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# ANTIMICROBIAL ACTIVITY OF ALUMINA NANOPARTICLES SYNTHESIZED BY LEAF EXTRACT OF OCIMUM SANCTUM

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**Abstract** – *In this research article, we synthesized Alumina nanoparticles using leaf extract of Ocimum Sanctum. We have characterized synthesized nanoparticles using FESEM, DLS and EDS analysis. We have also investigated antimicrobial activity of the Alumina nanoparticles using disc diffusion method against gram positive and gram negative bacteria. It is concluded that Alumina nanoparticles are successfully synthesized using leaf extract of Ocimum Sanctum and they are spherical in shape. It is also concluded that these Alumina nanoparticles are good antimicrobial agents against both gram positive and gram negative bacteria.*

**Key words** – Alumina nanoparticles, FESEM, DLS, EDS, Antimicrobial activity.

## I. INTRODUCTION

During last few years researchers are trying to use nanotechnology in every field of life and study. Due to very high surface to volume ratio and unique chemical and physical properties, nanoparticles can be used for wide number of applications. Physico – chemical properties play an important role in anti microbial activity of nanoparticles and we know that nanoparticles show properties very much different from their bulk counterparts. Therefore, nanoparticles are emerged as novel anti microbial agents [1]. Morones J.R. et al (2005) observed that nanoparticles can change the properties of bacterial cell membrane, can damage DNA of bacteria and release toxic ions to damage bacteria [2]. Dutta R.K. et al (2012) shows their interest in inorganic nanoparticles as antimicrobial agents as they are ecofriendly and more stable than previously used organic antimicrobial agents [3]. Varghese N. et al (2014) concluded that Alumina nanoparticles are thermally stable over a wide range of temperature. They stated that Alumina nanoparticles have corundum like structure with oxygen atoms having hexagonal closed packing and Aluminium ions filling two – third of octahedral sites in the lattice [4]. Ruparelia J.P. et al (2008), Hameed A.S.H. et al (2016) and Mitoraj D. et al (2007) clarified that nanoparticles show antimicrobial activity against E. coli and styphylococcus

aureus bacteria [5, 6, and 7]. In this research article, attempts have been made to investigate anti microbial activity of Alumina nanoparticles synthesized by green method on gram positive and gram negative bacteria.

## II. EXPERIMENTAL PROCEDURE

We prepared extract of Ocimum Sanctum. The prepared extract was stored at 4 °C. The solution of Aluminium nitrate was prepared. Then, plant extract was mixed with solution of salt and constantly stirred with the help of magnetic stirrer. Obtained precipitate is filtered using filter paper. The detailed experimental procedure is described elsewhere [8].

FESEM studies are carried out on Hitachi – PU model operating at resolution from 100 nm to 1.0 µm at an accelerating voltage 5.0 KV and magnification 25000 to 180000. The hydrodynamic size of Alumina nanoparticles is determined by differential light scattering (DLS). For this purpose, nanoparticles were sonicated in water at 25°C temperature.

The antimicrobial activity of Alumina nanoparticles is investigated by Disc diffusion method against two bacteria E. coli and staphylococcus aureus. The antimicrobial activity is investigated for five different concentrations 6.25 mg/mL, 12.5 mg/mL, 25 mg/mL, 50 mg/mL and 100 mg/mL.

## III. CHARACTERIZATION

### A. FESEM Analysis

The surface morphological analysis of the nanoparticles is done by FESEM. SEM micrographs (Fig.1) indicate that Alumina nanoparticles synthesized by this method are spherical.

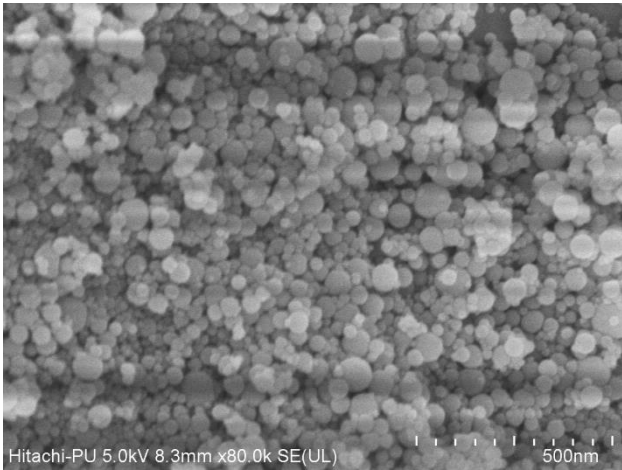


Fig. 1 FESEM image of Alumina nanoparticles

**B. DLS Analysis**

To determine hydrodynamic size, size distribution by intensity is plotted (Fig.2). Peak is obtained at 96.10 nm with standard deviation 48.73 nm. This result is compatible with the result obtained by XRD and HRTEM.

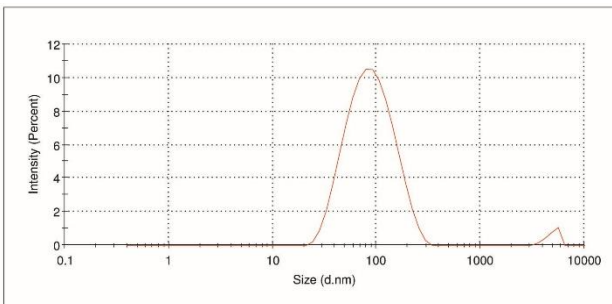


Fig. 2 DLS image of Alumina nanoparticles

**C. EDS Analysis**

Quantitative analysis of Alumina nanoparticles is done by Energy Dispersive Spectroscopy (EDS). From EDS (Fig.3), it is clear that Al and O are major components of the prepared sample and rests are present as impurity. This confirms the formation of Alumina nanoparticles by this method.

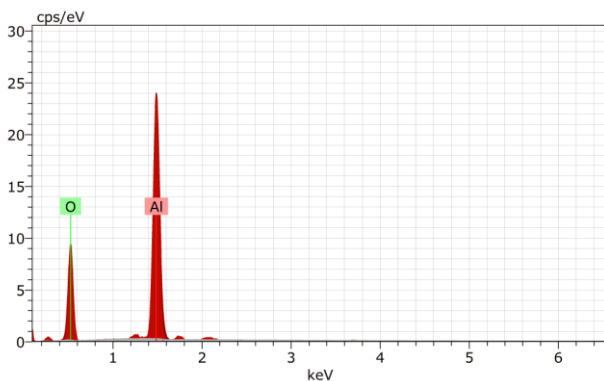


Fig.3 EDS image of Aluminium oxide nanoparticles

**IV. ANTIMICROBIAL ACTIVITY OF ALUMINA NANOPARTICLES**

Disc diffusion method is used to investigate antimicrobial activity of Alumina nanoparticles. The antimicrobial activity is investigated against two microorganisms, E. coli and staphylococcus aureus. The media used for this purpose was MaeConkey Agar (Fig.4) and Nutrient Agar (Fig.5). Simultaneously the standard antibiotic gentamycin is tested against the pathogens. We can see that as concentration increases, zone of inhibition also increases.

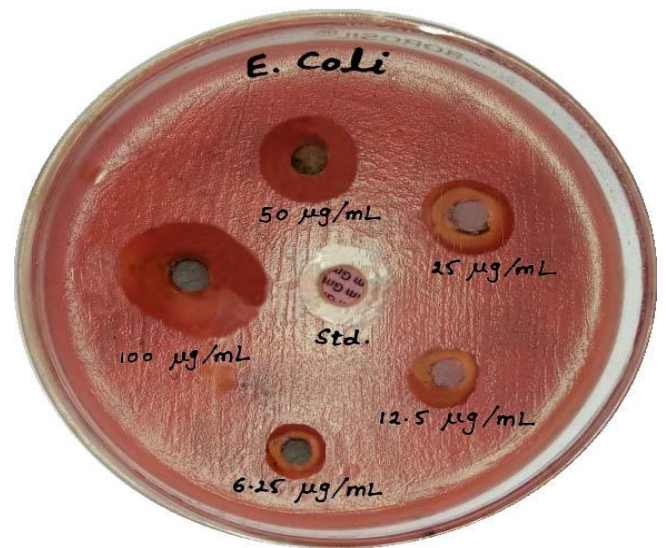


Fig.4 Antimicrobial activity of Aluminium oxide nanoparticles against E. Coli in media Maeconny Agar

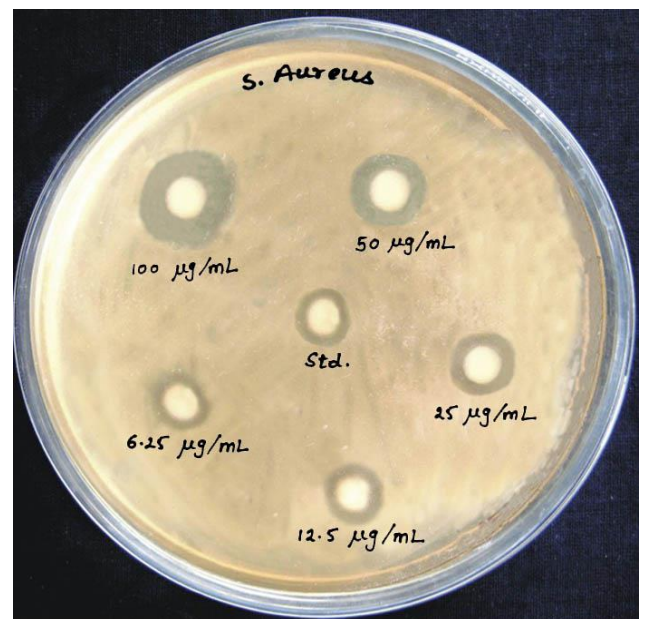




Fig.5 Antimicrobial activity of Aluminium oxide nanoparticles against *S. aureus* in media neutriant agar

The result shows that Alumina nanoparticles synthesized by leaf extract of *Ocimum Sanctum* have effective antimicrobial activity against pathogenic bacteria.

## V. CONCLUSION

From this research work, it is concluded that Alumina nanoparticles synthesized by leaf extract of *Ocimum Sanctum* are showed antimicrobial activity against both gram positive and gram negative bacteria. Formation of zone of inhibition confirms that these nanoparticles are good antimicrobial agents.

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