

Prevention of Diaper Dermatitis in Baby Diapers with Nanoencapsulated Natural Extracts

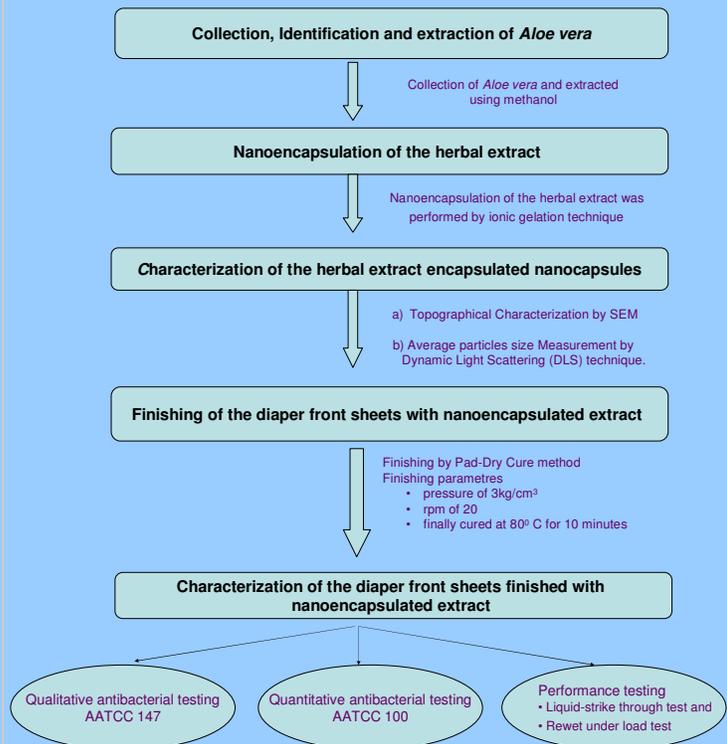
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1. Introduction:

- Baby diapers are designed to hygienically catch and hold urine and feces voided by children until the diaper can be changed. The widespread use of baby diapers has been accompanied by a marked reduction in skin irritation and a decrease in the spread of infectious diseases.
- Nappy rash or diaper dermatitis (also known as napkin dermatitis or diaper rash) is the common term used to encompass a wide range of inflammatory processes that occur in the area covered by a diaper.
- Diaper dermatitis is probably the most common cutaneous disorder of infancy and early childhood. Because most diaper rash is treated conservatively at home, the exact prevalence is unknown, but it is estimated that 7% to 35% of infants are affected.
- Though there are lots of factors that contribute to the diaper dermatitis, from microbiological point of view, there is good correlation between the growth of pathogenic bacteria and fungi and the diaper dermatitis.
- Hence it is the need of the hour to control the growth of microbes in diapers by incorporating suitable antimicrobial agents. In spite of the availability of numerous antimicrobials for textile applications, herbal antimicrobials are preferred because they were non-toxic, non-allergic, eco-friendly.
- Novel uses for nanotechnology have infused the textile industry with innovative niche products or improved versions of existing ones. Hence in the present study an attempt has been made to incorporate the nanoencapsulated herbal antimicrobials in the front sheets of the baby diapers and to study the antimicrobial efficacy of the finished diapers

Experimental (Modeling)



Results

- The topography of the as prepared herbal extract encapsulated nanocapsules were studied by SEM analysis and shown in Fig.1. The SEM results showed uniform distribution of the nanocapsules with roughly spherical morphology.
- The average size of the thus prepared nanocapsules was analyzed by DLS technique (Fig.2) and the average size of the nanocapsules were found to be ~ 44 nm.

Fig.1: SEM image of *A.vera* encapsulated nanocapsules

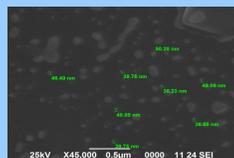
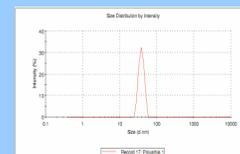


Fig.2: DLS image of *A.vera* encapsulated nanocapsules



Qualitative assessment of Antibacterial activity of the Diaper (Parallel Streak method)

Table-1: Antimicrobial activity assessment by Parallel Streak method

Test Fabric	Growth		Zone of Inhibition (in mm)	
	<i>E.coli</i>	<i>S.aureus</i>	<i>E.coli</i>	<i>S.aureus</i>
Diaper front sheets treated with nanoencapsulated <i>A.vera</i> extract	NIL	NIL	15	23
Untreated diaper front sheets	+	+	0	0

'+' Positive growth under the fabric; 'Nil' No growth under the fabric

- Treatment with *A.vera* nanocapsules inhibits microbial growth and is evident from the absence of growth under the treated diaper front sheets. However the untreated diaper front sheets show microbial growth even beneath it.

Quantitative Assessment of Antibacterial Activity of the Diaper (AATCC 100)

- The results of the Percentage reduction test confirmed the antimicrobial activity of the Diaper front sheets treated with nanoencapsulated *A.vera* extract.
- The Diaper front sheets treated with nanoencapsulated *A.vera* extract expressed a bacterial reduction percentage of 96.66 and 94.16 against the test organisms namely *S.aureus* and *E.coli* respectively.

Table-2: Antibacterial assessment by Percentage reduction Test

Fabric Tested	Organism	% Reduction
Diaper front sheets treated with nanoencapsulated <i>A.vera</i> extract	<i>E.coli</i>	96.66 %
	<i>S.aureus</i>	94.16 %
Untreated diaper front sheets	<i>E.coli</i>	—
	<i>S.aureus</i>	—

Performance testing

- In the case of liquid strike-through test, nanoencapsulated *A.vera* treated and untreated diapers take 0.75s and 0.73 s respectively to transport the liquid from their surface. The results proved that there was not any significant difference in the liquid strike through between the diapers finished with nanoencapsulated *A.vera* and the untreated diapers.
- The diaper finished with nanoencapsulated *A.vera* extract expressed a slightly higher rewet value (6.1g) compared with the untreated diapers which had a rewet value of 5.9s. The lesser the rewet value the better is the performance of the diaper. If the absorbed fluid surfaces on to the diaper, then it would cause dampness and would result in skin infection

Conclusion:

- In the present work, antimicrobial finishing of the diaper front sheets with eco-friendly, anti-allergic herbal extract has been described.
- The over all results illustrated that nanoencapsulated *A.vera* extracts was compatible for finishing the diaper front sheets. Since the active principles were of natural origin and it does not have any ill effects on the baby skin.

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