International Journal of Research in Engineering, Science and Management
Volume-2, Issue-4, April-2019
www.ijresm.com | ISSN (Online): 2581-5792

Sustainable Approach Towards Developing Herbal Nano-Finished Cloth Mask to Reduce the Propensity of Asthma

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***Abstract*: interdisciplinary products such as Agri, Geo, Medical, Industrial Sports etc. Among these, medical textiles are very promising sector which plays a vital role in health of mankind. It consists of textiles used in operative and post-operative tasks in and around the patient and the medical practitioners. Our idea of this project is to develop the sustainable nano finished woven mask using tulsi (Ocimum tenuiflorum) to reduce the impact of asthma. This work is a small effort in developing eco-friendly mask to help the person who is struggling in asthma. The fabric was nano finished and evaluated for anti-asthmatic, anti-bacterial, anti-fungal and durability against repeated wash cycle tests. This study definitely helps the Medi-tech sectors to develop innovative protective solutions for asthma patients. The aim of this research work is to serve the society and makes asthma free world.**

***Keywords*: Green synthesis health care and hygiene textiles, Nano finished tulsi cotton mask, Ocimum tenuiflorum nano synthesis cotton mask, Sustainable herbal mask**

1. Introduction

Asthma is a common long term inflammatory disease that affects the airways of the human lungs. Symptoms include episode of wheezing, coughing, chest tightness and shortness of breath especially in the morning or at the night time. People who affected by these kind of dieses always wear mask to protect them from inciting factors for asthma which are miscible in the air. These masks are exclusively disposable and made of non-woven synthetic textile materials and used widely in the world. Nowadays the world turns towards green concept due to the adverse effect of non-ecofriendly products and process. This latest scenario knocks the doors of medical textile sectors to find reusable and sustainable health care and hygiene products to prevent pollution in all aspects such as water, air and land. In this research, an organic cotton woven fabric was used to make reusable mask to bestow a solution for land filling pollution. This fabric was finished with nano particles of tulsi leaves to reduce the adverse effect of asthma and thus helps the public get acquit from such kind of inflammatory dieses. Tulsi (Ocimum tenuiflorum) is an aromatic shrub in the basil family. It is native to the Indian subcontinent and widespread as a cultivated plant throughout the Southeast Asian tropics. It is traditionally taken as herbal tea, dried powder, and fresh leaves or mixed with ghee. It is used in both siddha and ayurveda practices and recommended as a treatment for a range of conditions including anxiety, cough, asthma, diarrhea, fever, dysentery, arthritis, eye diseases, otalgia, indigestion, hiccups, vomiting, gastric, cardiac and genitourinary disorders, back pain, skin diseases, ringworm, insect, snake and scorpion bites and malaria. Nano technology is an emerging and promising field to find innovative and alternate solution for many impossible processes. This research article, take an initiative to develop a nano finished organic cotton mask using tulsi extract to confer a solution for asthma patients.

2. Methodology

A. Material Selections

1) Organic Cotton Fabric

Fabric selection is a crucial step in making a project because fabrics are designed for specific applications. In this 100 % organic cotton (Fig 1) fiber is selected in consideration with their following properties and the characteristics. Cotton is a soft, absorbent and breathable natural fiber, making it the perfect fiber worn close to the skin also non-allergenic. Further it prevents skin irritation, bacterial efficiency 70%, filters dust particles size up to 4 microns, Cool, breathable, washable and reusable

Technical Specification of the material:

EPI	: 99
PPI	: 54
GSM	: 140
Bleaching	: Half or Semi bleached

Fig. 1. Cotton fabric

B. Tulsi Leaves (Ocimum tenuiflorum)

Fresh tulsi leaves were used for nano particle extraction Ocimum tenuiflorum nanoparticle extraction: Nano particles of tulsi leaves are derived by Soxhlet extraction method. It is a chemical process of transferring the partially soluble components of a solid into the liquid phase. Here, the fresh tulsi leaves are transferred into nanoparticles with chemical components at maintaining constant temperature. The extraction of nano practicals are developed as follows,

Fig. 2. Tulasi

1) Herbal Powder Extraction by aqueous extraction techniques

It is prepared using an effective Soxhlet extraction protocol (Fig 3). Extraction refers to separating the desired material by physical or chemical means with the aid of a solvent. Antimicrobial active substances were extracted from the leaves by aqueous extraction method. The powdered plant material was extracted with water by adding 50g of herbal in750ml for 24h.

Fig. 3. Soxhlet extraction

2) Synthesis of herbal extracts nanoparticles

Herbal extract nanoparticles (Thulasi extracts) were prepared by coacervation process by cross-linking with glutaraldehyde. In this method, the herbal extract was incubated with bovine serum albumin (wall material – 2% w/v) for one hour at room temperature. Using 1Ml HCl pH was adjusted to 5.5. Ethanol was added to the solution in the ratio of 2:1 (v/v) at the rate of 1ml/min. The entire setup was carried out in a magnetic stirrer (Fig 4).

Coacervate thus formed was hardened with 25% glutaraldehyde for 2 hours to allow cross-linking of protein. Organic solvents were removed by rotary vacuum evaporator and resultant nano capsules were separated and purified by centrifugation at 10,000 rpm. Pellets were suspended in 0.1M PBS (pH 7.4) and lyophilized with mannitol (2% w/v). Nano particles were separated.

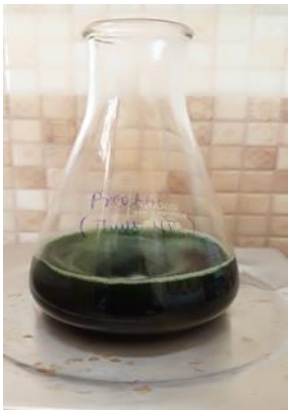

Fig. 4. Extract

3) Nano finishing process

The fabric sample was treated with herbal-nano particle composites using citric acid as cross-linking agent. Nanoparticle - composite was applied on to the fabric separately with material-to-liquor ratio of 1:10 at 40ºC using 8% citric acid concentration. Composite mixture was padded onto the fabric materials for 30min. The finished sample is dried at100-120ºC for 5min and cured at 180ºC for 3min (Fig. 5).

Fig. 5. Nano

4) Developing Product

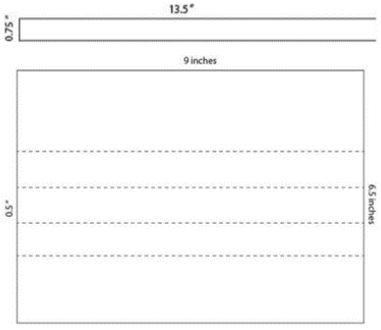

Fig. 6. Product

Pattern for mask was made as per the standard size (Fig. 6). The Nano finished cotton fabric was laid on the table and

patterns were kept on it cut manually as per the pattern. After cutting, the fabric is first pleated at center and made to finish at the sides using lock stitch machine. Next, the edges are finished with doubled folded at all sides. Finally, the adjustable loop is separately made and attached at equal distance for tying at the back (Fig. 7). Then the product is evaluated for its sewing quality and finally the mask is packed.

Fig. 7. Mask

3. Results & Discussion

The present investigation aimed at developing herbal Nano finished cloth mask using tulsi herbal leaves extract. This product evaluated against anti asthmatic (Table 1), anti-fungal (Table 2), anti-bacterial (Fig. 8 & 9) and washing durability (Table 3). The findings show that Herbal Nano finished cloth mask yields a better result, on preventing asthma than non-woven (melt blown) material.

Table 1
Histamine-induced bronchoconstriction

S. No.	Treatment Group	% increase in time of PCD
1	Control	3.25 ±1.41
2	Chlorpheniramine	81.53±3.18
3	100mg/kg	44.67±2.29
4	200mg/kg	68.34±2.66

Table 2
Antimicrobial activity of cotton fabric finished with Tulsi herbal extracts – AATCC 147

S. No.	Test Organism	Zone of inhibition (mm)
1	Acinetobacter SP	32
2	Staphylococcus aureus	34
3	Candida Species	19

Table 3
Wash fastness test – AATCC 124

S. No.	After 20 wash cycle	
1	Gray Scale Ratings	4
2	Staining Scale Ratings	4-5

Escherichia coli ATCC 25922 Staphylococcus aureus ATCC 6538

Fig. 8. Assessment of qualitative antibacterial activity of Thulasi NPs finished fabric (BEFORE WASH)

Escherichia coli ATCC 25922 Staphylococcus aureus ATCC 6538

Fig. 9. Assessment of qualitative antibacterial activity of Thulasi NPs finished fabric (AFTER FIVE WASH)

4. Conclusion

In recent years, people exposed to many diseases due to their food habits as well as polluted surroundings. Asthma is one among the dieses and is an incurable illness of the airways. The disease causes inflammation and narrowing inside the lung, restricting air supply. Many medications are available to get relief shortly from this complaint. But it creates side effects to the health when used for long terms. The people who affected by asthma using disposable mask during they exposed to polluted environment. These masks are made of synthetic polymer by melt blown non-woven techniques. These materials are suspected to non-ecofriendly due to their least bio degradability factors. This makes to find an innovative sustainable hygiene solution to overcome these kind of environment crises. This research article concludes that, the application of herbal nano finished (Ocimum tenuiflorum leaves extract) cotton fabric mask prevents the adverse effect of asthma. This new plant source exhibiting, antibacterial, antifungal and anti-asthmatic property can be used in development of medical textiles as well as in health care and hygiene sector. Further it does not develop any side effects to the users. This study also provides a new source for natural plant material which can be combined with new technologies.

References

[1] Ahmed M, Ahamed RN, Aladakatti RH, Ghosesawar MG. Reversible anti-fertilityeffect of benzene extract of Ocimum sanctum leaves on sperm parameters and fructose content in rats. J Basic Clin Physiol Pharmacol. 2002; 13(1):51-9.

[2] Amrani S, Harnafi H, Bouanani Nel H, Aziz M, Caid HS, Manfredini S, Besco E, Napolitano M, Bravo E. Hypolipidaemic activity of aqueous Ocimum basilicum extract in acute hyperlipidaemia induced by triton WR-1339 in rats and its antioxidant property. Phytother Res. 2006; 20(12):1040-5.

[3] Banerjee, S, Parashar R, Kumar A, Rao A R. Modulatory influence of alcoholic extract of Ocimum leaves on carcinogen-metabolizing enzyme activities and reduced glutathione levels in mouse. Nutr Cancer 1996, 25(2): 205-217.

[4] Bansod S and Rai M. Antifungal Activity of Essential Oils from Indian Medicinal Plants against Human Pathogenic Aspergillus fumigatus and A. Niger. World Journal of Medical Sciences 2008, 3(2): 81-88.

[5] Bhargava K P, Singh N. Antistress activity of Ocimum sanctum Linn. Ind J Med Res 1981, 73:443-451.

[6] Chattopadhyay RR. Hypoglycemic effect of O sanctum leaf extract in normal and streptozotocin diabetic rats. Indian Journal of Experimental Biology 1993, 31 891–893.

[7] Chiang L C, Ng L T, Cheng P W, Chiang W & Lin C. Antiviral activities of extracts and selected pure constituents of Ocimum basilicum. Clinical and Experimental Pharmacology and Physiology 2005, 32(10): 811-816.

[8] Dhar M L, Dhar M, Dhawan BN, Mehrotra BN & Roy C. Screening of Indian plants for biological activity, Part I. Indian Journal of Experimental Biology 1968, 6 232– 247.
[9] Reghunandana R et al. (1995). Effect of Ocimum sanctum Linn (Tulsi) extract on testicular function. Indian J Medical Research 1995, 49(4):83–87.
[10] Gupta S K, Prakash J, Srivastava S V. Validation of claim of Tulsi, Ocimum sanctum Linn as a medicinal plant. Indian J Experimental Biology 2002, 40(7): 765–773.
[11] www.medicalnewstoday.com
[12] www.mayoclinic.org
[13] www.ncbi.nlm.nih.gov