The most effective antibiotic on bacteria biology essay

ASSIGN BUSTER

Before bacteria can multiply and cause symptoms our immune system can usually destroy them. We have special white blood cells that attack harmful bacteria. Even if symptoms do occur, our immune system can usually cope and fight off the infection. There are occasions, however, when it is all too much and our bodies need some help – from antibiotics.

The first antibiotic was penicillin. Such penicillin-related antibiotics as ampicillin, amoxicillin and benzylpenicilllin are widely used today to treat a variety of infections – these antibiotics have been around for a long time. There are several different types of modern antibiotics and they are only available with a doctor’s prescription in industrialized countries.

An antibiotic is given for the treatment of an infection caused by bacteria. They target only bacteria – they do not attack other organisms, such as fungi or viruses. If you have an infection it is important to know whether it is caused by bacteria, and not a virus or fungus. Most upper respiratory tract infections, such as the common cold and sore throats are generally caused by viruses – antibiotics do not work against viruses.

Antibiotics are overused or used incorrectly there is a chance that the bacteria will become resistant – the antibiotic becomes less effective against that type of bacterium.

A broad-spectrum antibiotic can be used to treat a wide range of infections. A narrow-spectrum antibiotic is only effective against a few types of bacteria. There are antibiotics that attack aerobic bacteria, while others work against anaerobic bacteria. Aerobic bacteria need oxygen, while anaerobic bacteria don’t.

Antibiotics may be given beforehand, to prevent infection, as might be the case before surgery. This is called ‘ prophylactic’ use of antibiotics. They are commonly used before bowel and orthopedic surgery.

Bacteria

The word bacteria is the plural of bacterium. Grammatically the headline should just say “ What are bacteria?” The incorrect usage has been included in the headline to remind readers that it is wrong – and hopefully help correct an increasingly common mistake in the English language. Bacteria are tiny living beings (microorganisms) – they are neither plants nor animals – they belong to a group all by themselves. Bacteria are tiny single-cell microorganisms, usually a few micrometers in length that normally exist together in millions.

A gram of soil typically contains about 40 million bacterial cells. A milliliter of fresh water usually holds about one million bacterial cells.

Planet Earth is estimated to hold at least 5 nonillion bacteria. Scientists say that much of Earth’s biomass is made up of bacteria.

5 nonillion = 5, 000, 000, 000, 000, 000, 000, 000, 000, 000, 000 (or 5×1030)

(Nonillion = 30 zeros in USA English. In British English it equals 54 zeros. This text uses the American meaning)

Bacterial cell walls

Bacterial cell walls consist of layer of peptidoglycan which is made up of many parallel polysaccharide chains with short peptide cross-linkage forming an enormous molecule with net-like structure. However, there are two different types of bacterial cell wall, which can be distinguished by Gram staining, a staining technique developed by Christian Gram in 1984 and still in use today. Before staining, bacteria are colorless. The cell walls of Gram-positive bacteria have a thick layer of peptidoglycan containing chemicals such as teichoic acid within their net-like structure. The crystal violet in the stain binds to the teichoic acid and resists decolouring in the rest of the process, leaving the positive purple/blue color.

The cell walls of Gram-negative bacteria have a thinner layer of peptidoglycan with ni teichoic acid between the two layers of membranes and then an outer membrane-like layer made up of lipopolisaccharides. Any crystal violet which does not bind is readily decolourised and replaced with red safranine in the Gram stain. So cells appear red.

PROBLEM STATEMENT

Which antibiotic is the most effective on bacteria?

APPARATUS

200 ml of micropipette, conical flask, forceps, 100 ml beaker

MATERIALS

Petri dish, sample of E. coli and staphylococcus, 3 different types of antibiotic which are carbenicilin, streptomycin and tetracycline, distilled water, Dettol handwash, 75 % of ethanol, agar, tissue paper

VARIABLES

Fixed variable : volume of bacteria

Manipulated variable : types of antibiotic

Responding variable : area of inhibition zone

HYPOTHESIS

The most effective antibiotic to inhibit bacteria growth is ampicillin

PROCEDURE

First of all, wash out hands with the soap or handwash. The working area is sprayed thoroughly with the disinfectant spray. It is left for at least 10 minutes, and wiped with a paper towel.

An agar plate seeded with is prepared. The petri dish is labeled on the base at the edge out of name, the date and type of bacterium it is inoculated with by usng permanent marker pen.

After finishing marking the petri dish, the Esterichia coli bacteria is poured by using micropipette into the petri dish on the marked labeling and distribute it evenly.

The agar is taken out from 60 ÌŠC oven. The mouth of the conical flask containing the agar is warmed in the flame to prevent any different bacteria from surrounding grow inside it.

The agar is left for 10 minutes for it to solidify before putting the sterile disc dip into three different antibiotics.

The forceps are flamed and used them to pick up disc or Mast ring. It is dip into the antibiotic solution and is placed firmly in the centre of the agar.

The dish is taped securely with two pieces of adhesive tape and kept it upside down at room temperature for 24 hours.

Step 1 until steps 7 are repeated by using another type of bacteria which is staphylococcus.

Our hands are washed with soap or handwash and the bench is cleaned again using the 75 % of ethanol.

After the incubation, the plate should be looked at carefully but do not open it. Where bacteria have grown the plate will look opaque, but where the antibiotics have inhibited growth, clear zones called inhibition zones will be seen.

The diameter of the inhibition zones is measured in milimetres and the information is used to decide which antibiotic is most effective at inhibiting the growth of the bacterium.

The data is collected from other members of the class who used the other bacterial cultures.

PRECAUTIONS

When carrying out the experiment, we should work very closed to the Bunsen burner to prevent any impurities in each apparatus that is used.

Do not seal completely the upper and lower part of petri dish.

Both petri dishes contain different bacteria need to be inverted to prevent the water vapour from forming at the upper site of the agar. It might affected or overshadow the inhibition zones that are formed inside the dish.

Make sure our hands are constantly being wash with disinfectant before touching any apparatus.

Before using any apparatus, they should be sterile to prevent any unwanted impurities to grow in the petri dish.

Do not open the petri dish after incubation to prevent from infection.

RESULTS

Antibiotic

Diameter of inhibition area/ cm

Inhibition area / cm^2

E. Coli

Staphylococcus

E. Coli

Staphylococcus

Tetracyclin

2. 6

3. 0

5. 3

7. 0

Streptomycin

1. 6

2. 0

8. 0

3. 1

Carbenicillin

1. 5

3. 5

4. 9

9. 6

Ampicillin

3. 6

3. 8

10. 2

11. 3

Control

0

0

0

0

Explanation of the data

Table above shows the area of inhibition zone of the bacteria growth on two different bacteria. Four types of antibiotics are used to be investigated which is the most effective on a particular bacteria. They are tetracycline, streptomycin, carbenicillin and ampicillin. Whereas two types of bacteria are used which are staphylococcus and Esterichia Coli.

For E. coli, ampicilin showed the greatest inhibition area of bacteria growth with 10. 2 cm^2. Another antibiotic that showed the closest reading is streptomycin. Tetacyclin and carbenicilin showed 5. 3 cm^2 and 4. 9 cm^2 respectively. This result clearly shown that ampicilin is the most effective antibiotic to inhibit the growth of E. coli. Besides that, E. coli is a gram negative bacteria. The cell walls of Gram-negative bacteria have a thinner layer of peptidoglycan with no teichoic acid between the two layers of membranes and then an outer membrane-like layer made up of lipopolisaccharides.

In addition to that, Staphylococcus also had a higher inhibition zone of bacteria on ampicilin. Other bacterias have no effect as great as ampicilin

which can be consider as a strong antibiotic. Staphy is a gram positive bacteria. The cell walls of Gram-positive bacteria have a thick layer of peptidoglycan containing chemicals such as teichoic acid within their net-like structure. The crystal violet in the stain binds to the teichoic acid and resists decolouring in the rest of the process, leaving the positive purple/blue color. That is why ampicilin is said to be the most effective antibiotic on both bacterias.

Limitations

There are some limitations that cannot be avoided when carrying out the experiment. The first one was every apparatus that we used had been sterile by the laboratory assistant. Thus we had to wash our hands thoroughly before touching anything. We even could not talk during the preparation. The problem was we carried out the experiment on the lab’s table, instead of using the cupboard fume to maintain the sterile apparatus. Thus, there might be some of the apparatus that we were using had been contaminated. This condition might affect the reliability of the experiment hence the expected results might not get at the end of the experiment.

Besides that, we had to wash our hands by using the dettol hand soap before we start and end the experiment. We had to remove all the impurities and bacteria and that was the purpose of washing hand. The problem rose as we did not know whether we had washed our hand to the maximum cleanliness. Consequently, all the apparatus and materials that we used might be affected by our hand. This is done so that there are no infections or contaminations on the agar that might give problems later.

Sources of error

There are some sources of error when carrying out this experiment. Firstly, we prepared the experiment at room temperature. It was supposed to carry out in sterile medium to prevent anything from affecting during the preparation of bacteria and antibiotics.

Next, the major problem that could be seen during the experiment was most of the groups could not be able to solidify their agar to the maximum hardness. Consequently, when inverting the petri dish, all its contents would be messy inside the petri dish and the disc had mixed to one another. Thus, the antibiotics on each disc also had mixed that could affected the whole result. To overcome this problem, students should let the agar solidify before inverting the petri dish. Another problem was some of the groups do not invert their petri dish before keeping it inside the incubator. This would cause the water vapour to form at the upper part of the petri dish. It would also affect the growth of the bacteria in agar.

Fourth, the layer of agar inside the petri dish was too thin that caused it fell to the bottom when inverting it. Besides ruining the shape of the agar and the position of the discs in the agar, the thin layer of agar also inhibits the growth of bacteria because it lacked of nutrients. To prevent this, the layer of agar should be half of the petri dish.

Further work

To get more reliable and accurate result, this experiment should be repeated by varying the temperature to investigate the activity of antibiotic on bacteria. This means that increase the temperature would cause the

antibiotic to act more rapidly compared to the temperature that we used before. Thus we do not have to wait for 24 hours to see the inhibition zone. This manipulated variable also do not waste the time consuming for the experiment. Moreover, as the antibiotic shows more faster effect, thus the bacteria and antibiotic should be put in separately different petri dish to prevent it from overlapping.

CONCLUSION

The most effective antibiotic is ampicilin.

The hypothesis is aceepted.

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