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EFFECT OF COMBINATION CHITOSAN AND BANANA BRACT (MODIFIED LEAF)

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ABSTRACT

Chitosan is one of promising biopolymer for palatable covering due to its biocompatibility, biodegradability and non-poisonous. The banana inflorescence bract strands could be utilized as a substitute for engineered filaments in making non-wovens and material composites. The starch parts like cellulose and lignin in the external bract have a compound creation of 35.7% and 11.7%, separately. The purpose of this study is an attempt to synthesis a membrane using Chitosan and Banana Flower Bracts, which would be characterized using, tensile strength (elasticity), swelling property, FT-IR and antibacterial activity.

KEYWORDS: Chitosan, Banana Flower Bracts, Elasticity, Swelling property and Antibacterial activity.

INTRODUCTION

The polymer is actually a chemical compound or mixture of compounds consisting of repeating structural units created through a process of polymerization. The units composing polymers derived from molecules of low relative molecular mass are termed as monomers.

Chitosan is available in different forms such as solution, powder, flake, fibre and film. Chitosan can be moulded into several shapes, membranes, microspheres, gel beads and films and is able to provide a ratio of surface area with mass that maximizes the adsorption capacity and minimizes the hydrodynamic limitation effects such as column clogging and frictional loss (Vierra and Beppu, 2005).

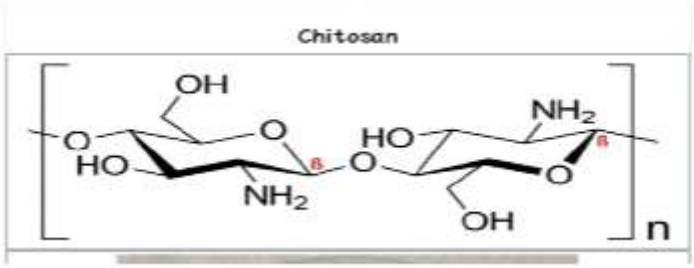

Figure 1: Structure of Chitosan.

Chitosan is a linear polysaccharide composed of randomly distributed B- linked Glucosamine and N-Acetyl- D Glucosamine. It has a number of commercial and bio medical uses.

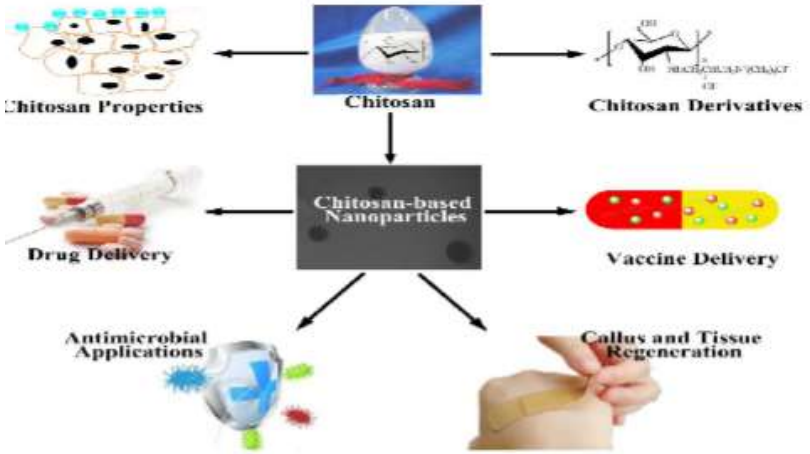

Figure 2: Applications of Chitosan-based Nanoparticles.

Inflorescences are discarded in abundance in banana fields, yet the inflorescences are considered to be nutritional complements. This part of the banana plant is used to make pie filling and salad. The dehydrated inflorescences have great nutritive components based on their high content of potassium and fibre. The nutritive component of inflorescence is not known and usually discarded or used as organic fertilizer (Catharina et.al., 2015, Okareh et.al., 2015 and Adeolu A.T and Enesi D.O, 2013).

Figure 3: Banana Bract (Modified Leaf). Figure 4: Banana Bract (Modified Leaf).

PROPERTIRES OF BANANA BRACT L

- It is an antioxidant
- It might possess a cytotoxic effect (Kills damaged cells)
- Anti-inflammatory
- It protects the liver (hepatoprotective)
- Anti-microbial
- It helps to lower the blood sugar levels
- It might be helpful against cancer

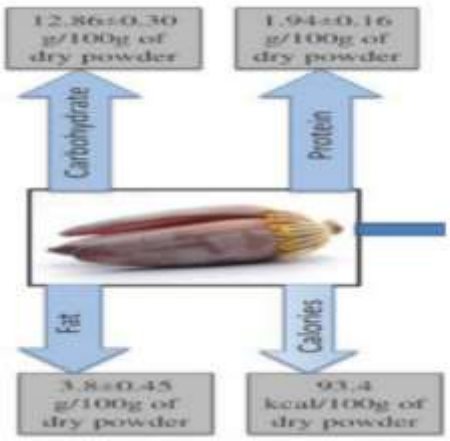

Figure 5: Banana Bract Dite format.

MATERIALS AND METHODS

MATERIALS REQUIRED

- Banana flower bracts
- Glycerol
- Acetic acid
- Glass rod
- Watch glass
- Beaker
- Petri dish
- Pellet
- Magnetic stirrer
- Butter paper
- Wash bottle
- E coli bacteria

- Bacillus subtills

PROCESSING OF BANANA FLOWER BRACTS POWDER

Banana flower was purchased from uzhavar sandhai, Vellore. The Banana Flower Bracts were separated and collected. It was washed with water to remove dirt, and dried in room temperature. It was then chopped into small pieces and then dried in an oven. After drying, the banana flower brackets were grounded. Then the skin was crushed and sieved. Then fine powder was sifted, so that the particle size remains stable and stored at room temperature in a plastic container.

Figure 6: Processing of banana flower bracts powder.

SYNTHESIS OF A MEMBRANE USING CHITOSAN AND BANANA FLOWER BRACTS

1 gram of chitosan powder, was dissolved in 2% acetic acid solution and stirred for 4 hours at room temperature. 1 ml of glycerol was added as a crosslinker and plasticizer. Now this

solution was mixed with banana flower bracket powder and stirred for 24 hours. It was dried at 40 ℃ for 24 hours to evaporate the solvent and form a membrane/film. The prepared membrane was gently peeled and further dried by keeping the oven at 40 ℃ for 4 hours.

Figure 7: Synthesis of a membrane using Chitosan and Banana Flower Bracts.

PHYSICAL MEASUREMENTS

Analytical techniques used to characterize the membrane were tensile Strength, Swelling Property and FTIR spectrometer.

Tensile strength (Elasticity)

The tensile strength of the membrane was measured at VIT University, Vellore by a tensile tester registering tensile stress versus strain (i.e., extension per original length) until failing or breaking. At the given temperature the membrane was clamped between two grips and stressed by moving the mobile grip at constant rate of extension, while the fixed grip was connected to a force transducer. The UTM applies a gradually increasing load to the specimen, recording the corresponding deformation or extension until failure occurs.

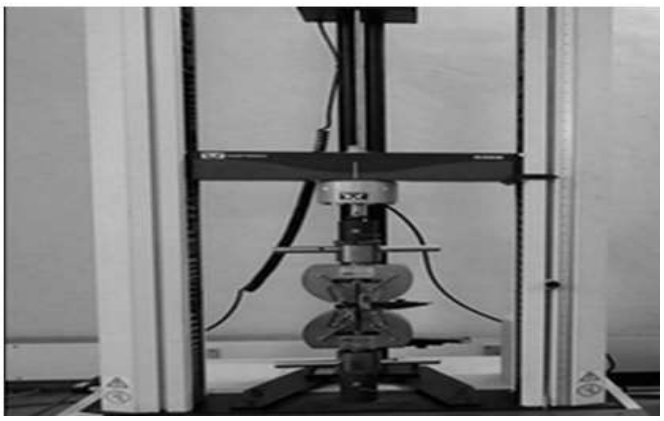

Figure 8: UTM tensile testing machine.

Swelling Property

In this method, 1 g of material is placed into a permeable bag, which is suspended over excess water in a beaker. Waited for 20 min. and weighed the bag and then calculate the percentage of swelling through the following formula: (w2-w1)/(w1) %.

FTIR Spectrometer

The FTIR spectra of the extracted dyes was recorded using SHIMADZU spectrometer in 4000-400 cm -1 range, using KBr pellet at D.K.M. College, Vellore.

BIOLOGICAL CHARECTERIZATION

Antibacterial activity

The prepared membrane was screened for their biological activities to test them bio efficiency. Bacterial subcultures were obtained from Shivamani Lab, Sathuvacharry, Vellore. Antibacterial analysis was followed using standard agar well diffusion method to study the antimicrobial activity of compounds. Each bacterial isolate was suspended in Brain Heart Infusion (BHI) broth and diluted to approximately 105 colony forming unit (CFU) per ml. They were flood-inoculated onto the surface of BHI agar and then dried. Five-millimeter diameter wells were cut from the agar using a sterile cork-borer and 30 µL (5µg compound in 500 µL DMSO) of the sample solution were poured into the wells.

RESULTS AND DISCUSSION

Tensile strength (Elasticity)

Two samples (A & B) were studied for tensile strength.

Table 1: Sample used for determining tensile strength.

Sample Name	Chitosan: banana bracket powder (grams)
A	1:0.5
B	1:1

Table 2: Results obtained from UTM for samples A & B.

Sample	Tensile MPa	Max force N	Elongation Max %	Elongation %	Stress break MPa	Force break N	Thickness
A	0.391600013	0.783200026	1.350000024	3.75	0.0008	0.0016	0.2000000003
B	0.561874986	1.123749971	2.742857218	5.11428596	0.022500001	0.045000002	0.2000000003

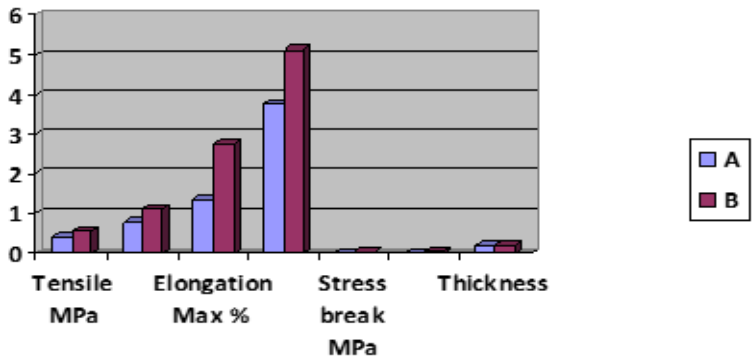

Figure 9: Graphical Representation.

It was found that the Tensile (MPa), Max force (N), Elongation Max (%), Elongation (%), Stress break (MPa) and Force break (N) was more for sample B than sample A. the thickness for both the samples were almost the same.

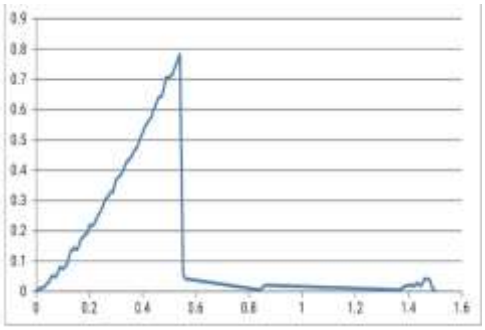

Figure 10: Tensile strength for Sample A.

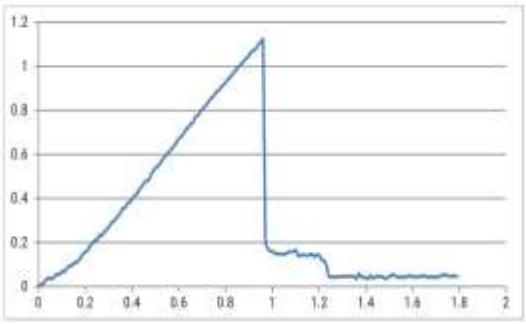

Figure 11: Tensile strength for Sample B.

Swelling Property

The swelling properties of Chitosan and the prepared membrane (sample B-1:1: chitosan: Bracket powder) were studied by measuring their weights after immersion in aqueous solution (neutral) at room temperature. The swelling curves are shown below.

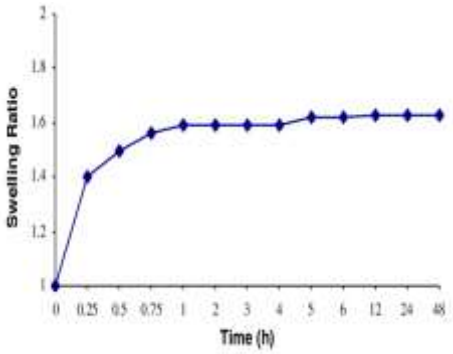

Figure 12: Swelling property of Chitosan.

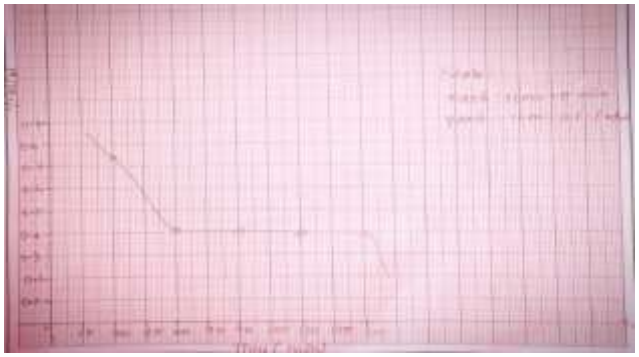

Figure 13: Swelling property of Sample B-1:1: Chitosan: Bracket powder.

In sample B the swelling ratio continual degradation leads to weight loss. The membrane tends to be thinner, and the swelling ratio decreases. Thus, the swelling studies may be useful when designing in Chit-based tissue scaffold, cartilage and drug delivery systems.

FT-IR Spectrometer

Five samples (A, B, C, D & E) were studied under FTIR.

Table 3: Samples ration studied in IR.

Sample Name	Chitosan: banana bracket powder (grams)
A	Chitosan
B	1:0.5
C	1:1
D	1:1.5
E	1:2

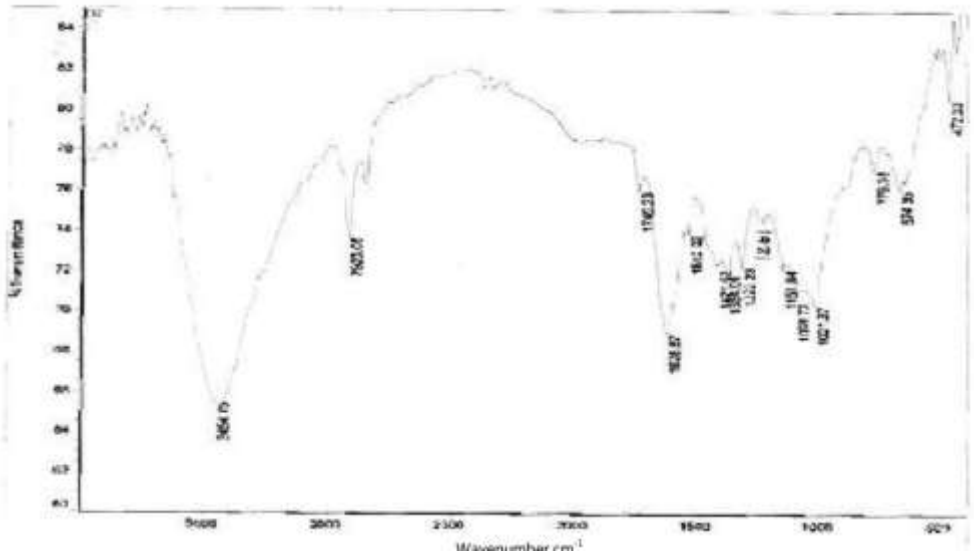

Figure 14: IR image of Chitosan.

Table 4: FT-IR spectral details of chitosan.

Absorption Frequency ($\sqrt{}$ cm^{-1})	Responsible Functional Group
3454.75	OH stretching, NH stretching, intermolecular hydrogen bonding, polymeric association
2923.08	Symmetric CH2 stretching vibration attributed to pyranose ring.
1740.23	Carbonyl group vibration
1628.87	C=O in amide group
1540.02	NH2 in amino group
1384.01	CH3 in amide group
1322.23	Secondary alcoholic group, C-C stretching
1151.84	-C-O-C in glycosidic linkage

1098.72	C-O stretching vibration
1021.37	C-O stretching vibration

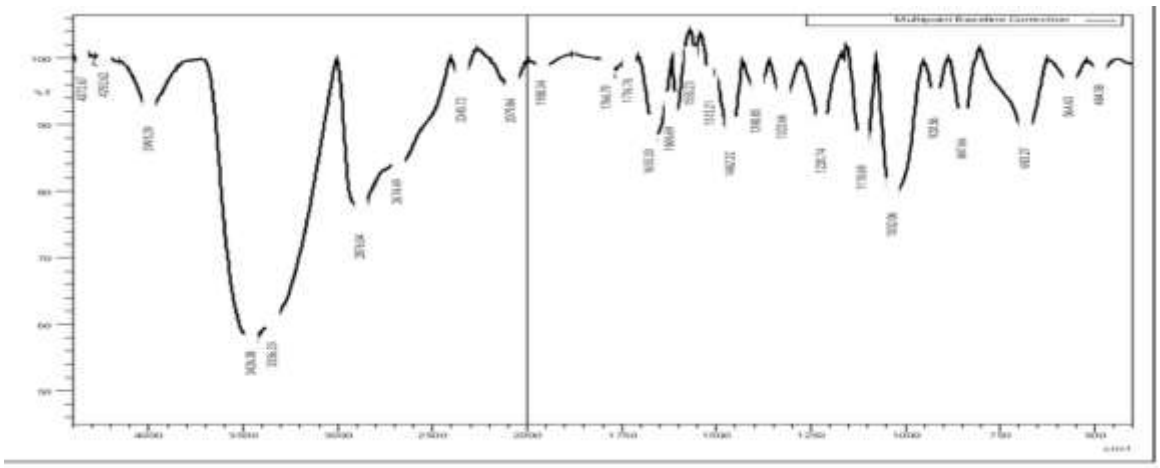

Figure 15: IR image of Sample B.

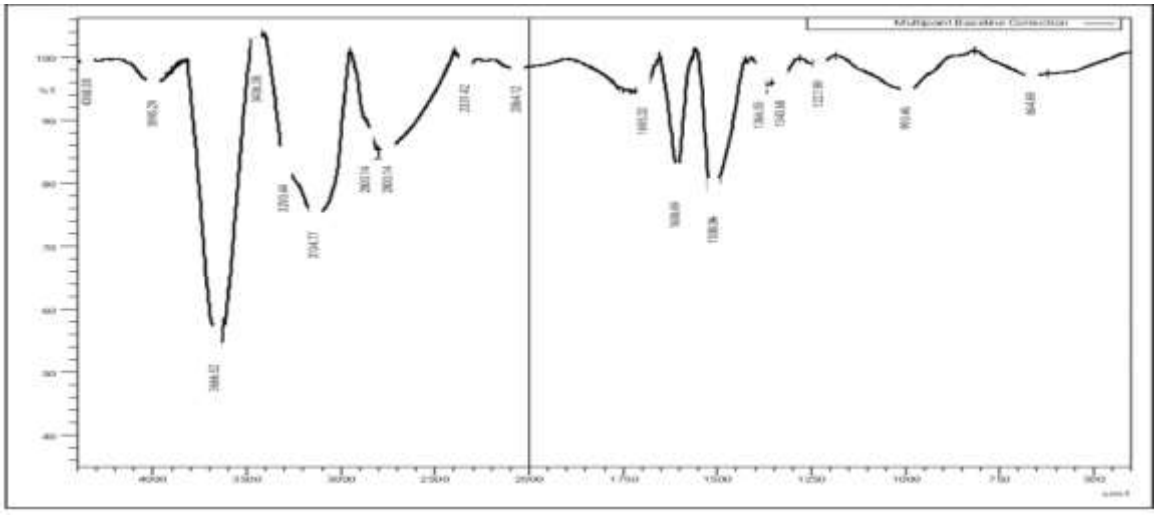

Figure 16: IR image of Sample C.

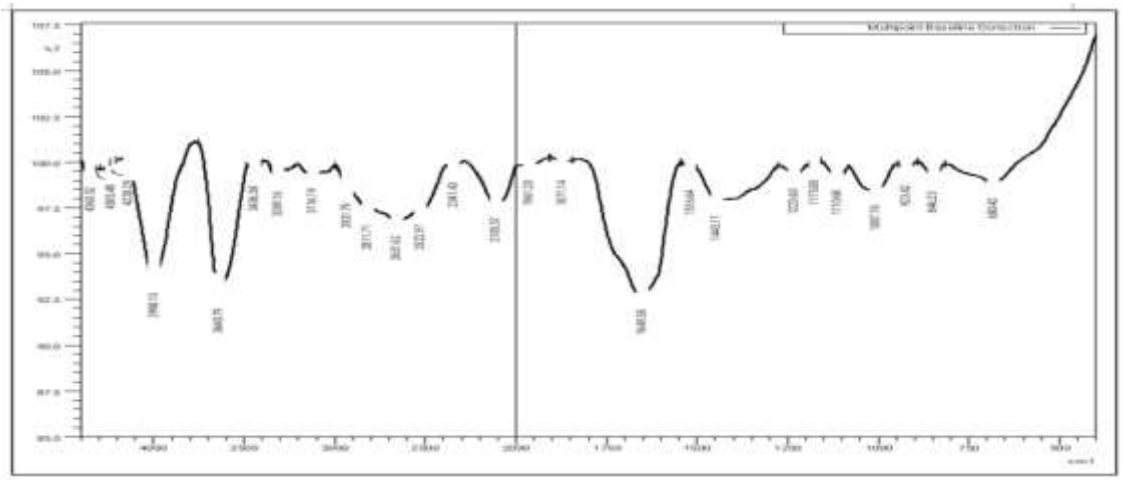

Figure 17: IR image of Sample D.

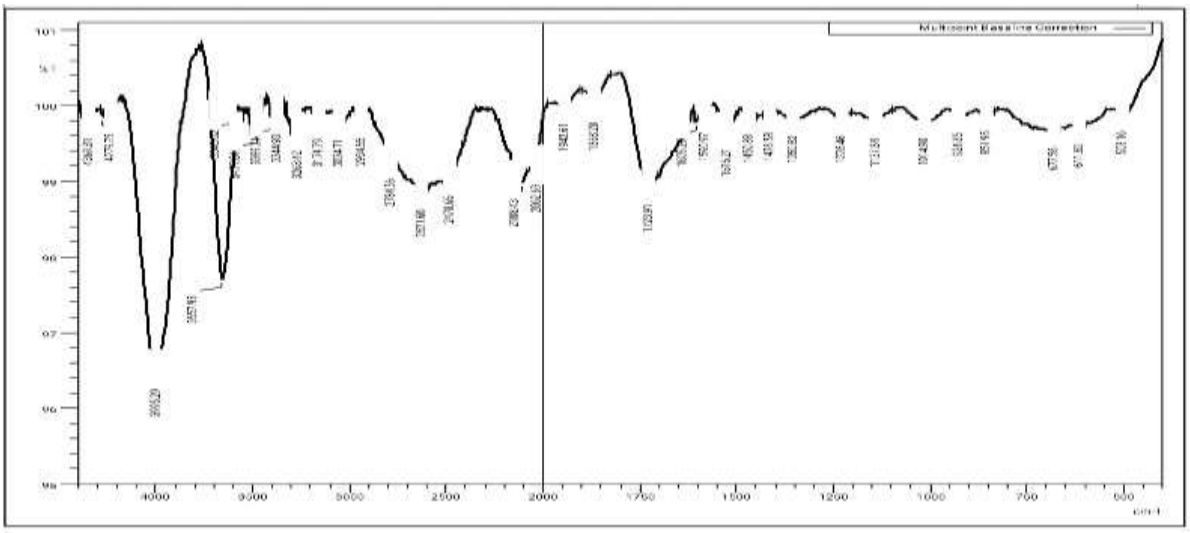

Figure 18: IR image of Sample E.

ANTIBACTERIAL ACTIVITY

Table 5: Samples ration studied for Antibacterial activity.

Sample Name	Chitosan: banana bracket powder (grams)
A	1:0.5
B	1:1
C	1:1.5
D	1:2

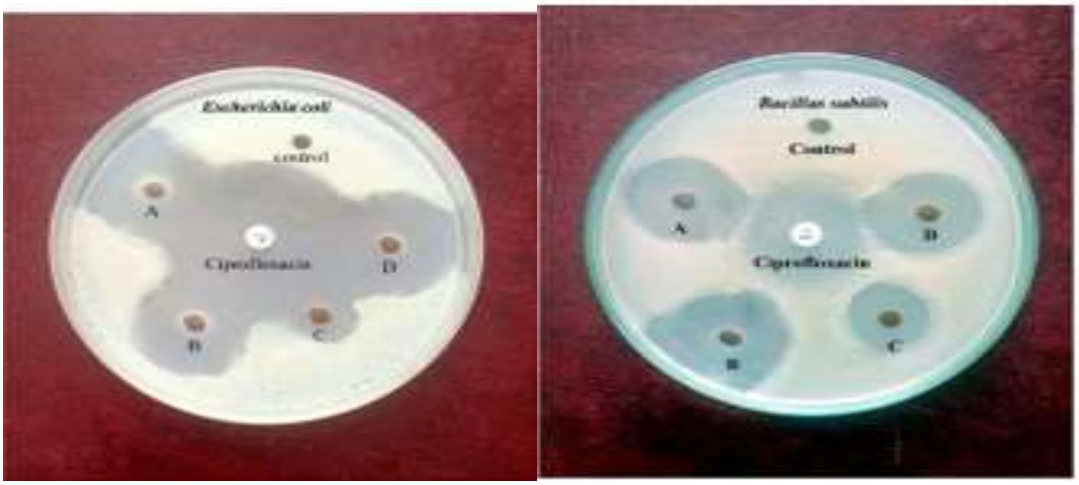

Figure 19: Antibacterial activity.

Table 6: Antibacterial activity on the samples.

S.No	Microorganisms	Control	A	B	C	D	Ciprofloxacin
		Zone of inhibition in mm					
1	Bacillus subtils	-	25	26	17	23	24
2	Escherichia coil	-	25	25	15	27	24

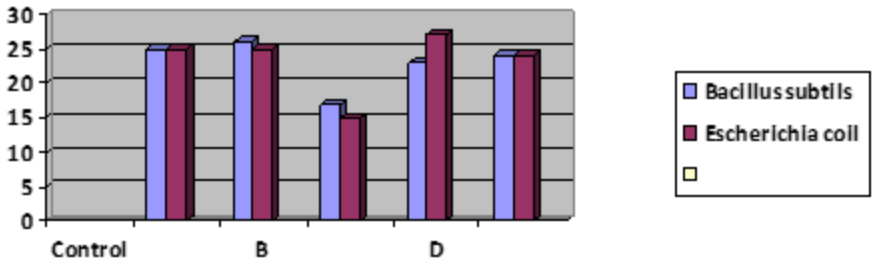

Figure 20: Antibacterial activity.

The above table and figures show the antibacterial activity of the various membranes. It is seen that the membranes showed the membranes A, B & D activity higher than the standard drug Ciprofloxacin and C lesser than the standard drug.

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