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**EXTRACTION OF TULSI CONTAINING ANTIBACTERIAL ACTIVITY
AND PREPARATION OF COMPOSITE FILM FROM POLYVINYL
ALCOHOL (PVA), MICRORYSTALLINE CELLULOSE, AND STARCH**

AHUJA S, SHAH T, PANDA SR AND PANDYA D

Department of Chemistry, Parul Institute of Applied Science, Parul University

Limda-391760 Waghodiya, Vadodara, Gujarat, India

*Corresponding Author: Dr. Sonam Ahuja: E Mail: sonam.ahuja82106@paruluniversity.ac.in

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ABSTRACT

The Antibacterial Activity of Tulsi (*Osmium Sanctum*) dried leaf against *Escherichia coli* and *Pseudomonas* was investigated using the Well diffusion method against *Escherichia coli* and *Pseudomonas*. The main purpose of this analysis is to succeed Polyvinyl alcohol (PVA), Microcrystalline cellulose, and Starch composite film. This Polyvinyl alcohol (PVA), Microcrystalline cellulose, and Starch film have the good potentiality to be used as a delivery medium for protein drugs. Polyvinyl alcohol is a multipurpose polymer with excessive mechanical properties. Cellulose crystals have higher thermal stability while starch crystals have lower thermal stability compared to cellulose. The films were transparent and it looks smooth on the surface. Polyvinyl alcohol (PVA), Microcrystalline cellulose, and starch-based composite films are biodegradable. It contains some other applications such as food packaging, wrappers for candies, and medicinal capsules.

Keywords: *Osmium Sanctum*, *Escherichia coli*, *Pseudomonas*, Polyvinyl alcohol,
Microcrystalline cellulose, Starch, Mechanical properties

1. INTRODUCTION:

Polymer any of natural or synthetic substance composed of very large molecules called micro molecules. Polymers may be natural which is found in plants and animals or synthetic which is manufacture by man. Different polymer have exclusive chemical and physical properties. Due to its renewable, biodegradable, and harmless nature, biodegradable polymers have attracted widespread attention in current years for use as food packaging. Low cost and biocompatibility are two of the most significant advantages of biodegradable polymers. Polymers have played an essential position within the development of drug delivery.

1.1 Polyvinyl alcohol (PVA):

Polyvinyl alcohol is a water-soluble synthetic polymer. Polyvinyl alcohol is a white or cream-colored granular powder with no odour or flavor [1]. It's been used to manufacture resins, surgical threads, and food packaging materials, among other things. PVA is a benign and nonhazardous thermoplastic polymer that is frequently utilised. PVA has a strong tensile strength as well as flexibility. PVA is employed as a biomaterial in medical devices because to its extremely advantageous attributes such as biocompatibility, nontoxicity, swelling

properties, and bioadhesive capabilities. PVA is very flexible and has a high tensile strength. Because of its numerous desired features, such as biocompatibility, nontoxicity, swelling properties, and bioadhesive capabilities, PVA is used as a biomaterial in medical devices [2].

1.2 Microrystalline cellulose (MCC):

MCC is a cellulose-derived polymer that is found in nature. It's an odourless white crystalline powder with important qualities like non-toxicity, biocompatibility, biodegradability, high mechanical strength, large surface area, and low density[3] Microcrystalline cellulose (MCC) is a word for refined wood pulp that is used in the food business as a texturizer, fat replacement, emulsifier, extender, and bulking agent. The most prevalent kind may be found in vitamin supplements or tablets.

1.3 Starch:

Due to its low cost, availability, and high manufacturing capabilities from renewable resources, starch is the most appealing material among these renewable natural polymers. Starch is a white, and amorphous powder. It a non-reducing carbohydrate that is insoluble in water, alcohol, and ether [4]. Starch have freeze-thaw stability, high-thickening, and good film-forming

properties. Starch-based composites are easy to make and it is commonly used in packaging purpose. The tensile properties of starch make it perfect for packaging.

1.4 Tulsi:

Tulsi, often known as Holy Basil (*Ocimum sanctum*), is a Lamiaceae plant. Due to its wide range of medicinal characteristics, it has made a significant contribution to science both in ancient times and in modern studies. Tulsi is known as the Queen of plants and the mother medicine of nature [5]. Tulsi is used for stomach cramps, vomiting, constipation, and enteritis. It was sometimes used as an antispasmodic for whooping cough. Tulsi has antioxidant properties and reduces blood glucose levels. Therefore it is helpful for diabetics [6]. Tulsi reduces total cholesterol levels. Hence it is helpful for heart disease patients. Tulsi reduces blood pressure. Tulsi aqueous extracts have traditionally been used to treat many forms of poisoning, stomach pains, common colds, headaches, malaria, and inflammation [7]. [8, 9] presents a comparative research of the antibacterial activity of

aqueous and alcoholic Tulsi leaf extracts against *E.coli*. Tulsi leaves are frequently utilised for their therapeutic properties. It is a tonic for the neurological system and so improves in memory sharpening significantly. It possesses antibacterial, antiviral, antifungal, and antioxidant properties [10].

2. MATERIAL AND METHODS:

2.1 Material:

Polyvinyl alcohol (PVA), Microrystalline cellulose, Starch, Glycerine, Distilled water for composite film. Dried leaf of Tulsi, methanol for extration. Nutrient agar, Agar agar powder, Test organism(*E.coil*) for Antibacterial activity.

2.2 Methods:

2.2.1 Preparation of Tulsi leaves Powder:

Tulsi leaves were washed in Distilled water and dried for 7 days. After that, the dried leaves were crushed separately in mortal pastel till a homogenous powder was formed. The powder was collected in an airtight container and stored away from direct sunlight and in a cold, dry place.



Figure 1: Dry powder of Tulsi leave

2.2.2 Preparation of Tulsi extraction:

The methanol extract was made by mixing 5 grams of Tulsi leaf powder with 50ml of methanol and storing it in a cold, dark area for two days [11]. The extract was filtered into a sterile Conical Flask after two days.

2.2.3 Preparation of PVA/MCC/Starch composite film:

A film-forming solution was prepared by dissolving 1 % specified amount of PVA in

100 ml distilled water and heating with specified amount of microcrystalline cellulose and 1 gm starch powder for 15 minutes at 60° C on a bunsen burner with constant stirring. The solution was to pour 25 ml into a petridish and put dried in oven for 8 hours at 90° C. For comparison, a pure film was created. While the solution is being kept in the petridish, 1 mL glycerol is being added for thickness (**Figure 2**).



Figure 2: (PVA/MCC/Starch composite film)

2.2.4 Preparation of PVA/MCC/Starch composite film with tulsi extraction:

A film-forming solution was prepared by dissolving 1 % specified amount of PVA in 100 ml distilled water and heating with specified amount of microcrystalline cellulose and 1 gm starch powder for 15 minutes at 60° C on a bunsen burner while stirring constantly. The solution was to pour 25

ml into a petridish and add 5 ml tulsi extract and dried in oven at 60°C for 24 hour films were peeled off.

3. RESULT AND DISCUSSION:

3.1. FTIR analysis of composite film:

Fourier transform infrared spectroscopy (FT-IR) is a highly versatile materials analysis technology that may be used to discover organic and inorganic components that could

cause product contamination or malfunction. As a result, we frequently offer FTIR as the initial stage in the testing procedure to our clients. A FT-IR spectrum 500 cm^{-1} was used to analyse this sample film using Fourier Transform Infrared Spectroscopy (FTIR) (Parul University). The scans had a resolution of 4 cm^{-1} and were analysed in the range of 4000 to 500 cm^{-1} . The transmittance mode was used to record the FTIR spectra.

Figure 3 illustrates the FT-IR spectra of the composite film. The stretching vibration of the -OH group has a higher peak at 3353.84 cm^{-1} in the FT-IR spectra of PVA due to intra and extra molecule hydrogen bonding. Peaks of PVA were found at 3353.84, 2907, 1429, 1338, 1057, and 860.54 cm^{-1} , which were ascribed to the hydroxy group's O-H stretching vibration, C-H asymmetric stretching vibration, C=O. MCC peaks were found at 1643 cm^{-1} (C=O stretching) and 1338 cm^{-1} (C-H bending). Peaks of starch were measured at 2934 cm^{-1} (C-H stretching) and 1159 cm^{-1} (C-O group).

3.2. Antibacterial activity of plant extract:

According to the antibacterial activity test results of the film by disc method, the tulsi leaves extract was effective against *E.coli*. The antibacterial activity of Tulsi leaf methanol extract was shown to be most effective against bacteria with a zone of inhibition of 20mm. The presence of bioactive component in the extract of medicinal plants was suggested by the antibacterial activity. The greatest activity against *E.coli* was found in the methanol extract of tulsi leaves, as shown in **Figure 4**.

3.3. X-ray Diffraction (XRD) analysis:

The identification of materials based on their diffraction pattern is one of the most common applications of XRD analysis. XRD provides information on how the real structure varies from the ideal one according to internal tensions and flaws, in addition to phase identification.

The characterization of the PVA/MCC/Starch composite film was done using XRD. **Figure 5** shows the diffraction of the XRD at various angles. The maximum intensity of the diffracted X-ray was recorded at 25°, as shown in the **Figure 5**.

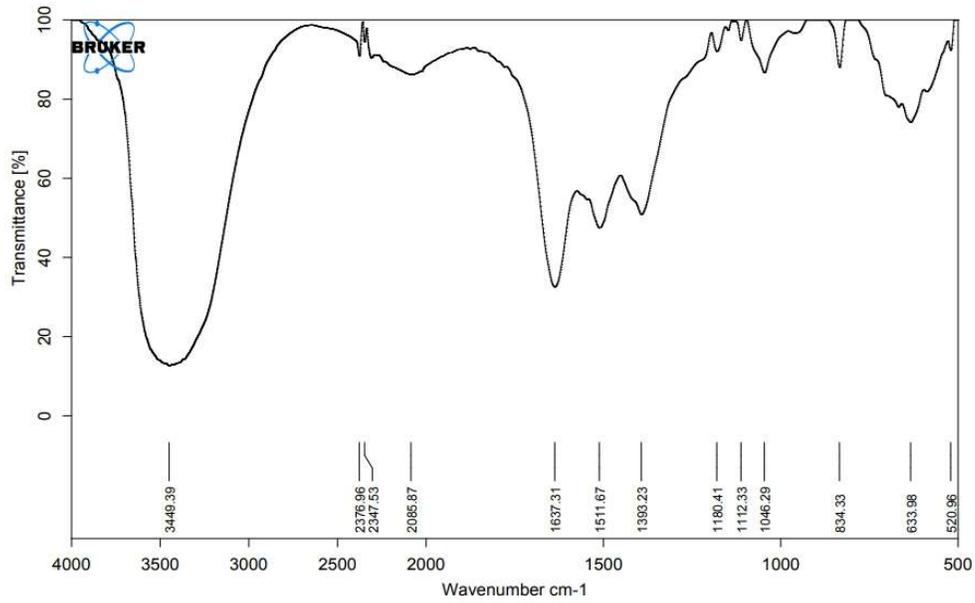


Figure 3: FTIR spectra of PVA/MCC/Starch composite film



Figure 4: Antibacterial activity of composite film containing tulsi extract

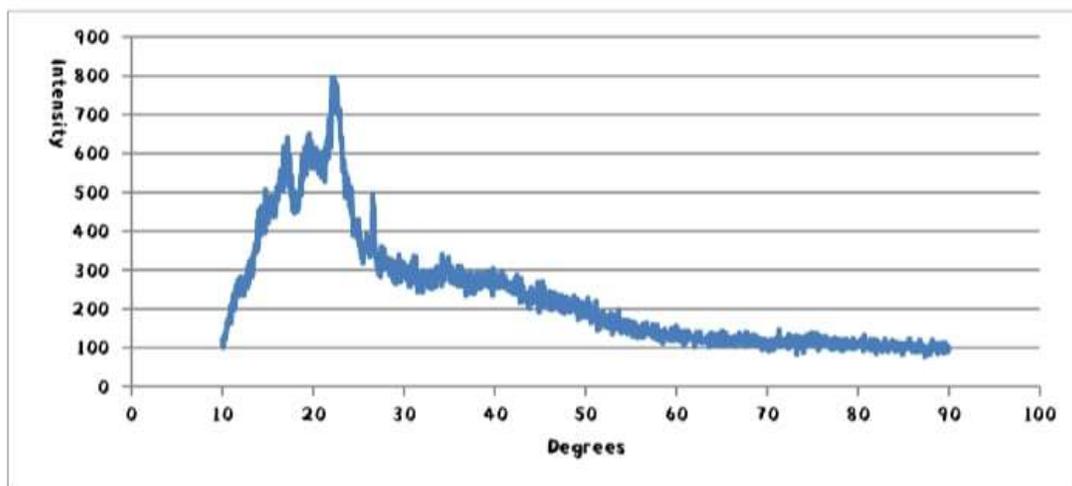


Figure 5: X-Ray Diffraction of PVA/MCC/Starch

4. CONCLUSION:

I have synthesis Tulsi extract loaded PVA/MCC/Starch composite film which found very good antibacterial activity again E.coli and by FTIR spectra we can find out PVA/MCC and starch are present in composite film. I also performed a X-ray diffraction [XRD] for identify the type of material as well as its phase and crystalline properties.

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