

STANDARDS FOR ABSORBENT COTTON AND ABSORBENT GAUZE.*

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The Author contends that U. S. P. test for absorbent quality of cotton is inadequate—glycerin and soap will increase the apparent absorbency. He suggests tests to be adopted for cotton in the forthcoming Pharmacopœia and also gives tests to which plain absorbent gauze should be subjected. Specification for cotton used in manufacturing are given.—Ed.

The large use of absorbent cotton and absorbent gauze for surgical dressings and in the arts has, from time to time, brought up the question of their standardization.

In the present day practice of surgery, generally only plain sterile gauze or cotton is required; that is to say, cotton or gauze not impregnated with an anti-septic.

In a paper published in the "Journal of the Society of Chemical Industry," October 31, 1904, the writer discussed the problems involved in the preparation of absorbent cotton and gauze for surgical purposes, and called attention to the fact that for the most part the Pharmacopœial standards are open to criticism.

The standard for absorbent cotton in the United States Pharmacopœia, Eighth Revision, seems to be inadequate as to its test for absorbency.

Absorbent cotton even when heavily charged with impurities, when pressed in the hand and placed on the surface of water, will sink. The Pharmacopœia failed to prescribe anything definite as to the amount of water to be used. This authority also prescribed that when purified cotton, previously pressed in the hand, is placed on the surface of cold water it will absorb the water and sink, and the water shall not acquire an acid or alkaline reaction.

The test of sinking in water is a test neither of purity nor absorbing power. Soap or glycerin will increase the apparent absorbency.

The British Pharmacopœia of 1914, has the following as a standard for what, in this country is termed "absorbent cotton."

GOSSYPIUM—COTTON—SYNONYM—COTTON WOOL.

Cotton consists of the hairs of the seed of *Gossypium herbaceum*, Linn., and of other cultivated species of *Gossypium*, freed from fatty matter.

Characters and Test.—In long, white, soft filaments, each consisting of an elongated cell, appearing, when seen under the microscope, as a flattened, twisted band with slightly thickened rounded edges. Inodorous and tasteless. Soluble in ammoniacal solution of copper oxide. Readily wetted by water, and not imparting to it either an alkaline or an acid reaction. Ash not more than 0.5 percent.

This standard would seem to be loose and lacking in definiteness, and in the writer's experience several low grades of absorbent cotton can be made to meet these requirements.

A considerable quantity of purified cotton, otherwise known as absorbent cotton, is now used in the arts and especially in the manufacture of explosives. In some

* Read before Scientific Section, San Francisco.

instances the Ordnance Department prescribed standards, three of which are here noted.

COTTON FOR SMOKELESS POWDER—U. S. NAVY DEPARTMENT SPECIFICATIONS.

Unspun cotton, prepared for nitrating purposes by bleaching cotton wastes and thoroughly washing to remove bleaching materials and lime salts; to contain not more than 7 percent moisture, not more than 0.4 percent materials which can be extracted by ethyl ether, and not more than 0.8 percent ash; to contain only traces of lime salts from the bleach and no hypochlorites; to be free from foreign matter of any kind and to be of such texture as will easily nitrate by the usual methods.

COTTON FOR NITRATION—SPECIFICATIONS FRENCH ORDNANCE DEPARTMENT.

Cotton to be furnished must be new, properly scoured and white. It must be free from any mixture with wastes, whatever they may be, coming from spinning mills, or factories working cotton for spinning mills. Heating chlorine bath, used for purpose of whitening, is absolutely forbidden. Any addition of coloring material, particularly blue, on purpose of modifying appearance of goods, is forbidden.

Moisture obtained by heating at 100 deg. C. up to constant weight, must never be over 6% of weight of dry cotton. However, when moisture even over 6%, is not more than 10%, delivery may be accepted, subject to rebate as shown per article nineteenth hereinafter.

Ash, fats (average) insoluble products in diluted sulphuric acid, and other material than cotton fibres, obtained as said in note herewith, must be respectively less than—0.30%, 0.30%, 0.75% and 1-5000. Cotton must be absolutely free from active chlorine. Rate of combined chlorine (Cl) must never be over 3+10000 of weight of dry cotton.

SPECIFICATIONS TO GOVERN THE SUPPLY OF COTTON FOR THE MANUFACTURE OF GUNCOTTON—ROYAL ORDNANCE FACTORIES, ROYAL ARSENAL, WOOLWICH.

To be bleached cotton cellulose, specially suitable for the manufacture of Guncotton.

To consist largely of fibres of long staple, preferably twisted, and to contain as little as possible of felted unspun, short fibre cotton, or dust, technically known as "fly."

The cotton must not show more than the following figures calculated as percentage on the dry material:

Moisture	7.0 per cent
Oily matter	0.6 " "
Soluble on boiling one hour in 3 percent Caustic Soda.....	5.0 " "
Reduction of Fehlings' solution (11 Vol. to 2 Vols. of water on heating 15 minutes at 100 degrees C. (Cu ₂ O).....	1.0 " "
Mineral matter	0.5 " "

Except as regards the above figures, it must be entirely free from organic matter other than pure resistant normal cellulose, and on dyeing with a basic dye such as Fuchsine (Rosaniline Acetate), the fixation of color must be slight and uniform, and must show no deeply dyed particles of fibres.

Following a long series of experiments in the laboratory with which the writer is connected, the following was worked out as a rational standard for purified or absorbent cotton. It was found that this standard is one to which the brands of the leading reputable makers in this country would be found to comply. In other words, this standard is attainable, and would exclude cottons of a low grade or to which foreign substances had been added.

GOSSYPIUM PURIFICATUM—PURIFIED COTTON—SUGGESTED STANDARD.

The hairs of the seed of *Gossypium* (Fam. Malvaceæ) freed from adhering impurities and deprived of fatty matter.

White, soft, fine filaments, appearing under the microscope as hollow, flattened and twisted bands, spirally striate, and slightly thickened at the edges; inodorous and tasteless; insoluble in ordinary solvents, but soluble in an ammoniacal solution of cupric oxide.

When Purified Cotton, previously compressed in the hand, is thrown on the surface of cold water, it should readily absorb the latter and sink.

Purified Cotton should contain no more than a very small quantity, if any, of visible impurities, and on combustion of five grams or more should not leave more than 0.2 percent of ash.

Ten gms. of Purified Cotton are saturated with 100 cc. neutral distilled water, the water pressed out and divided into two portions, each of which is placed in a white porcelain dish. To one portion is added 3 drops phenolphthalein T. S., and to the other portion 1 drop methyl orange T. S. Neither portion should develop a pink color (absence of acid or alkali).

If 20 gms. be extracted in a narrow percolator with ether until 300 cc. percolate is secured, the percolate should, on evaporation to dryness in a tared beaker, leave a residue of not more than 0.5 percent of the weight of cotton used (limit of fatty matter). A blank test should be made with an equal quantity of the ether used.

If 20 gms. be extracted in a narrow percolator with alcohol until 200 cc. percolate is secured, the percolate should not be of a blue or green tint (absence of dyes), and on evaporation to dryness in a tared beaker the residue should amount to not more than 0.5 percent of the cotton used (limit of resins and soap). A blank test should be made with an equal quantity of the alcohol used.

If 20 gms. be extracted in a narrow percolator with hot distilled water (80 degrees to 90 degrees C.) until 200 cc. percolate is secured, the percolate should not be clouded (absence of soap), and on evaporation to dryness in a tared beaker the residue should amount to not more than 0.2 percent of the weight of cotton used (limit of soluble salts). A blank test should be made with an equal quantity of the water used.

SURGICAL GAUZE.

Gauze cloth, otherwise known as surgical gauze, has a large use not only in surgery but in the arts and even in the household.

In modern surgery a piece of sterile gauze is sometimes the only dressing employed. The process of its manufacture is well known and is given in some detail in the articles heretofore cited.

Gauze cloth in the cotton trade is known as "Cheese Cloth," "Tobacco Cloth" or unbleached gauze, and is quite distinct from surgical gauze, although large quantities of the former are used for surgical purposes. In this country gauze is spun and woven solely for surgical uses by one or more makers.

In the surgical gauze found in the market there is a variation in the length of the fibre, the size and weight of the thread from which the gauze is woven, also a variation in the yardage per pound and in other physical and chemical characteristics.

In some samples of gauze in the market there will be found certain dressings or loadings added to improve the appearance, to increase the weight, as well as to assist in holding the gauze out to its full width and length.

In the cotton trade woven fabrics of the character of gauze are standardized by taking a square inch and counting the number of threads. For example, a high grade gauze carrying forty longitudinal and forty-four cross threads per square inch, carries eighty-four inches of thread.

Fabrics of this character are made in something like twenty grades beginning with gauze carrying twenty threads by ten, or thirty threads per square inch.

Much of the surgical gauze in the market will be found not to be fully thirty-six inches in width. This is accounted for by the fact that these goods are woven in the gray thirty-six inches wide, and it is not practicable to bleach the goods, render them absorbent, and retain their full width. The usual variation is about one inch per yard; in other words, the average width will be found to be about thirty-five inches.

The following table shows the threads per inch, the average yardage per pound of the best known grades of surgical gauze:

SURGICAL GAUZE.	
Threads per Inch.	Yards per Pound.
44 x 40	9.38
32 x 36	14.81
28 x 24	16.00
24 x 20	18.83
20 x 14	23.20

The Bureau of Municipal Research of New York City has made an attempt to secure uniformity in the supplies for the various departments of the City of New York. They have adopted a standard requirement for surgical gauze as follows:

The gauze shall count in the finished state not less than the total number of threads per square inch specified, shall not exceed the yardage per pound specified, and it shall be acceptable by the Bureau as first quality in every respect. Gauze delivered under these specifications shall be made from clean, white, long cotton fibre, fully bleached and absorbent, of soft finish, and upon extraction with acidulated water (2 percent Hydrochloric Acid) it shall show a loss of not more than 1 percent, and shall show no reaction for starch, soap, dextrin, glue or other filling.

The object of the foregoing test—extraction with acidulated water—is to prevent the addition of starch, soap, dextrin, or glue for making weight, increasing the apparent size of thread, etc.

The following test for Surgical Gauze was worked out in conjunction with the Medical Supply Department of the U. S. Army.

PLAIN ABSORBENT GAUZE.

The gauze must be free from loading material and visible particles other than cotton, and be colorless.

Two yards boiled in 500 cc. of distilled water for one-half hour, boiling distilled water being added at intervals, to replace that lost by evaporation, the water pressed out, rinsed with sufficient boiling distilled water to measure 505 cc. cooled to 25° C., and made up to 500 cc. with distilled water at 25° C., shall yield a turbidity not more than that produced by 0.030 gram of infusorial earth (passed through a 200-mesh sieve) well shaken in 500 cc. of distilled water in a colorless glass bottle, when examined by transmitted light.

Two yards boiled in 500 cc. neutral distilled water for one-half hour, boiling distilled water being added at intervals to replace that lost by evaporation, the water pressed out, cooled to 25° C., and divided into two equal parts; one part

shall be neutral to three drops of phenolphthalein test solution, the other to one drop of methyl orange test solution.

Two yards boiled in 500 cc. distilled water for one-half hour, boiling distilled water being added at intervals to keep the volume at the original quantity, the water pressed out and rinsing twice with 250 cc. portions of boiling distilled water, the water pressed out and the total volume evaporated to dryness in a platinum dish and kept at 100° C. until constant in weight, shall yield not more than 0.13% by weight of residue, of which not more than 0.045% shall be inorganic.

One yard extracted with 95 per cent ethyl alcohol in a Soxhlet extractor for five hours shall yield a solid extract, when dried at 100° C. of not more than 0.55% by weight.

One yard extracted with ethyl ether in a Soxhlet extractor for five hours shall yield a solid extract when dried at 100° C. of not more than 0.55% by weight.

One yard incinerated in a platinum crucible shall yield not more than 0.55% by weight of ash, containing potassium, sodium, magnesium, calcium, iron and aluminum, which were originally in combination with hydrochloric, sulphuric and phosphoric acids.

One yard folded into a square, the surface of which measures sixteen square inches, with the loose ends loosely joined by No. 30 white cotton thread, when held nearly in contact with the surface of distilled water and dropped thereon, at 25° C. temperature shall be completely submerged in five seconds.

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