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SYNTHESIS, CHARACTERIZATION AND STUDY OF ANTIMICROBIAL ACTIVITY OF HEXAMINE FROM FORMALDEHYDE

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Abstract: Ammonia and formaldehyde solutions are used in this investigation to create hexamine. A number of qualitative and quantitative methods were used to describe this hexamine compound. The antibacterial activity and synthesis were both assessed using the cup-plate method in the investigation at hand. When used against E. coli and S. aureus, the products displayed equivalent antimicrobial efficacy to benzene and hydroalcoholic solution (water + methanol) at the same concentration. Urinary tract infections and gastro-urinary infections affect the Hexamine. It is used to make liquid or granular phenolic resin medicines as well as sprays and creams for the treatment of concurrent smell and excessive sweating under medical supervision.

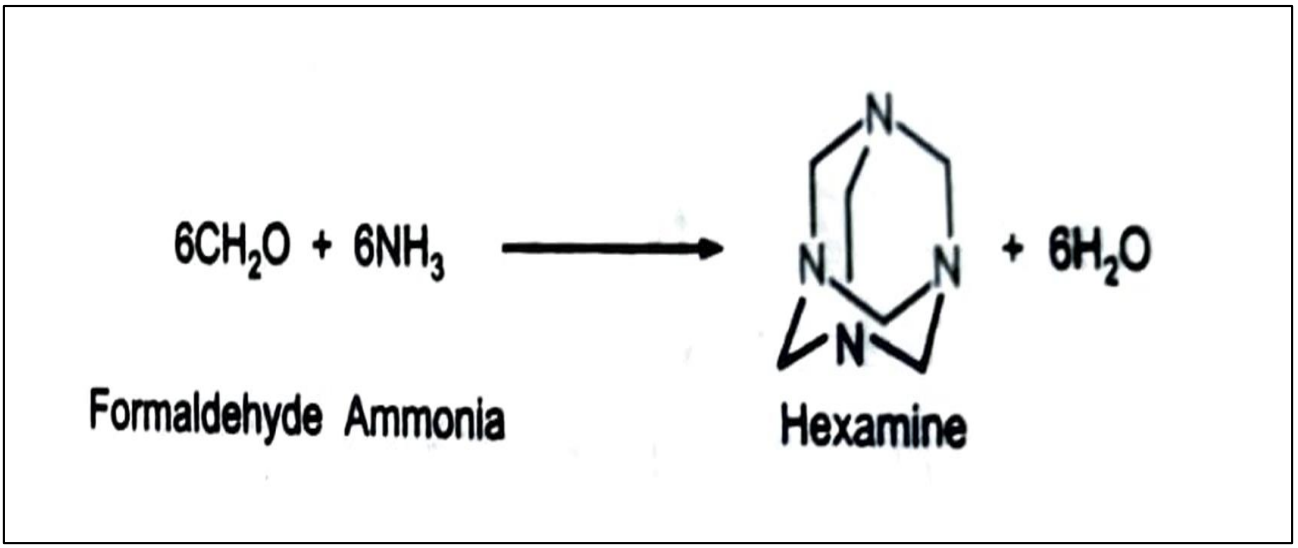
Keywords: **Antimicrobial activity, Quantitative methods, Hexamine compound, Hydroalcoholic solution.**

1. INTRODUCTION

More than 2000 years have passed since the invention of antimicrobial agents. A natural, synthetic, or semisynthetic chemical with the capacity to prevent or stop the growth of diseases is referred to as an antimicrobial agent. Antimicrobial drugs could affect the host insignificantly or not at all. Among other medical classes, antimicrobials stand out as pharmacotherapeutic agents. They are the only type that predominantly targets bacteria rather than human tissues or endogenous products. These anti-infective agents have reportedly reduced the death rates of major illnesses and played a crucial role in the breakthroughs in medicine and surgery.[1,2,3.]

In this study, we concentrated on the synthesised hexamine drug's antimicrobial activity and came to a conclusion. In both people and animals, different kinds of organisms, such as bacteria, fungus, and viruses, etc., can cause infections and diseases. For antimicrobial activity against Escherichia coli and Staphylococcus aureus, it contains both gram positive and Gram-Negative microorganisms (S. Aureus, E. coli).[4.]

By condensation of ammonia and formaldehyde under acidic aqueous circumstances, hexamethylenetetramine (1,3,5,7-tetraazatricyclo [3.3.1] Decane, C6H12N4), a fourth-cycled molecule, may be easily produced at ambient temperature and atmospheric pressure. hexamethylenetetramine also called hexamine, Urotropine.[5,6.]



2. MATERIALS

2.1 Synthesis Material:

Ammonium hydroxide, Ammonia, Formaldehyde, Ethyl alcohol etc.

2.2 Solvent:

Benzene, Chloroform and Hydroalcoholic solution (water + Methanol).

2.3 Nutrient Agar Media:

Agar, Peptone, Beef extract, Yeast extract, Sodium chloride, Activated carbon.

2.4 Micro- organisms:

Gram positive and Gram negative (E. coli and S. aureus).

3. METHODS

3.1 Synthesis of Hexamine:

Formaldehyde and ammonia condense to create hexamine. The reaction between 47.3 g of a 38% formaldehyde solution and 70 g of a 20% ammonium hydroxide solution results in a mildly alkaline solution. A few hours of standing time at room temperature are given to the mixture, and additional ammonia is added as needed. The solution is filtered after which it is evaporated to create a thick paste. Ethyl alcohol is used to filter and clean the hexamine crystals. Hexamine is recrystallized from either water or alcohol.[7,]

Figure 01. Hexamine Crystals

3.2 Solubility Testing:

In chloroform, Benzene, hydroalcoholic solution (water + methanol), Di- ethyl ether and Xylene.

3.3 Antimicrobial activity:

By mixing 1 litre of distilled water with 28 g of nutritious agar powder, heating the mixture, and allowing all ingredients to dissolve, agar plate medium was created. The mixture is allowed to cool but not solidify after 15 minutes in an autoclave set at 121°C. The chosen microorganism was then injected into a nutrient agar medium, put into plates, and allowed to sit until it solidified. After that, 9 mm-diameter holes are made in the medium using a sterile cork borer utilising the cup-plate method or agar well diffusion method. In the pores was directly applied the Hexamine solution. The plates are incubated.[4,8,9,10.]

4. RESULT AND DISCUSSION

4.1. The synthesized product of Hexamine was characteristics by:

- Nature: White Crystalline Solid.
- PH: 7.8
- Melting point: 281°C.

4.2. Solubility Testing:

Freely Soluble in water and soluble in Benzene, Methanol, Ethanol, Acetone Di- ethyl ether, Chloroform and Xylene

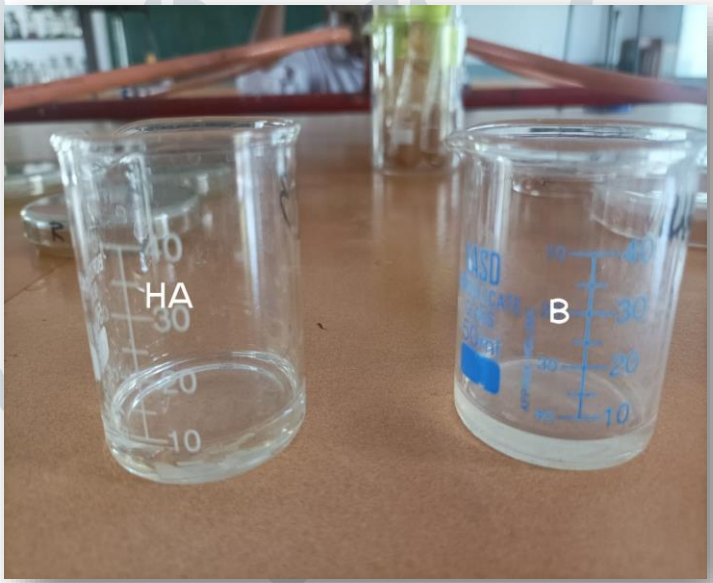


Figure 02. Solubility of Hexamine

4.3. Study of Antimicrobial Activity:

Hexamine, a synthetic chemical, was examined for its ability to combat both Gram positive and Gram-Negative microorganisms. The widths of the zone of inhibition (cm) against human pathogens Escherichia coli and Staphylococcus aureus, as measured by the cup plate method, are shown in Table no 01 and Fig. no 03 A and B

Table no 01- Antimicrobial activity of Hexamine

Sr. No.	Name of solution	Concentration (mg/ml)	Zone of Inhibition (cm)	
			S.aureus	E-coli
1.	Hexamine in Benzene (B)	0.5	0.57	0.54
2.	Hexamine in Hydroalcoholic solution [Methanol + water] (HA)	0.5	0.63	0.60

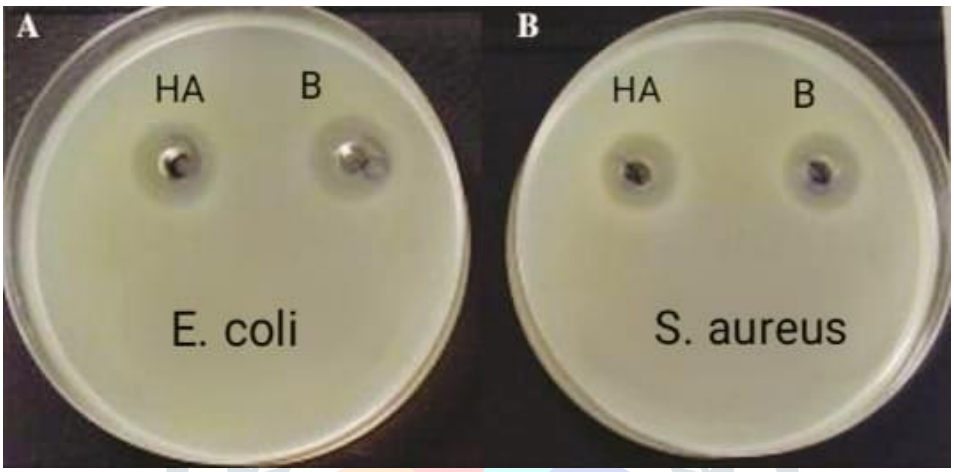


Figure 3. Antimicrobial activity of Hexamine

CONCLUSION:

Hexamine has been synthesized, examined, and conformed to certain characters. The hexamine compounds' antimicrobial activity in combination with benzene and hydroalcoholic solution demonstrates their effectiveness against both gram positive and Gram-Negative microorganisms. The compounds' antimicrobial action exhibits better results against the s. Aureus bacterium than the e. Coli bacteria. Hexamine chemicals have the ability to stop pathogenic microorganisms' ability to proliferate metabolically.

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