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MEDICAL TEXTILES-CELLULOSIC SUPERABSORBENTS

Chinta, S.K.*, Mhetre, S.B., Ms. Vyas, S.K.
DKTE'S Textile & Engineering Institute, Ichalkaranji

ABSTRACT
In this work cotton in the form of Comber noil which is treated with citric acid in the presence of catalyst like sodium hypophosphite and sodium alginate in the presence of catalyst like gluteraldehyde for making cotton super absorbent at different concentrations, temperatures and time. At the same time the samples are treated with various bleaching sequences for comparison with above treated samples. The results shows that out of various bleaching sequences, scoured, mercerized and bleached sample shows good results as far as preparation of super absorbent materials are concerned, irrespective of treatment with citric acid or sodium alginate. The final results gives samples which e medically compatible as cellulose reacts with iodinated zinc chloride to form a violet colored complex.

KEYWORDS: superabsorbent, citric acid, sodium alginate, medically compatibility.

INTRODUCTION

Medical textiles are major growth area of technical textiles and amongst which super absorbent material occupy an important place because people take much care about health and hygiene. So development of super absorbent fibres having unique property that it can absorb water at 100 times their own volume and higher absorbency is a desired property in many end uses such as diapers, tampons, sanitary napkin, medical sponge, baby wipes etc. [1] As a result, super absorbent polymers caused a huge revolution in the personal health care industries in just over ten years. Super absorbent polymers (SAP) are hydro gels that can absorb 100 times their own volume[2]. Absorbency depends mainly on the osmotic pressure, ionic impulsion and elasticity of the polymers[3]. Thus super absorbents are cross linked network of hydrophilic polymers with high capacity for water uptake. The absorbency of superabsorbent depends not only on the nature and density of hydrophilic groups but also on density of crosslink forming the three dimensional network[4]. This kind of polymer gel is developed by group of researchers at 1970[s5]. It offers numerous health, safety and cost advantages. It is used to lock in wetness and to keep it away from the skin which minimizes rash and irritation and provides consumer with comfort, and piece of mind.[6]

In this work an attempt has been made to study cotton (Comber noil) which is treated with citric acid in the presence of catalyst like sodium hypophosphite and sodium alginate in the presence of catalyst like gluteraldehyde for making cotton super absorbent at different concentrations, temperatures and time.

EXPERIMENTAL WORK

Material used: Comber noil,
Chemicals used: Citric acid, Sodium alginate, Sodium hypophosphite, Gluteraldehyde,Sodium hydroxide, Soda

ash , Hydrogen peroxide, etc. All the chemicals used were of LR grade

Chemical treatments

In this experiment, Citric acid is applied to the pretreated comber noil in the presence of catalyst like sodium hypophosphite and sodium alginate in presence of catalyst like, gluteraldehyde for making cotton super absorbent at different concentrations, temperatures and time.

Process flow chart

The experiment has been divided into two major parts such as

With Mercerization:
1. Comber Noil – Scouring –Bleaching –Mercerization-Chemical treatments (SBM)
2. Comber Noil – Scouring - Mercerization–Bleaching-Chemical treatments (SMB)
3. Comber Noil – Mercerization— Scouring –Bleaching – Chemical treatments (MSB)

Without Mercerization:
Comber Noil – Scouring –Bleaching- Chemical treatments (SB)

Process Parameters
1 Material: Liquor = 1:20
2 Concentrations of citric acid= 5%, 10% & 15%
3 Temperatures =30°C, 50°C, 70°C &100 °C
4 Time =30 min, 60 min, 120 min & 240 min

Testing Methods

The standard test methods are followed which are as below

1. **Sinking Test**[7]
2. **Free swell Capacity (FSC)** [8]
3. **Water retention Value (WRV)** [9]
4. **Pharmaceutical Tests**[10]

Absorbent cotton consists of pure cellulose with 6 to 7% moisture. Cellulose reacts with iodinated zinc chloride to form a violet colored complex. The same reagent gives yellow color with jute, and purple to yellow with hemp & flax.

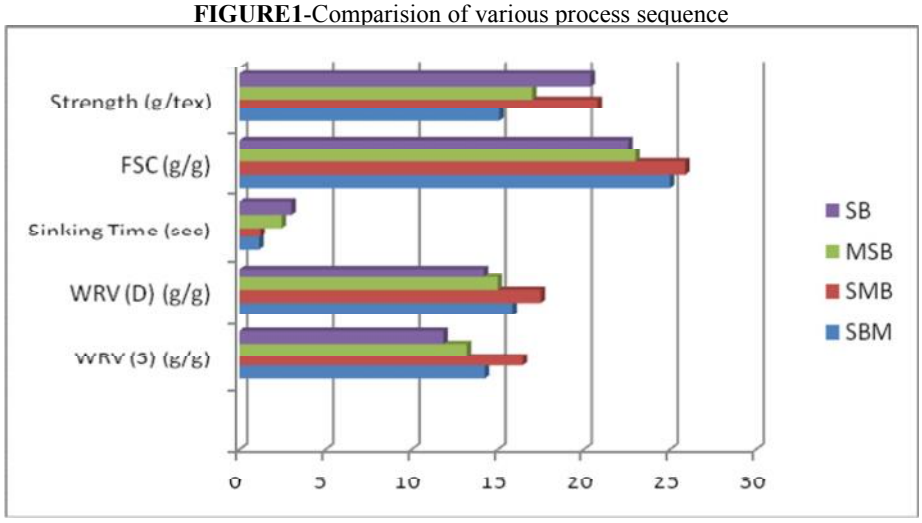
RESULTS AND DISCUSSION

A] Citric acid treatment:

TABLE 1. Effect of various process sequences on various parameters when treated with citric acid in the presence of sodium hypophosphite.

Code	Process	Conc %	Temp °C	Time min	Sinking Time sec	Free Swelling Capacity (FSC) g/g	Water Retention Value (Distilled water) g/g	Water Retention Value (Saline water) g/g	Strength g/tex
SBM	Scoured Bleached Mercerized	10	70	120	1.14	25	15.85	14.25	15.1
SMB	Scoured Mercerized Bleached	10	70	120	1.22	25.89	17.5	16.45	20.8
MSB	Mercerized Scoured Bleached	10	70	120	2.45	23	15	13.2	17
SB	Scoured Bleached	10	70	120	3.02	22.59	14.2	11.85	20.4

FIGURE1-Comparision of various process sequence



After going through so many experiments as mentioned in experimental work, Table 1 shows only the optimum results obtained when the sample was treated with the above process sequence followed by treatment with citric acid in the presence of catalyst like sodium hypophosphite. The scoured, bleached and mercerized sample at 10% conc. of citric acid for 120 min at 70^0C shows sinking time as 1.14 sec and free swelling capacity as 25 g/g. Water retention values for distilled and saline water shows 15.85 g/g and 14.25 g/g respectively. The strength of the sample was found to be 15.1 g/tex. As the sinking time is less, the free swelling capacity of fibre increases and the same trend was found for water retention values, as more the pre-swelling capacity more will be the water retention value. The same is applicable both for distilled as well as saline water. This may be due to not only the structural and chemical changes brought in by scouring, bleaching and mercerizing, also influenced by citric acid treatment at lower temperature and concentration. When compared with all the four processes, the scoured mercerized and bleached samples shows excellent results with respect to free swelling capacity and water retention values both for distilled and saline water which is an essential requirement of super absorbent material. The reason behind this may be attributed to cleansing (removal of oils, fats and waxes) process due to scouring first and then enhancement of sinking time and free swelling capacity due to mercerization followed by scouring. This is clearly seen in Fig.1.Threre is not much change in strength of the samples when treated with various process sequence.

B] Sodium alginate Treatment

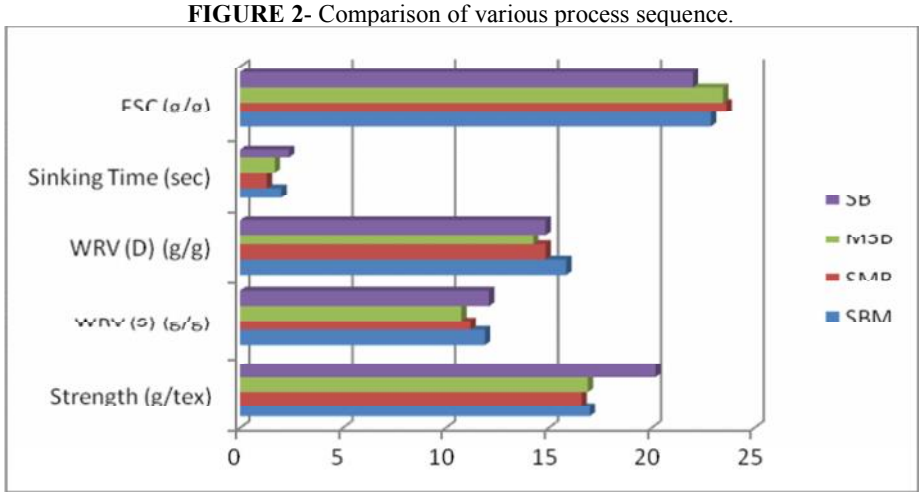
TABLE 2: Effect of various process sequences on sinking, free swelling water retention value and strength parameters when treated with sodium alginate in presence of gluteraldehyde

Code	Process	Conc %	Temp °C	Time min	Sinking Time sec	Free Swelling Capacity (FSC) g/g	Water Retention Value (Distilled water) g/g	Water Retention Value (Saline water) g/g	Strength g/tex
SBM	Scoured Bleached Mercerized	10	70	120	2.01	22.89	15.85	11.9	17
SMB	Scoured Mercerized Bleached	5	70	120	1.3	23.64	14.85	11.2	16.6
MSB	Mercerized Scoured Bleached	5	70	120	1.69	23.48	14.25	10.75	16.9
SB	Scoured Bleached	10	70	120	2.38	22.01	14.85	12.1	20.2

After going through so many experiments as mentioned in experimental work, Table 2 shows only the optimum results obtained when the sample was treated with the above process sequence followed by treatment with sodium alginate in the presence of catalyst like gluteraldehyde.

The scoured, bleached and mercerized sample at 10% conc. of sodium alginate for 120 min at 70^0C shows sinking time as 2.01 sec and free swelling capacity as 22.89 g/g. Water retention values for distilled and saline water shows 15.85 g/g and 11.90 g/g respectively. As the sinking time is less, the free swelling capacity of fibre increases the same trend was found for water retention values, as more the pre-swelling capacity more will be the water retention value. The same is applicable both for distilled as well as saline water. This may be due to the structural and chemical changes brought in by scouring, bleaching and mercerizing and followed by treatment with sodium alginate. When compared with all the four processes, the scoured mercerized and bleached samples shows excellent results with respect to free swelling capacity and water retention values both for distilled and saline water which is an essential requirement of super absorbent material.

FIGURE 2- Comparison of various process sequence.



Pharmaceutical Tests

Sr No.	Identification Test	Observation
1	Scoured Mercerized Bleached	Violet colour
2	Scoured Mercerized Bleached & Citric Acid at 10% at70^0 for 120 min	Violet colour
3	Scoured Mercerized Bleached & Sodium Alginate at 5% at70^0 for 120 min	Violet colour

In Identification Test it was found that these three samples were medically compatible as cellulose reacts with iodinated zinc chloride to form a violet colored complex.

CONCLUSION

From the results, it may be concluded that scoured, mercerized and bleached sample shows good results as far as preparation of super absorbent materials are concerned, irrespective of treatment with citric acid or sodium alginate

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