

EFFECT OF STATIC MAGNETIC FIELD ON E.coli Growth

Morteza Haghi^{2,3*}, Mohammad Javad Maghsoodi¹,
Mohammad Bagher Janipor⁵, Saman Seyyedgholizadeh⁴

¹Armenian National Academy of Sciences

²Department of Microbiology and Biotechnology, JNTU University, AP, India

³Young Research Club Urmia Branch, West Azerbaijan, Iran

⁴Department of Microbiology Azad Islamic University of Science and research branch, Shiraz, Iran

⁵Department of Biotechnology, Osmania University, AP, India

*Corresponding Author e-mail: Araz.anadilim@gmail.com

[Received - 14/10/2012, Accepted - 04/11/2012]

ABSTRACT

Many studies indicate that magnetic fields have some biological effect on living things. The effect of magnetic fields are studied in different areas such as drug delivery, cancer therapy, sterilization, water treatment and etc. E. coli collected from hospital environment was subjected to magnetic field of 16 gauss from 2 to 18 hours to study the growth rate of it. The antibiotic susceptibility of E. coli measured according to Kirby-bauer disc diffusion technique. Results obtained in this study illustrate that magnetic field of 16 gauss increased the logarithmic phase within 4 hours of treatment and also decreased from 16 to 18 hours figure. Many researches have been done to study the effect of magnetic field on bacteria. The magnetic field could be used as inhibitory factor against the bacteria such as sterilization of food products and etc.

Key words: magnetic field, E. coli, Kirby bauer

INTRODUCTION

Many studies indicate that magnetic fields have some biological effect on living things (1-5). The effect of magnetic fields are studied in different areas such as drug delivery, cancer therapy, sterilization, water treatment and etc. (6)

Magnetic field affects DNA synthesis and transcription (7) as well as ion transport through all membrane (8). Several studies have been done on different microorganisms and the effect of magnetic fields was a variable of the type of the microorganism. (9)

Patti et al (10) found that the exposure of *Serratia marcescens* to a static magnetic field 80+20 GAUSS resulted in inhibition of *S. marcescens* growth.

Mohammad et al (11) reported that exposure of the microorganism *S. typhi* to the magnetic field caused change in growth characteristics and the number of cells at the stationary phase increased.

Many of these effects of magnetic fields are the result of interactions with all membrane components and improving the enzymatic activity (12-19).

MATERIALS AND METHODS

The test organism used in this study was E.coli collected from hospital environment .10 ml of over night culture was added in 90 ml of Nutrient broth and incubated at 37 C for 24 hours.

Antibiotic Susceptibility Test

The Muller-Hinton Agar medium was prepared and after culture antibiotic susceptibility test done by using Kirby-Bauer Disk Diffusion technique and Gentamycin (10µg),Tetracycline (30), Methicillin (20), Vancomycin10(), Streptomycin (30µg) , Oxacillin() , Ampicillin (10 µg), and Amoxicillin (25µg) disks were placed over the media.

Magnetic Field Treatment

Two permanent Magnets with opposite to each other (north pole in front of south pole and vice versa) beside the 15 ml NB tubes containing 1ml newly subculture E.coli producing 16 Gauss magnetic field.

The tubes were subjected to magnetic field at 37 C for 2 to 18 hours and one sample did not subjected to magnetic field as control.

To evaluate the concentration of bacteria ,OD values were taken at 600nm.

Antibiotic susceptibility test was done for each of the tubes from 2 hours to 18 hours.

RESULT

Results obtained in this study illustrates that magnetic field of 16 gauss increased the logarithmic phase within 4hours of treatment and also decreased from 16 to 18 hours figure 1 .

According to antibiogram test, ampicillin and methicillin nonresistant in whole test and magnetic field does not have any effect on inhibition zone of ampicillin, methicillin and oxacillin.

For antibiotic susceptibility, 2, 4, 8, 12 and 16 hours evaluated. For first 2, 4 and 14 hours amoxicillin should a sharp increase in zone of inhibition in contrast to the blank.

Streptomycin:

The zone of inhibition increased in 4, 8, 12, 14 and 16 hours for streptomycin.

Tetracycline:

The zone of inhibition increased in 8 and 16 hours.

Gentamycin:

The zone of inhibition increased in 8, 14 and 16 hours.

Ampicillin:

E.coli was resistant for first 12 hours, but became sensitive in 14 and 16 hours while the magnetic field increased zone of inhibition.

DISCUSSION:

In this study we aim to study the effect of static magnetic field on E.coli growth and it's antibiotic resistance pattern. Many studies indicted that magnetic field have biological effect on living things. As relatively simple living organisms, bacteria are important research subject in this field.

Kohno et al. [2000] studied the effect of static magnetic field on bacteria, Streptococosmutans, Staphylococosaureus and E.coli. According to their study, ferrite magnet caused strength-dependent decrease in the growth rate and maximum number of bacteria for S.mutans, S.areus when cultured under anaerobic conditions but their growth was hot inhibited under aerobic condition and however no growth effects were detected in E.coli culture.

Samir. H. Nasher and Amal. A.hussein. [2001] Concluded that magnetic field effect on bacteria could be considered as bactericidal; While in our study that magnetic field effects the logarithmic and death phase.

Stan sell et al [2001] reported that exposure ofE.coli to static magnetic field increased it's antibiotic resistance whereas in our study antibiotic resistance relatively decreased in 18 hours of exposure.

ACKNOWLEDGMENTS

I am thankful to my father Mr. HassanHaghi who always supports me financially and emotionally during my research studies and also Mr.M.HAsgharzadehShirazi and Miss.BehnazBabaei who helped us in this study.

REFERENCES

1. Phillips JL, Campbell BM, Ivaschuk CO, Ishida JT, Haggren LW. Exposure of molt-4 lymphoblastoid cells to a 1 G sinusoidal magnetic field at 60-Hz: effects on

EFFECT OF STATIC MAGNETIC FIELD ON E.coli Growth

cellular events related to apoptosis. In: Annual Review of Research on Biological Effects of Electric and Magnetic Fields from the Generation, Delivery, and Use of Electricity. Frederick, MD:W/L Associates, Ltd. 1997.112-118.

2. Ahuja YR, Vijayashree BL, Saran RB, Jayashri EK. In vitro study, Effect of low frequency electromagnetic field on DNA in human leucocytes by comet. Assay. Indian J Biophys 1999; 36:318-322.

3. Svedenstal BM, Johanson KL, Mattsson MO, Paulson LE. DNA damage, cell kinetics and activities studied in mice exposed to electromagnetic fields generated by transmission lines. In Vivo, J Health Physic 1999; 13:507-514.

4. Inadian Gyan BF. The story of magneto therapy 2nd ed. Indian Gyan.Com Put- Ltd. (Indian Gyan.com) 2000.p.2-24.

5. Zmyslony M, Palus J, Jajte J, Dziubaltowska E, Rajkowska E. DNA damage in rat lymphocytes treated in vitro with iron cations and exposed to 7 mT magnetic fields (50 Hz). Mutat Res 2000;453:89-96.

6. J. Vander Sloten, P. Verdonck, M. Nyssen, J. Haueisen (Eds.): ECIFMBE 2008, IFMBE Proceedings 22, pp. 2623–2627, 2008 www.springerlink.com © Springer-Verlag Berlin Heidelberg 2009

7. Phillips, J. L., Haggren W., Thomas W. J., Ishida-Jones T., and Adey W. R.: Magnetic field-induced changes in specific gene transcription. Biochim.Biophys.Acta, 112, 140-144 (1992).

8. Liburdy, R. P., Callahan D. E., Harland J., Dunham E., Sloma T.R., and Yaswen P.: Experimental evidence for 60 Hz magnetic fields operating through the signal transduction cascade: effects on calcium influx and c-MYC mRNA induction. FEBS. Lett., 334, 301-308 (1993).

9. Kohno MF, Yama ZA, Kimura I, Wafa MC. Effect of static magnetic field on bacteria streptococcus mutans and Escherichia coli. J Am pathophysiology 2000; 17(2): 143-148.

10. PIATTI, E., M.C. ALBERTINI, W. BAFFONE, D. FRATERNALE, B. CITTERIO, M.P. PIACENTINI, M. DACHA, F. VETRANO, A. ACCORSI, Antibacterial effect of a magnetic field on *Serratiamarcescens* and related virulence to *Hordeumvulgare* and *Rubs fruticosus* callus cells, *Comparative Biochemistry and Physiology, B, Biochemistry and Molecular Biology*, 2002, **132(2)**, 359–365.

11. MOHAMED, A.A., F.M. ALI, E.A. GAAFAR, H.R. MAGDA, *Effects of magnetic field on the biophysical, biochemical properties and biological activity of Salmonella typhi.*, Master thesis submitted for Biophysics department, Faculty of science, Cairo University, Egypt, 1997.

12. Ceon R and Martin JT. low- level, magnetic field induced growth modification of *Bacillus subtilis*. J Bioelectromagnetics 2005; 8 (3):275-282.

13. Kohno MF, Yama ZA, Kimura I, Wafa MC. Effect of static magnetic field on bacteria streptococcus mutans and Escherichia coli. J Am pathophysiology 2000; 17(2): 143-148.

14. Mandronero A S. influence of magnetic fields on calcium salts crystal formation. J Bio Med Res 1990; 12:627-634.

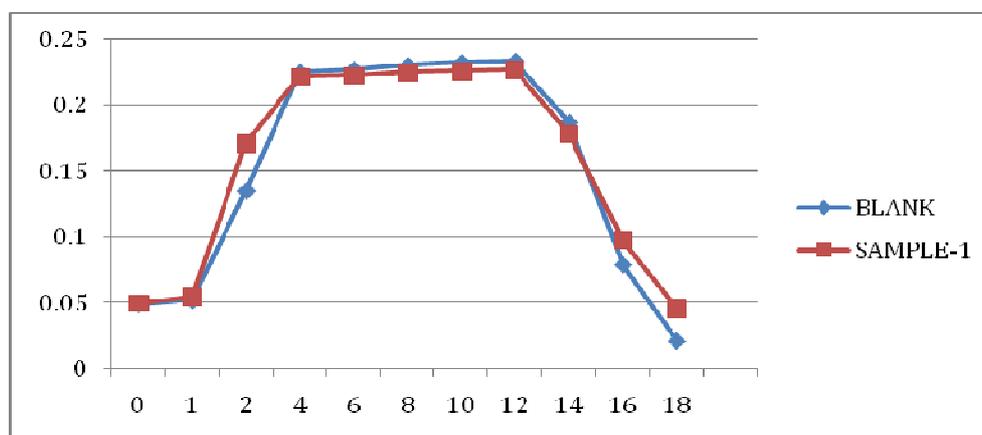
15. Stepanian AA, Barsegian ZH, Alaverdian GG, Oganessian LS, Markosian SN, Airapetion BK. The effect of magnetic fields on the growth and division of *Escherichia coli*. J Clin Bio 2000 40(3): 319-322.

16. Victor Zeines FK. A patients Guide To magnetic. 2nd ed. London. Zenergy Com. (www.Natdent.com); 2000.p.7-12.

17. Kate Melville BC. Magnetic bacteria maintain their mystery. Naval, J Med. Laboratory Res 2006; 8:312-315. 18

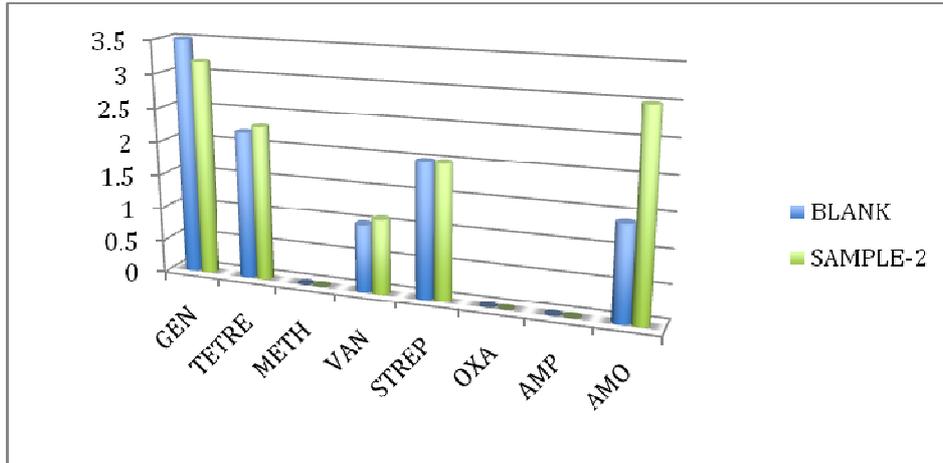
18. Bokkon IK. Phosphenomenon, A new concept. J Biophys Res 2008; 92: 168-174.

Figures:

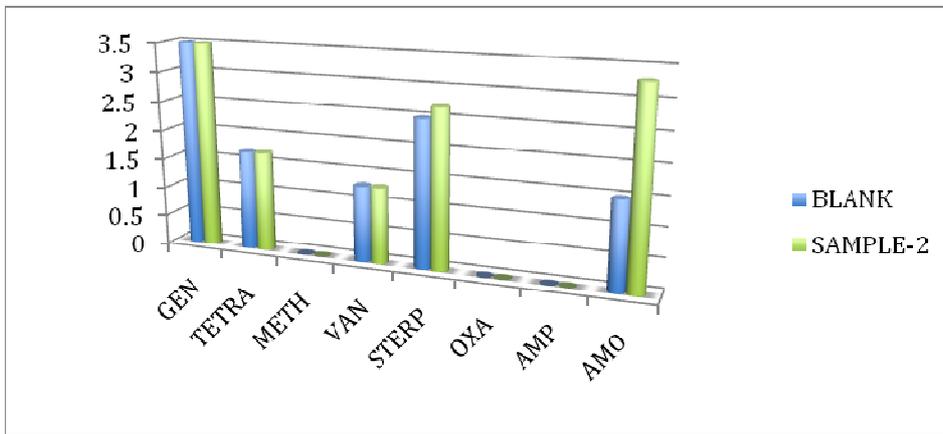


Analysis comparison based on time in hours →

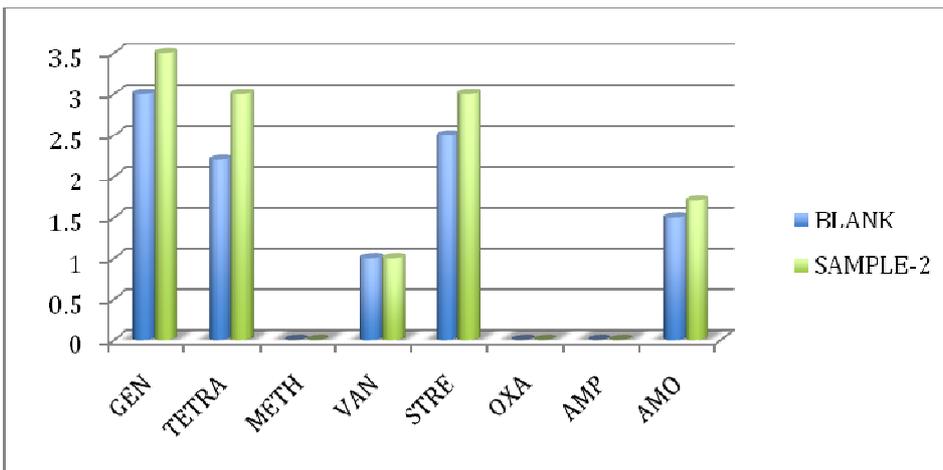
EFFECT OF STATIC MAGNETIC FIELD ON E.coli Growth



2hour

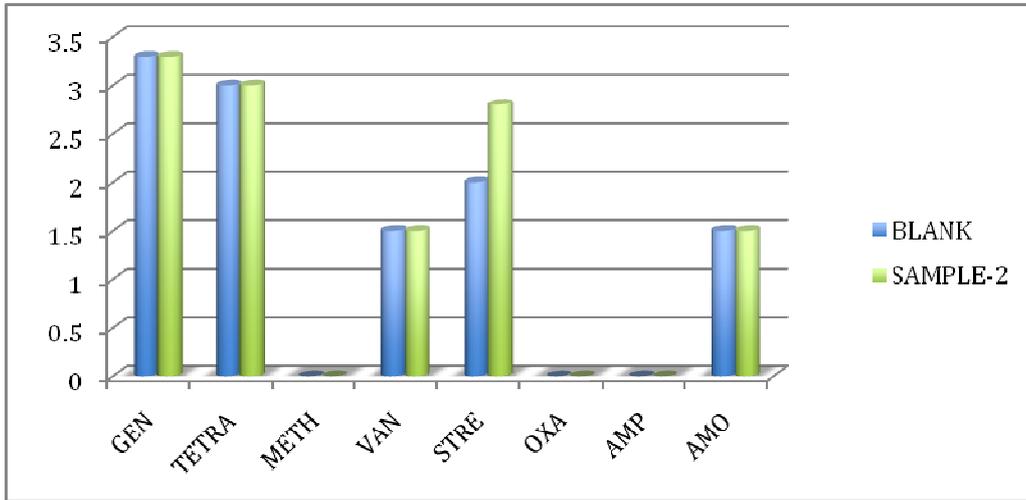


4hour

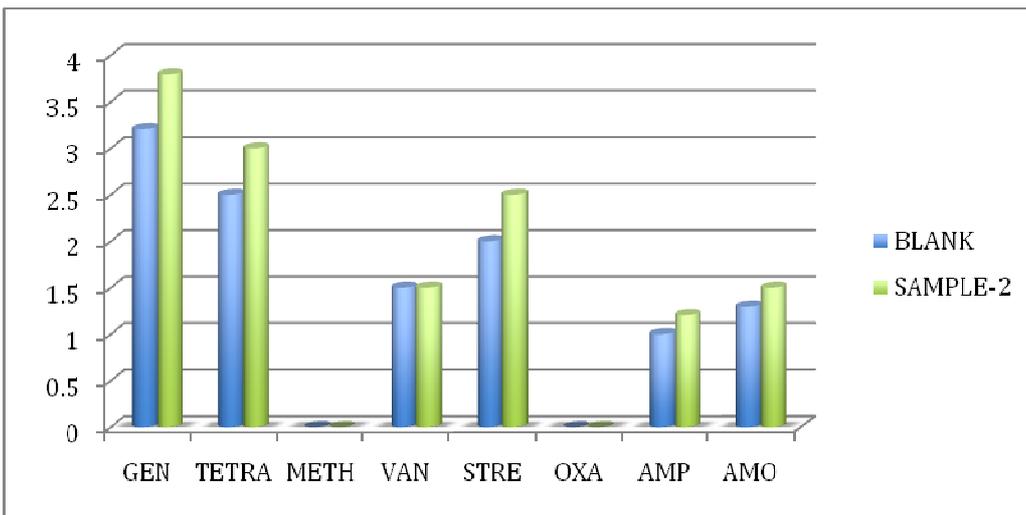


8hour

EFFECT OF STATIC MAGNETIC FIELD ON E.coli Growth



12hour



16hour