

Absorbent cotton from non-spinnable fibres by eco-friendly means

S G Gayal, Central Institute for Research on Cotton Technology, Mumbai

A process has been developed to make absorbent cotton from short staple cotton using commercial pectinase preparation. The enzymatically prepared absorbent cotton from Bengal Desi cotton variety fulfils the standard norms and qualities and could find its application in biomedicine as surgical cotton.

Cotton consists of fibres or hairs which come out from cottonseeds. These fibres are unicellular, flattened tubular structures. The cotton fibres vary in length from 20 mm to 40 mm and in width from 15 μm to 25 μm . The cotton fibres are separated and cleaned from the seeds by a mechanical process called 'ginning'.

Cotton fibres are basically cellulosic polymers. Raw unpurified cotton as such is hydrophobic in nature, i.e. it does not absorb water, on the contrary it repels water. This hydrophobic property of the cotton is due to the presence of non-cellulosic substances such as waxes, pectins, proteins, etc. on the fibre. A typical chemical composition of cotton fibres is (%): cellulose, 94; waxes, 0.6; pectins, 0.9; protein, 1.3; mineral matters, 1.2; organic compounds 0.8; total sugars, 0.3.

Cotton is mainly used in textile for manufacturing fabric. However, cotton varieties such as Bengal Desi or RG 8 are having fibre length less than 20 mm and generally are not suitable for fabric making. Such short staple cotton could find alternative applications in the field of biomedicines such as dressings, gauzes, bandages etc.

The basic raw material used for surgical cotton and dressings is the short staple raw cotton fibres or the waste cotton fibres. The surgical cotton in biomedicine is used in three different forms:

- (a) Non-absorbent, bleached cotton
- (b) Absorbent not bleached cotton
- (c) Absorbent bleached cotton

For preparing absorbent cotton from native cotton, it is necessary to remove the non-cellulosic materials from the cotton. Conventionally, the absorbent cotton is made by treating the cotton with alkali such as sodium hydroxide at boil and pressure. The process is called as scouring process. In laboratory, the scouring is being done by treating cotton with 1.0% NaOH 1:20 volume at 121° for 4 hr in an autoclave at a pressure of 15 lb/in². The scoured cotton is washed with water, 1% acetic acid and finally with water and dried.

Enzymes are biocatalysts and they bring about reactions under moderate conditions. In textiles, many enzymes, such as amylase, cellulase, protease, pectinase, lipase find applications. Enzymes such as lipase, cellulase, pectinase and protease could be used for scouring of cotton and fabric.

A process has been developed at CIRCOT to make absorbent cotton from short staple cotton using commercial pectinase preparation. The process consists of treating the Bengal Desi with pectinase under optimum condition for 30 min, in the presence of wetting agent.

Keeping it in at 80°-85°C for 30 min in a water bath and finally washing with cold water. The sample is further treated with hydrogen peroxide at 85°-90°C for one hour, washed thoroughly with cold water and air dried. The process is ecofriendly and helps to minimize pollution.

The air-dried sample is opened in Shirley opener machine and its absorbency is tested. The absorbency of the sample thus prepared was found to be 1.8 seconds. As per the norms of Indian Pharmacopia Standards absorbency of the absorbent cotton should be less than 10 seconds. The properties of bioabsorbent cotton prepared are given in Table 1.

Table 1. Properties of ecofriendly absorbent cotton form Bengal Desi

Variety	Properties of absorbent cotton						
	Average sinking time (sec)	Ash content (%)	Water-holding capacity of cotton (g/g)	Effect of heat (30 min)	Solubility in 80% w/v H ₂ SO ₄ (30 min)	Solubility in 4% w/v NaOH (30 min)	Water soluble matter (%)
Bengal Desi	1.8	0.21	26.8	NY	S	IS	<0.5

NY, Not Yellowing; IS insoluble; S, soluble

The absorbent cotton prepared by either conventional chemical method or by any other process such as enzymatic process, if it is to be used for surgical purpose, it is required to conform to certain standards and qualities, such as laid down by Indian Pharmacopia Standards or British Pharmacopia Standards. Following are some of the important qualities the absorbent cotton should have:

- (i) It should not be soluble in 4.0% NaOH
- (ii) Its sinking time (absorbency) should be less than 10 seconds
- (iii) Its ash content should not be more than 0.5%
- (iv) It should not turn brown when heated at 110°C for 20 min
- (v) When screened under an ultra violet light, should not give more than occasional point of fluorescence

The enzymatically prepared absorbent cotton from Bengal Desi fulfils all the above norms and could find its application in biomedicine as surgical cotton.