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MONITORING THE QUALITY OF ANTIBIOTICS: POTENTIAL TESTS AND TESTS COMPARISON OF ANTIBIOTIC DOXYCYCLINE USED IN CASES OF ANTIBIOTIC RESISTANCE IN ACUTE RESPIRATORY INFECTION DISEASE

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ABSTRACT

Objective: Acute respiratory infection (ARI) is a disease of the upper and lower respiratory tract and is usually contagious and can cause various spectrums of disease caused by viruses, bacteria, rickettes. Doxycycline antibiotics are one of the antibiotics commonly used to treat ARI. The use of antibiotics that are of less quality and can cause treatment is less effective and can cause resistance. This study aims to determine the potential value and comparative test of tetracycline antibiotics as a quality evaluation. **Methods:** Test the antibiotic potency with diffusion method to use 3 doses with using antibiotic samples. Comparative test of antibiotic testing by comparing samples with standard against *Staphylococcus aureus* ATCC 29213 test bacteria. **Results:** The potential value obtained was 86.8%, and comparative test was 1 : 1.03. **Conclusion:** Potential antibiotic test results indicate that the potential value of the doxycycline antibiotic used has decreased from the provisions listed in Indonesian pharmacopoeia 88 - 98%.

KEYWORDS: Doxycycline, antibiotic resistence, potential test, comparative test, agar diffusion.

INTRODUCTION

Acute Respiratory Infection (ARI) is known to be one of the main causes of mortality for all ages, especially in children. The age group of 6-23 months is the most vulnerable age group

to experience ARI.[1] The results of the basic health research in the province of West Java, the prevalence rate of ARI in the city of Tasikmalaya ranked third.[2]

ARI can be caused by bacteria, viruses and rickets such as Streptococcus genus, Staphylococcus, Pneumococcus, Hemophilus, Bordetella, and Corynebacterium.[3] Virus causes include 9 groups Mexovirus, Adenovirus, Coronavirus, Pikornavirus, Mikoplasma, Herpesvirus, and others.[4]

Testing the potential of antibiotics aims to determine the biological activity of an antibiotic in inhibiting microorganisms, which cannot be determined chemically or physically.[5] Testing the comparative value of antibiotic activity aims to determine the comparison of antibiotic activity with standard samples against clinically sensitive bacterial isolates.[5]

In this study will be tested potential test of doxycycline which is also an important data to determine the quality of antibiotics used in the health center of Tasikmalaya City. The requirements of antibiotic levels should be in accordance with Indonesia Pharmacopeia.

MATERIALS AND METHODS.

Test Materials

Materials tested were doxycycline standard from PT. Sanbe Farma, Indonesia. McFarland standard No. 0.5, and physiological saline 0.9% (Merck).

Bacteria Test

Test bacteria used to test the potential of doxycycline antibiotics is Staphylococcus aureus ATCC 29213.[5]

Bacterial Growth Media

Bacteria growth medium used was Mueller Hinton Agar (Merck) with a concentration of 43 g/L and Mueller Hinton Broth (Oxid, Basingstoke, UK) at a concentration of 21 g/L, Mueller Hinton Agar (Merck, USA) with a concentration of 43 g/L.

Method

The antibiotic potency test was performed by agar diffusion method. Determination of antibiotic potency using 3 doses done calculation by formula:

$$I = \log \frac{Dt}{Dm} = \log \frac{Dm}{Dr}$$

$$E = \frac{1}{4} x [(St - Sr)] + [(Bt - Br)]$$

$$b = \frac{E}{\log 2}$$

$$F = \frac{1}{3} x [(St + Sm + Sr)] - [(9Bt + Bm + Br)]$$

$$M = \frac{F}{b}$$

Potency = antilog M x 100%.[6]

Testing the comparability of doxycycline antibiotics using sample and standard antibiotics with 3 variations of concentration, namely 2 µg / mL, 1 µg / mL, and 0.1 µg / mL.[6]

RESULT AND DISCUSSION

Testing Potential Antibiotics

The potential test of doxycycline antibiotics according to IV Pharmacopoeia Indonesia (1995) was used Staphylococcus aureus ATCC 29737 bacteria. The experimental pattern of the agar diffusion method used is the 3 + 3 pattern where one comparison standard is used and one sample with 3 dose variations. The doses used were high doses (2 µg / mL), medium doses (1 µg / mL), and low doses (0.5 µg / mL).[6]

The inhibition diameter obtained from the test for the potential of doxycycline antibiotics can be seen in Table 1.

Table 1: Inhibition Diameter of Potential Test Results.

Inhibition Diameter (mm)					
$S_{td}H$	$S_{td}M$	$S_{td}L$	$S_{sm}H$	$S_{sm}M$	$S_{sm}L$
17.8	15.3	12.02	16.51	13.71	12.26

Table Descriptions

$S_{td}H$: High Dose Standard
$S_{td}M$: Middle Dose Standard
$S_{td}L$: Low Dose Standard
$S_{sm}H$: High Dose Samples
$S_{sm}M$: Middle Dose Medium
$S_{sm}L$: Low Dose Samples

The results of the calculation of the potential test for doxycycline antibiotics with a three-dose pattern obtained a value of 86.8%. The potential value of this antibiotic has decreased compared to the requirements in the Indonesian Pharmacopoeia, which is between 88% - 98%.[6]

Antibiotic Comparison Test

The comparative test of antibiotic activity aims to be resistant to antibiotics using resistant clinical isolate bacteria. The result of this treatment is for patients with respiratory infection.[7] Testing the comparability of doxycycline antibiotics using sample and standard antibiotics with 4 variations of concentration, namely 0.8 µg / mL, 0.4 µg / mL, 0.2 µg / mL, and 0.1 µg / mL. The inhibition diameter obtained from the comparative value of doxycycline antibiotic activity can be seen in Table 2.

Table 2: Inhibited Diameter of Antibiotic Comparison Test.

Testing	Inhibition Diameter (mm)			
	0.8 µg/mL	0.4 µg/mL	0.2 µg/mL	0.1 µg/mL
Standard	18.87	16.24	14.44	12.63
Sample	18.57	16.30	14.34	12.47

Determination of the comparison test of antibiotics is done by making a curve between the log concentration and the inhibitory diameter then a linear regression equation is obtained. After the calculation, the results of the equation for the standard are y = 6.8166x + 19.284 with R^2 = 0.9904, while the results of the equation for the sample are y = 6.7302x + 19.111 with the value R^2 = 0.9979. The curve between log concentration and inhibition diameter for the standard and sample can be seen in Figure 1, and Figure 2.

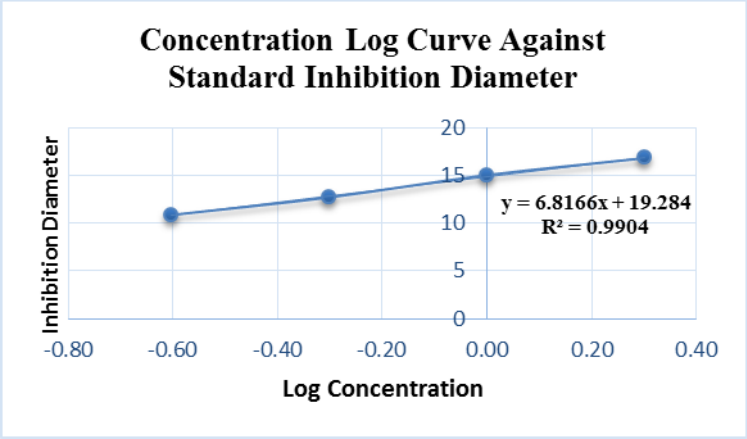

Figure 1: Log concentration curve against standard inhibitory diameter.

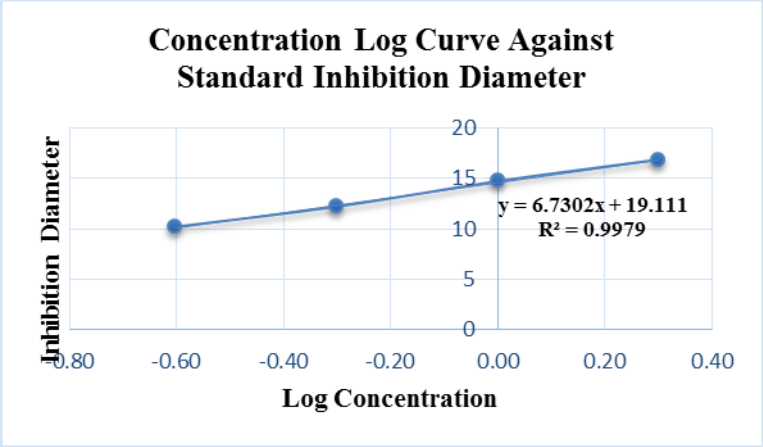

Figure 2: Log concentration curve against sample inhibitory diameter.

The concentration log of the standard antibiotic concentration is substituted as the value of x in the standard equation, so that the value of the inhibitory zone diameter or y value is obtained. Then, the value of y is inserted into the sample equation, so that the value of x is obtained. The antilog value of x is the value of the antibiotic concentration of the sample which is equivalent to the reference standard concentration with the same inhibitory zone diameter. The graph of the sample and standard antibiotic appellate values can be seen in Figure 3.[8]

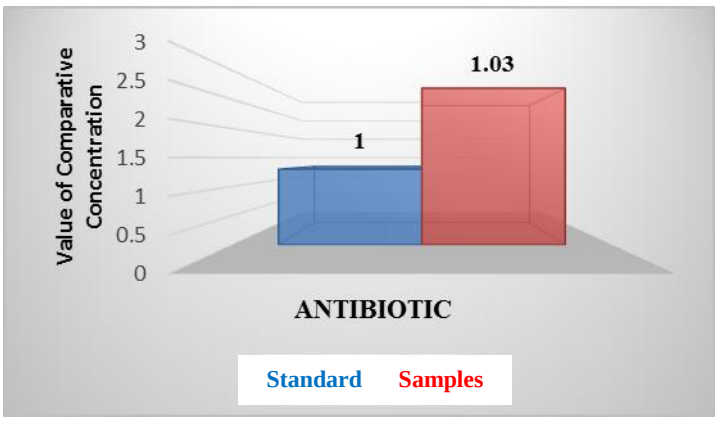

Figure 3: Comparative test values of antibiotic samples and standards.

The comparative value of doxycycline antibiotics obtained is 1: 1.03, this value indicates that the concentration needed by the antibiotic sample is not much different from the standard antibiotic comparison.[9]

CONCLUTION

The antibiotic potency of doxycycline was 86.8 %, and the comparative test was 1 : 1.08. The potential test value of this antibiotic has decreased compared to the requirements in the Indonesian Pharmacopoeia.

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