# PERSPECTIVES OF VECTOR ALGEBRA THEORY IN ANALISIS OF PROPERTIES OF ANTIBACTERIAL MEDICATIONS

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**Introduction.** At the present, a problem of infections diseases of human (dental, otolaryngological, dermatological, etc.) and their treatment is the issue of importance both, for Ukraine and for the world in general. But mathematical theory for quantitative description of antibacterial medications and comparison of their properties has been not described.

**The aim of the thesis** is to show the possibility to use vector algebra theory for quantitative description of antibacterial medications and comparison of their properties.

**Materials and methods**. For the purpose of screening of antimicrobial properties the following medications have been taken: “Tincture of Sophora japonica”, “Tincture of eucalyptus”, “Tincture of propolis”, “Tincture of calendula”, “Fitodent”, “Stomatofit”, “Rotokan”, “Romazulan”, “Sangviritrin”, “Chlorophillipt” (Galichpharm), “Kamistad”, “Orasept”, “Hexoral”, “Metrogyl Denta”, “Myramistinum”, “Decasanum”, “Chlorhexidine digluconate”, “Benzalkonium chloride” and “Octenisept”.

Antimicrobial activity of medications has been determined by easily performed method of “wells”, with determination of zone diameters of microorganism growth inhibition. According to recommendations of World health organization and State Pharmacopoeia of Ukraine the following test strains of microorganisms were used for valuation of antimicrobial activity of medications: Staphylococcus aureus ATCC 25923, Escherichia coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853, Proteus vulgaris ATCC 4636, Bacillus subtilis ATCC 6633, Candida albicans ATCC 885/653. Antimicrobial properties of medications have been examined in the State Institution I.I. Mechnikov Institute of Microbiology and Immunology of National Academy of Medical Sciences of Ukraine, Kharkov, under supervision of the Head of Laboratory “Biochemistry of microorganisms and nutrient media”, candidate of biological sciences, Osolodchenko T.P.

Calculation of the complex indicator of medication antimicrobial activity and its measurement error has been performed using the following formulas:

$$A=\sqrt{\left(a_1\cdot\frac{D_1}{25}\right)^2+\left(a_2\cdot\frac{D_2}{25}\right)^2+\left(a_3\cdot\frac{D_3}{25}\right)^2+\left(a_4\cdot\frac{D_4}{25}\right)^2+\left(a_5\cdot\frac{D_5}{25}\right)^2+\left(a_6\cdot\frac{D_6}{25}\right)^2} \quad (1)$$

and

$$\Delta A = \sqrt{a_1 \cdot \left(\frac{\Delta D_1}{25}\right)^2 + a_2 \cdot \left(\frac{\Delta D_2}{25}\right)^2 + a_3 \cdot \left(\frac{\Delta D_3}{25}\right)^2 + a_4 \cdot \left(\frac{\Delta D_4}{25}\right)^2 + a_5 \cdot \left(\frac{\Delta D_5}{25}\right)^2 + a_6 \cdot \left(\frac{\Delta D_6}{25}\right)^2} \quad (2)$$

where $A$ is a complex indicator of medication antimicrobial activity, dimensionless value, (indicator efficiency ranges: 1.0-1.5 the medication has weak antimicrobial activity; 1.5-2.5 the medication has medium antimicrobial activity; more than 2.5 the medication has strong antimicrobial activity);

$a_1$, $a_2$, $a_3$, $a_4$, $a_5$, $a_6$ are weighing coefficients of microorganism strain significance in the disease, in order to simplify, we have taken them as a unit, however, application data from research on prevalence degree of microorganisms in affected people can be used;

$D_1$, $D_2$, $D_3$, $D_4$, $D_5$, $D_6$ are zone diameters of growth inhibition of the examined microorganism strains: Staphylococcus aureus ATCC 25923, Escherichia coli ATCC 25922, Pseudomonas aeruginosa ATCC 27853, Proteus vulgaris ATCC 4636, Bacillus subtilis ATCC 6633, Candida albicans ATCC 885/653, mm;

$\Delta A$ is a measurement error of complex indicator of medication antimicrobial activity.

**Results and discussion.** It has been shown that among 19 medications, 7 possess upper-range value of complex antibacterial index: Chlorhexidine digluconate - 2.07; Tincture of Sophora japonica - 2.05; Chlorophyllipt (Galichfarm) - 1.99; Sangviritrin - 1.91; Decasanum - 1.84; Metrogil Denta - 1.51; and Tincture of eucalyptus - 1.50.

This method in pharmacoeconomics allows choosing optimal cost/quality ratio among the antibacterial medications.

**Conclusions.** This method allows evaluation of medications' antibacterial activity and opportunity to choose the most active ones, as well as compare them with each other.

It has been shown that among 19 medications, 7 possess upper-range value of complex antibacterial index: Chlorhexidine digluconate - 2.07; Tincture of Sophora japonica - 2.05; Chlorophyllipt (Galichfarm) - 1.99; Sangviritrin - 1.91; Decasanum - 1.84; Metrogil Denta - 1.51; and Tincture of eucalyptus - 1.50.

It is noted that medications of natural origin are inferior to those of synthetic origin as for their antibacterial activity, and new galenic medications possess the most antimicrobial properties.

It is noted that this method in pharmacoeconomics allows choosing optimal cost/quality ratio among the antibacterial medications.