имеют длительный свободный пробега. Было обнаружено, что в магнитное поле, настроенном на циклотронную частоту иона гидроксония, меняется рН чистой воды. Такие изменения рН должны приводить к определенным биологическим эффектам воздействия МП.

Ключевые слова: гравитропическая реакция, комбинированное электромагнитное поле, циклотронная частота, ион гидроксония.