MORE ABOUT DUMBELL TEST USING TWO DIFFERENT SWELLING AGENTS

مزيد من الضوء على اختبار Dumbell
باستخدام محلولين مختلفين للانتفـــاخ

By

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الخلاصة :- أجريت دراسة احتمال استبدال محلول الصودا الكاوية تركيز ١٥٪ بمحلـــول الانتفاخ المقترح في هذا البحث وتأثير ذلك على قدير ـــة تلف التغيرات القطنيـــة المصرية والسودانية استخدم معامل اسبيرمان لقياس قوة الارتباط بين النتيجتين ثبت من هذه الدراسة أن كلا المحلولين يمكن استخدامه بثقة كبيرة لتقدير جودة القطـــن ميكروسكوبيا .

ABSTRACT

The light microscope was used to follow up the behaviour of some Egyptian and Sudanese cottons, before and after treatments similar to those normally used in the finishing mills of cotton products. It was found that iodo-zinc chloride swelling agent could be used in the maturity and/or damaged microscopic test instead of caustic, soda, both agents gave results that are strongly correlated to each other.

INTRODUCTION

The purpose of the present investigation is to show that one could rely on light microscope for assessing the quality [1,2], maturity [3,4,5], strength [3,5,6] and the damage [1-6] that may occur to the cotton fibre at any stage of processing or when stored.

It is indicated that these microscopic tests are well related to each other and that all of them could be used equally to assess the cotton under consideration [3].

Here again it is evident that the microscopic determinations, either by the average number of beads, or by the number of fibres, by the dumbell test are well correlated to the mechanical tests represented by fibre bundle strength [5,6,7].

Because of the simplicity of the dumbell test (which is a microscopic test) in comparison to the average number of beads test, which includes many complic' ions such as the type of damage that may occur to the primary wall and the na' bulging of the secondary wall, it was thought of expanding this test by u' swelling solutions namely iodo-zinc chloride, and caustic soda (15%), which is used in maturity tests.

The technique proposed here is simple and may prove it's suita' routine tests in the industry.

EXPERIMENTAL PART

Raw Material

Varieties of Egyptian and Sudanese cotton fibres which ar have been used. The commerical cotton fibres are G 45, B2, G1 and G.2. In preparing test specimens for this investi

Microscopic Examination

A light microscope with heating disc was used. All the measurements were conducted at constant slide temperature of 62°C.

Maturity per centage

The percent maturity values (M) were determined by the sodium hydroxide methoo (ASTM : D 1442-75T) .

Fibre bundle Strength

The tensile strength was measured using Pressley Strength Tester at zero gauge.

Preparation of swelling agents [9].

The swelling agent used consists of Zn Cl_2 (100g), KI (32g), (34 ml) distilled water, and I_2; till saturation.

New Dumbell test

The Dumbell test described in Ref. [1,2,3, and 8] was used to assess the damage that has been occured to the fibres, using iodo-zinc chloride swelling agent instead of caustic soda 15 % .

RESULTS AND DISCUSSION

Table 1 shows the (%) of undamaged fibres (n1 and n2 types) for a variety of Egyptian and Sudanese cottons when these fibres (200 μ length) are placed in solutions A and B. Determinations have been carried out for 200 fibres in each test.

Table (1): Values of the (%) of undamaged fibres for Egyptian and Sudanese cottons placed in iodo-zinc chloride and caustic soda (15%).

	Type of cotton	Caustic Soda (15%) (Sol. A)	Iooo-Zinc chloride Sol. B.	(%) difference
Sudanese Cottons	Barakat - B1	74.7	78.2	4.7 %
	Barakat - B2	86.1	84.4	1.97%
	Gizera - G1	61.3	65.9	7.16%
	Gizera - G2	68.7	72.3	5.24%
Egyptian Cottons	Giza 45	78.9	86.1	9.13%
	Giza 75	75.8	96.7	27.57%
	Giza 74	68.9	82.9	20.32%
	Karnak	75.5	80.2	6.23%

To test if the two solutions rank the cottons in the same manner, the Spearman's rank correlation coefficient (R) was calculated from the equation:

$$R = 1 - \frac{6 \sum d^2}{n^3 - n}$$

' R was found to be 0.83 and highly significant at the 5% level. This result indicates
h solutions could be used with great confidence to assess the quality of cottons
oic tests, but the differences are quite sigificant with Egyptian cottons
this case the (%) difference reaches to 27.57%, and when ranking is
iety alone, it was found to be R = 1 for Sudanese cottons, and

R = 0.60 for Egyptian cotton. In fact this result indicates that in microscopic tests when cotton are placed in swelling agents care should be taken because of the response of each type to the swelling agent which would affect the magnitude of the (%) undamaged fibres determined.

Plotted in Fig. 1 the values of fibre bundle strength (mechanical test) versus fibre maturity (microscopic test) using iodo-zinc chloride swelling agent instead of caustic soda 15%. Statisticall analysis has shown that fibre bundle strength (P.I.) is positively correlated with the fibre maturity (M), which is basically determined from microscopical examination of fibres. The correlation coefficent (r) is 0.84.

Plotted in Fig. 2 the (%) of undamaged fibres when using solutions (A) and (B) i.e. caustic soda (15%) and iodo zinc chloride respectively. The correlation coefficient (r) is good and equal to 0.657 and generally the Egyptian cotton examined showed higher percentage of undamaged fibres when both solutions were used.

In fact these result calls for the suitability of using iodo zinc chloride instead of caustic soda as a swelling agent in Dumbell test. The present method is easy and saves much time and effort.

RELATIONSHIP BETWEEN PERCENT UNDAMAGED FIBRES AND FIBRE MATURITY AS DETERMINED USING CAUSTIC SODA AND IODO-ZINC CHLORIDE SWELLING AGENTS.

Table 2 shows the (%) undamaged fibres and the (%) Maturity when some Egyptian and Sudanize cotton were immersed in caustic soda (solution A) and iodo zinc chloride (Solution B), but we have to mention that the (%) undamaged fibres was determined by dumbell test using iodo-zinc chloride solution.

Plotted in Figs. 3 and 4 are the (%) of undamaged fibres versus maturity (%) when using solutions (A) and (B) respectively. It is evident from the plots that the (%) of undamaged fibres are well correlated with fibre maturity irrespective of the swelling agent used. The correlation coefficient (r) is high, and highly significant at the 5% level.

When the (%) difference in the maturity percent (M) was calculated it was found to be higher for Sudanese cottons when caustic soda was used as a swelling agent, the (%) difference ranges between 3.65% and 16.06% while the opposite occured with the Egyptian cottons which showed in general very much less differences.

However since the (%) of undamaged fibres when using solutions (A) and (B) are well correlated (Fig. 3 and 4), one would expect both M (%) values to be well correlated. Plotted in Fig. 5 are the values of M (%) as determined when using caustic soda and iodo-zinc chloride swelling agents. The correlation coefficient (r) is high and equal to 0.95 and highly significant at the 5 (%) level. Here again the maturity (%) and the Dumbell tests could be used equally to assess fibre quality and in particular fibre strength. It is surprising to find from the plot that the results are splitted into two groups, but generally they are positively correlated. For the time being no explanation can be offered for this phenomenon.

CONCLUSIONS

From the pervious discussions and investigations the following conclusions may be drawn :-

1- The percentages of undamaged fibres as determined by the dumbell test using caustic soda (15%) and iodo-zinc chloride swelling agents are strongly correlated to each other.

2- In the dumbell test the percentage of undamaged fibres as determined using the iodo-zinc chloride swelling agent is generally higher than that determined using the caustic soda swelling agent.

3- The maturity of Egyptian and Sudanese cottons as determined by the standard method using caustic soda and iodo-zinc chloride swelling agents shows different trends, while negligible differences in values for Egyptian cottons, can be observed.

4- The iodo-zinc chloride swelling agent could be used in the maturity microscopic test instead of caustic soda, both agents gave results that are strongly correlated to each other.

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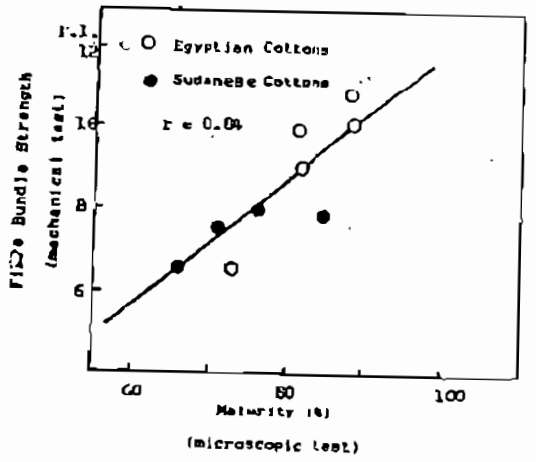

Fig. 1. Values of fibre bundle strength versus maturity (%).

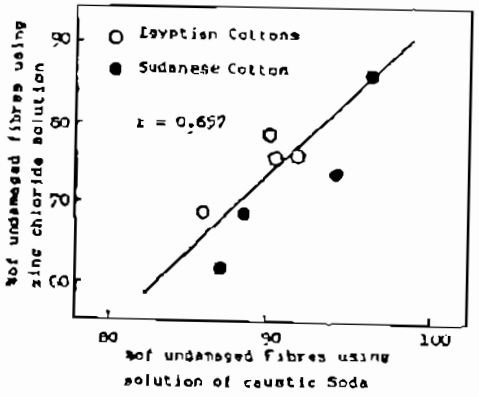

Fig. 2. (%) of undamaged fibres in caustic soda versus (%) of undamaged fibres in iodo-zinc chlovide

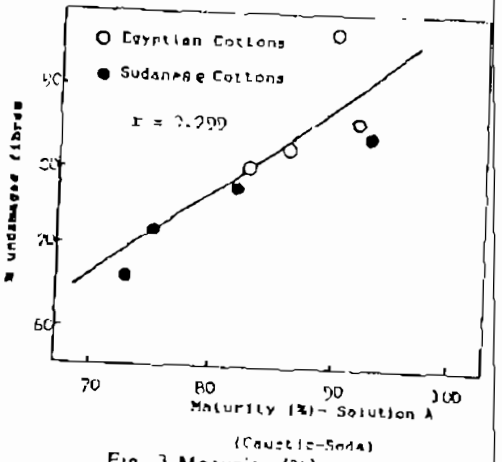

Fig. 3 Maturity (%) versus (%) undamaged fibres.

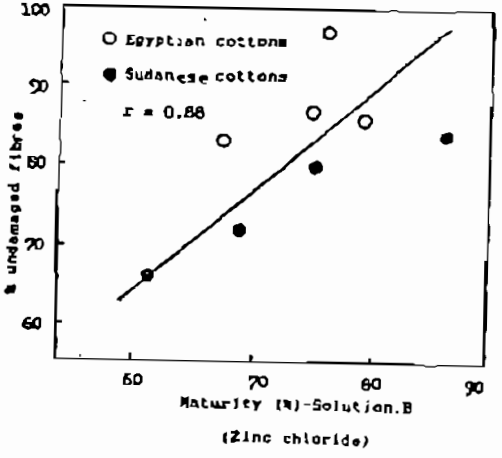

Fig. 4 Maturity (%) versus (%) undamaged fibres.

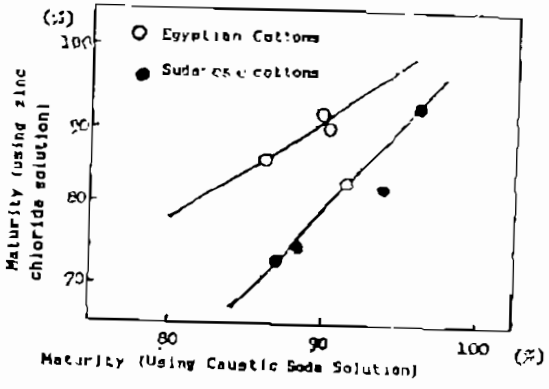

Fig. 5 Values of Maturity using different swelling agents

Table (2) Values in (%) of Undamaged Fibres and Maturity in (%) Using Caustic Soda (sol. A) and Iodo-zinc chloride (Sol. B) Swelling Agents.

	Type of Cotton	Caustic Soda (Sol. A)		Iodo Zinc Chloride		(%) Difference in M
		Undamaged Fibres (%)	M (%)	Undamaged Fibres (%)	M (%)	
Sudanize Cottons	Barakat-B1	74.07	94.2	78.2	82.0	12.95(%)
	Barakat-B2	86.1	96.5	84.4	93.0	3.63 (%)
	Gizera -G1	61.5	87.2	65.9	73.7	16.06(%)
	Gizera -G2	68.7	88.4	72.3	75.0	15.16(%)
Egyptian Cottons	Giza -45	78.9	89.9	86.01	91.9	2.23 (%)
	Giza -75	75.8	90.4	96.7	90.4	0
	Giza -74	68.9	85.9	82.9	85.9	0
	Karnak	75.5	91.7	80.2	83.2	9.27 (%)

* Note . The (%) of undamaged fibres is determined by dumbell test using iodo-zinc chloride