

# Anti-microbial finishing on Cotton Using Moringa Oleifera

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**Abstract** - Moringa Oleifera commonly known as drumstick tree is a fast growing Indian native plant whose parts have many medicinal, antimicrobial properties. Now a days as technology improves consumers are looking for more eco friendly products which won't harm them and the environment. Anti-microbial finishing are done to inhibit the growth of micro-organisms when worn close to the skin. The powdered leaves and seeds of the plant along with a concentration of methanol is used to produce the aqueous solution in a soxhlet extractor. This solution is used to finish the terry structured cotton fabric. The method of application is direct method of application along with citric acid as the cross-linking agent. The antimicrobial activity of the finished fabric was assessed by qualitative(AATCC 147) and quantitative methods(AATCC 100) using the testing organisms Staphylococcus Aureus and Klebsiella Pneumoniae. The finished fabric along with Moringa seeds aqueous solution showed antimicrobial activity of 99.99% against Staphylococcus aureus and Klebsiella pneumoniae. The anti-microbial finished fabric can be used to develop hygienic products.

**Key Words:** Antimicrobial finish, Moringa Oleifera leaves, seeds,

## 1.INTRODUCTION

More than 300 million women in India are not aware about safe menstruation products, and putting their lives at risk with infections. This situation provoked to develop an Eco-friendly anti-microbial finished fabric which can be used in making sanitary napkins, diapers. Among all the natural antibacterial, antimicrobial agents, the plant products comprise the major segment. Healing power of some of the plant materials has been used since ancient times<sup>[1]</sup>. Many plants have been used because of their antimicrobial traits, which are due to compounds synthesized in the secondary metabolism of the plant.<sup>[2]</sup>

Moringa Oleifera is one such plant and all of parts has various medicinal benefits. Moringa Oleifera has gained widespread popularity due to potent antibacterial, anti-fungal, antioxidant, anti-diabetic, anti-inflammatory activities of its extracts prepared from different parts of the plant. The phenols and

flavonoids act as antioxidants that prevent oxidative damage and control degenerative diseases. Alkaloids are known for antibacterial and anti-fungal activities. The highest antibacterial activity against all used strains was recorded with methanol extract.<sup>[3]</sup>

As of now various parts of Moringa Oleifera are used for waste water treatment, drinking water purification. A study has discussed that the seeds of Moringa Oleifera contains a coagulant protein which helps in the treatment of industrial waste water. For drinking water purification, Moringa seeds are used as coagulant agent due to its high content of water soluble cationic protein which is able to reduce the turbidity. It has also stated that the oil extracted from Moringa can be used for water treatment, drinking water purification, and also for textile wastewater treatment.<sup>[4]</sup>

The literature is evident that Moringa Oleifera has anti-microbial activities, and so in this present study an effort has been made to give anti-microbial finishing on terry structured cotton fabric using methanol extracts of Moringa Oleifera leaves and seeds to develop hygienic products.

## 2. MATERIALS AND METHODS

The leaves of Moringa Oleifera tree were collected from a farm located in Erode. And the seed powder of Moringa Oleifera was sourced from an organic shop named "The Nattu Marundhu Kadai" located in Coimbatore. 100% cotton fabric knitted in Terry structure is used. Methanol and citric acid are used as the solvent and cross linking agent for this study.

### 2.1. Extraction process

The leaves collected was ensured to be healthy and uninfected. The leaves were washed under running tap water to eliminate dust and other foreign particles and to clean the leaves thoroughly and later it was dried. The leaves of the plant were air dried under shed, and then grounded into powder. Fifty grams (50g) of the powdered leaves and seeds were weighed and poured into 250 ml of methanol separately. The mixture was kept for 24 hours in a Soxhlet extractor to extract the solution.

## 2.2. Applications of Moringa Oleifera

Moringa Oleifera (Drumstick) is a mineral rich, medicinally important tree species of family Moringaceae. It has a wide range of culinary applications, and has bio remediation, nutritional and medicinal properties. Conventionally, seeds of the tree have been used as natural coagulants and flocculent in waste water treatment. Its leaves and bark act as biosorbent for remediation of heavy metals and dyes. The tree provides remedies for a range of diseases and disorders by dint of its unique combination of numerous phytochemicals<sup>[5]</sup>

## 2.3. Method of application

The cotton knitted fabric was padded with 15% concentration of the anti-microbial agent along with 10% of citric acid as the cross linking agent at 50 degree Celsius. The sample was dried at 100 to 120 degree Celsius for about 5 minutes and cured at 180 degree Celsius for 3-4 minutes.

## 2.4. Test methods

The treated fabric sample and untreated sample was tested for the anti-microbial activity using standard testing methods like qualitative(AATCC 147) and quantitative(AATCC 100) against testing organisms like Staphylococcus Aureus and Klebsiella Pneumoniae. Quantitative testing is an excellent way to quantify the antimicrobial activity level of an antimicrobial fabric. It helps to test the ability of the fabrics and textiles to inhibit the growth of microorganisms or kill them in a 24 hour period of contact.<sup>[6]</sup> AATCC 147 method is commonly known as the parallel streak method, which is designed to qualitatively evaluate the antibacterial activity of diffusible antimicrobial agents on the treated textiles. It helps to test the ability of the of the treated textile to inhibit the growth of microorganisms to be bacteriostatic.<sup>[7]</sup>

## 3. RESULT AND DISCUSSION

### Quantitative Testing

Sample size : Swatches of 4.8 cm in diameter for each bacteria

Test organism used : Staphylococcus Aureus (ATCC 6538), Klebsiella Pneumoniae (ATCC 4352).

The results of quantitative tests for treated samples with moringa oleifera leaves are shown in the Figs 1,2,3 and 4, which shows the before and after antibacterial activity.

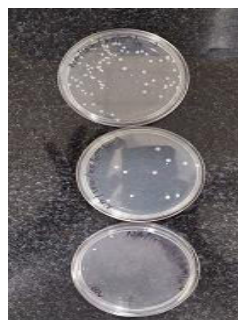


Fig -1 K.pneumoniae



Fig-2 S.aureus



Fig-3 K.pneumoniae



Fig-4 S.aureus

**Fig-1&2 :** Klebsiella pneumoniae before and after treatment

**Fig-3&4 :** Staphylococcus aureus before and after treatment

**Table-1 :** Antimicrobial Evaluation of Moringa Oleifera Leaves - Quantitative AATCC 100

Test organism used	No. of swatches	Bacterial reduction (%)
Staphylococcus Aureus	5	92.9
Klebsiella Pneumoniae	5	99.99

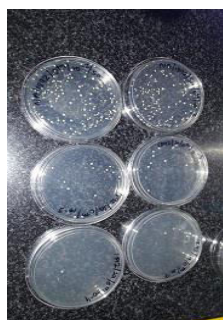
The results of quantitative tests for treated samples with moringa oleifera seeds are shown in the Figs 5, 6, 7 and 8, which shows the before and after antibacterial activity.



Fig-5 K.pneumoniae



Fig-6 S.aureus



**Fig-7** K.pneumoniae



**Fig-8** S.aureus

**Fig-5&6 :** Klebsiella pneumoniae before and after treatment

**Fig-7&8 :** Staphylococcus aureus before and after treatment

**Table-2 :** Antimicrobial Evaluation of Moringa Oleifera Seeds - Quantitative AATCC 100

Test organism used	No. of swatches	Bacterial reduction (%)
Staphylococcus Aureus	5	99.99
Klebsiella Pneumoniae	5	99.99

### Qualitative Testing

Sample size. : Swatch of 25 x 50 mm for each bacterium

The results of qualitative tests for treated samples with moringa oleifera leaves are shown in the Figs 9 and 10, which shows the bacteriostatic activity.



**Fig- 9** K.pneumoniae



**Fig- 10** S.aureus

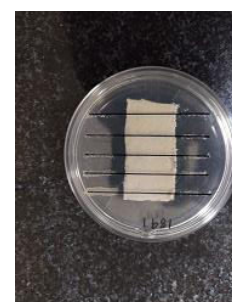
**Table-3 :**Antimicrobial Evaluation of Moringa Oleifera Leaves - Qualitative AATCC 147

Test organism used	No. of swatches	Bacterial reduction (%)
Staphylococcus Aureus	3	Absent
Klebsiella Pneumoniae	0	Present

The results of qualitative tests for treated samples with moringa oleifera seeds are shown in the Figs 11 and 12, which shows the bacteriostatic activity.



**Fig- 11** K.pneumoniae



**Fig-12** S.aureus

**Table-4 :** Antimicrobial Evaluation of Moringa Oleifera Seeds - Qualitative AATCC 147

Test organism used	Bacteriostatic activity(mm)	Growth under fabric
Staphylococcus Aureus	0	Absent
Klebsiella Pneumoniae	0	Present

The results of the qualitative and quantitative testing for the antimicrobial evaluation of Moringa Oleifera leaves and seeds are depicted in the table-1,2,3&4. It is understandable from the give data that the finished fabric with the methanolic extracts of moringa leaves and seeds have good antimicrobial activity against the bacterium used. The extracts of the Moringa seeds have 99.99% of antimicrobial activity against the bacterium and the extracts of the Moringa leaves have 92.9% and 99.99% of the antimicrobial activity against Staphylococcus Aureus and Klebsiella Pneumoniae. The qualitative test of the Moringa leaf and seed extracts showed presence of antibacterial activity against Staphylococcus aureus and absence of antibacterial activity against Klebsiella pneumoniae.

#### 4. CONCLUSIONS

The Moringa Oleifera leaf and seed extract have good antimicrobial activity against the bacterium used. The aqueous solution was extracted using methanol and the method of application is pad dry cure method using citric acid as the cross linking agent. The qualitative and the quantitative test results shows that both the methanolic extracts of Moringa leaves and seeds have better activity against Staphylococcus aureus and Klebsiella pneumoniae. Based on the results it is evident that this fabric can be used to develop hygienic products like sanitary napkins, kids diapers.

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