Investigation of Combined Desizing, Scouring and Bleaching Effect with H_2O_2

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Abstract

The aim of this project is to investigate the combined desizing, scouring, and bleaching effect with H_2O_2. Now the world textile trade arena has been very competitive and tough. For a profitable textile business and for a high market share one needed to produce high quality textile with minimum cost and time. For all such requirements, it must be met against economic constraints relating to the cost of water, labor, plant, chemicals and energy. The first water is particularly the most important. A pretreatment process is the heart of textile. Pretreatment processes include desizing, scouring & bleaching which makes subsequent dyeing and soften processes easy. Uneven desizing, scouring and bleaching in pretreatment processes might cause drastic deterioration in the quality of processed products. The main innovation of the project lies in the combination of two or more continuous pretreatment processes in a single step, as would be the desizing, scouring and bleaching ,it has been tried to eliminate the process desizing by a combine scouring and bleaching bath with a high content of H_2O_2. The aim is to bring same color effect by this combine bath and regular individual bath (desizing, scouring and bleaching). This project was performed with two portions. One was as regular pretreatment processes (enzyme desizing, scouring and bleaching individually) and a combine bath of scouring and bleaching with high H_2O_2. Then these two samples were dyed in same condition. The difference of this two determined the project fate. And differences were evaluated by color difference, reflectance index, whiteness, strength, absorbency, rubbing fastness and weight loss.

Keywords: *Pretreatment, Desizing, Scouring, Bleaching, Enzyme, H_2O_2.*

I. INTRODUCTION

Bleaching is the removal of unwanted colour from the textile fibres and typically involves the use of one of the four main bleaching agents, namely sodium hypochlorite, calcium hypochlorite, sodium chlorite and hydrogen peroxide [1] [11]. The bleaching process includes three main steps, namely (i) saturating the fabric with the bleaching agent and other necessary chemicals; (ii) raising the temperature to the recommended level for the particular textile and maintaining that temperature for necessary duration; and (iii) thoroughly washing and drying the fabric [2, 5]. In foreign country there a lot of experiment has done to reduce the processing steps. They used cocktail enzyme to reduce the processing steps [3].

In cocktail enzyme they used different types of

enzyme which are able to work in definite condition and able to do desizing, scouring, bleaching simultaneously in a single step. Their research work is under development but yet not come to practical use. This project is different from others. It has been used higher amount of H_2O_2 instead of desizing enzyme. Higher amount of H_2O_2 will work as desizing agent. If it becomes successful in this project, one processing state will eliminate [4, 5, 7].

In this work, it has been used higher amount of H_2O_2 instead of using desizing agent. One sample was desized one step and in next step bleached and scoured. Another was desized, scoured and bleached in single stage. Then both sample was dyed by same recipe and their reflectance, color change, strength, whiteness and color difference were measured. Cost is main fact in getting the order from buyer. Buyer seeks better quality with low price. The main competitor country is India, Pakistan and Vietnam [3, 8]. Their industries gets sufficient amount of energy. So it is tried to eliminate one step in pretreatment process that is desizing. If it is able to do it then it will be very much cost effective and will be able to provide goods with better quality, lowest cost and no country will able to beat our price.

In present industrial scenario, the quality control in processing is becoming more important besides the cost control. Therefore, in addition to energy saving benefits, there is emphasis on prediction of quality parameters like whiteness index, strength loss, weight loss, carboxyl group content and copper number. Such a prediction will be very much beneficial for obtaining required quality processing in bleaching

II. MATERIALS AND METHODS

A. Materials

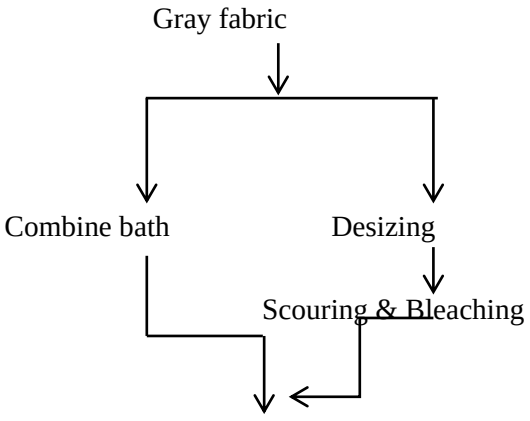
The following materials are used to complete the testing and evaluation of this work:

- 100% cotton fabrics
- Plain woven Fabrics
- Hydrogen peroxide (H_2O_2)
- Enzymes
- Reactive Dyes (D-B-G-X)

B. Methods

It is very complex to do desizing, scouring and bleaching. For a simple and cheap process here it is used higher amount of Hydrogen peroxide (H_2O_2). The operation goes within the following steps:

- At first take 220 gm grey fabric.
- Then the fabric was divided into two parts.
- One part was taken to combine desizing, scouring and bleaching bath.
- Another part is taken to desizing bath then to scouring and bleaching bath.
- After completing these processing, it evaluated the absorbency test & weight loss. Then this two kinds of sample ware divided into several parts.
- Then dyed each samples with three basic color of each two kind of sample.
- These sample were sent to Dyesin-chem lab for measuring their color difference along with whiteness and reflection index of undyed sample.
- Then the strength test was done.
- Finally, evaluated the test result and make decision on the project.



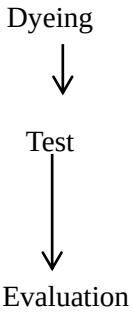


Figure 1: Process flowchart

1. Desizing, Scouring and Bleaching (For Combined bath)

Recipe:

- Wetting Agent : 1.00 cc/L
- NaOH : 4.00 g/L
- Sequestering Agent : 0.5 cc/L
- Sodium Silicate : 3.00 g/L
- H_2O_2 : 8.00 g/L
- M:L : 1: 30
- Temperature : 70° C ±5
- Time : 40 min
- pH : 10-11

Calculations:

- Sample weight : 205 gm
- Total Liquor : (205 x30)= 6150 ml
- Required NaOH : (4x6150)/1000= 24.6 gm
- Required Sequestering Agent : (0.5x6150x100)/(1000x100)= 3.075 gm
- Required Wetting Agent :(1x6150)/(1000)= 6.15cc
- Rerquired H_2O_2 : (8x6150x100)/(1000x50)= 98.4 cc
- Required Amount of Water : 6150 - (3.07+6.15 +98.4+16.15) = 5996.25 cc

Process Curve:

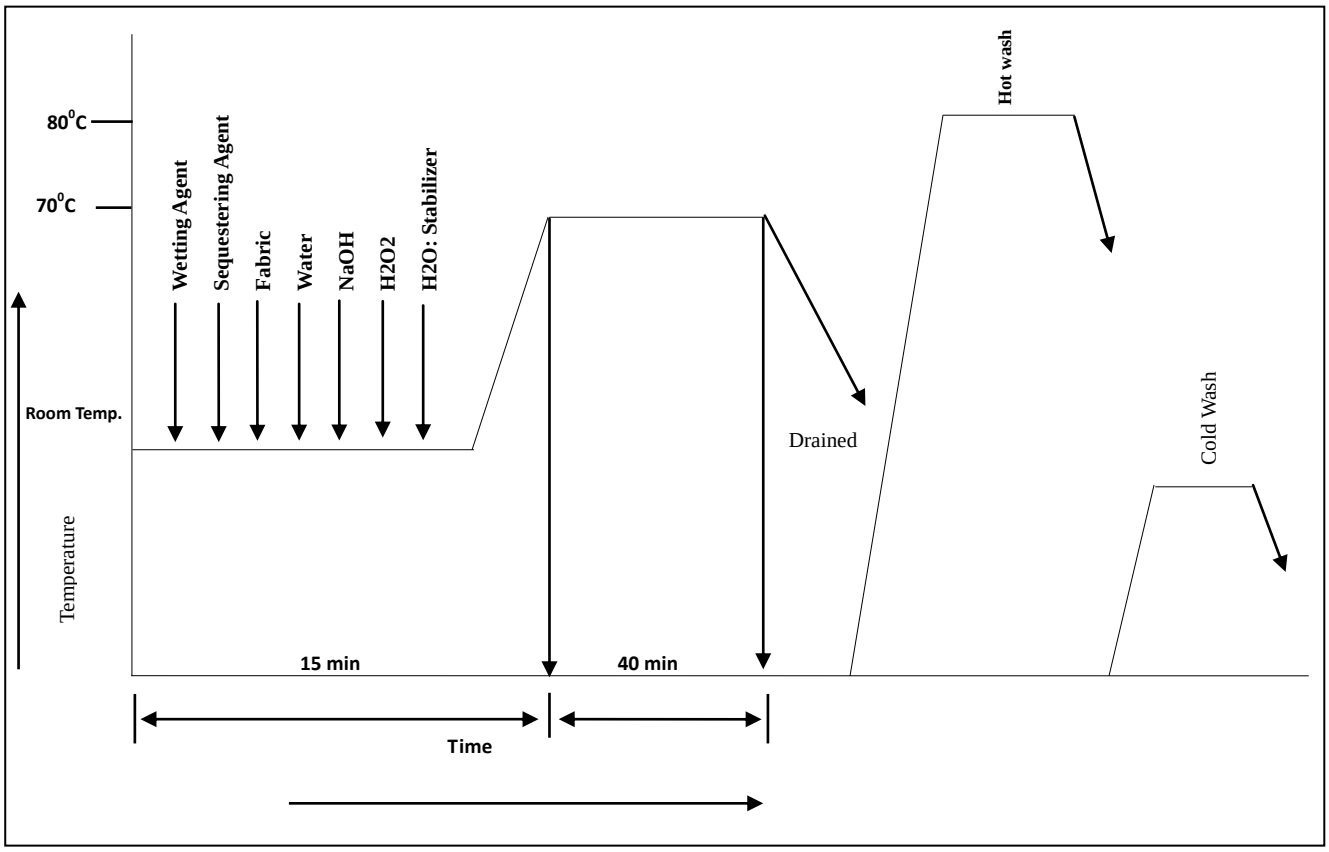


Figure 2: Process Curve for Combined bath

Process Description:

- At first the fabric is taken into the combined dye bath.
- The combined process is run with the fabric at room temperature with required amount of water.
- Then required amount of wetting agent, Sequestering agent, Sodium Hydroxide (NaOH), H_2O: Stabilizer are added in the dye bath and the bath is run at 15 minutes at Room temperature up to rise the temperature at 70 ^{0}C.
- When the process is reach at 70 ^{0}C then the bath is run at this same temperature for 40 minutes.
- After completing the process drain out the liquor from the dye bath.
- Then hot wash is done in the fabric at 80^{0}C temperature and at last cold wash is done in the fabric.

2. Desizing, Scouring and Bleaching (For Individual Bath)

Recipe:

Wetting Agent	:	1.00 cc/L
Desizing Enzyme	:	1.00 cc/L
Sequestering Agent	:	0.5 cc/L
Acetic Acid	:	1.00 cc/L
M:L	:	1: 30
Temperature	:	60° C ±5
Time	:	40 min
pH	:	4.5-5.5

Calculation:

Sample weight : 210 gm
Total Liquor : (210 x30) = 6300 ml
Required Sequestering Agent : (0.5x6300x100)/(1000x100)= 3.15 gm
Required Wetting Agent : (1x6300x100)/ (1000x100) = 6.3 cc
Required Desizing Agent : (1x6300x100)/ (1000x100) = 6.3 cc
Required Acetic Acid : (1x6300x100)/ (1000x100) = 6.3 cc
Required Amount of Water : 6300 - (3.15+6.3 +6.3) = 6284.25 cc

Process Curve:

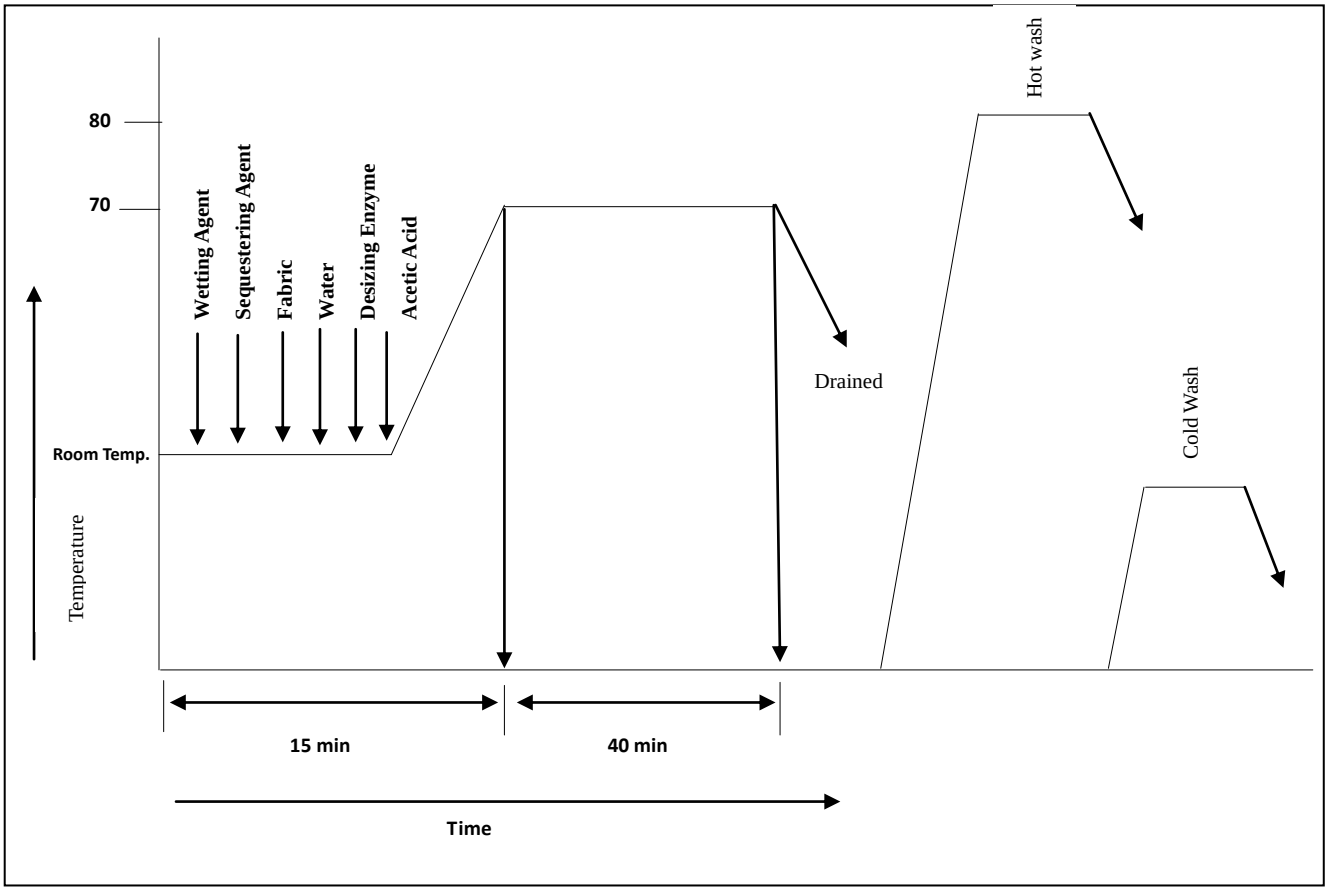


Figure 3: Process Curve for Individual bath

Description:

- At first the fabric is taken into the individual dye bath.
- The individual process is run with the fabric at room temperature with required amount of water.
- Then required amount of wetting agent, Sequestering agent, Desizing enzyme and Acetic Acid are added in the dye bath and the bath is run at 15 minutes at Room temperature up to rise the temperature at 70 ^{0}C.
- When the process is reach at 70^{0}C then the bath is run at this same temperature for 40 minutes.
- After completing the process drain out the liquor from the dye bath.
- Then hot wash is done in the fabric at 80^{0}C temperature and at last cold wash is done in the fabric.

3.Dying Process

Recipe:

Wetting Agent	:	1.00 cc/L
NaoH	:	3.00 cc/L
Sequestering Agent	:	1.00 cc/L
Sodium Silicate	:	1.00 cc/L
H_2O_2	:	4.00 cc/L
M:L	:	1: 30
Temperature	:	60° C ±5
Time	:	30 min

Calculation:

Sample weight	:	210 gm
Total Liquor	:	(210 x30) = 6300 ml
Required Sequestering Agent	:	(1x6300x100)/(1000x100)= 6.3 gm
Required Wetting Agent	:	(1x6300x100)/ (1000x100) = 6.3 cc
Required NaOH	:	(3x6300)/1000= 18.9 cc
Required H_2O_2	:	(4x6300x100)/ (1000x100) = 25.2 cc
Required Sodium Silicate	:	(1x6300x100)/ (1000x100) =6.3 cc
Required Amount of Water	:	6300 - (16.3+6.3 +25.2+6.3) = 6255.9 ml

Process Curve:

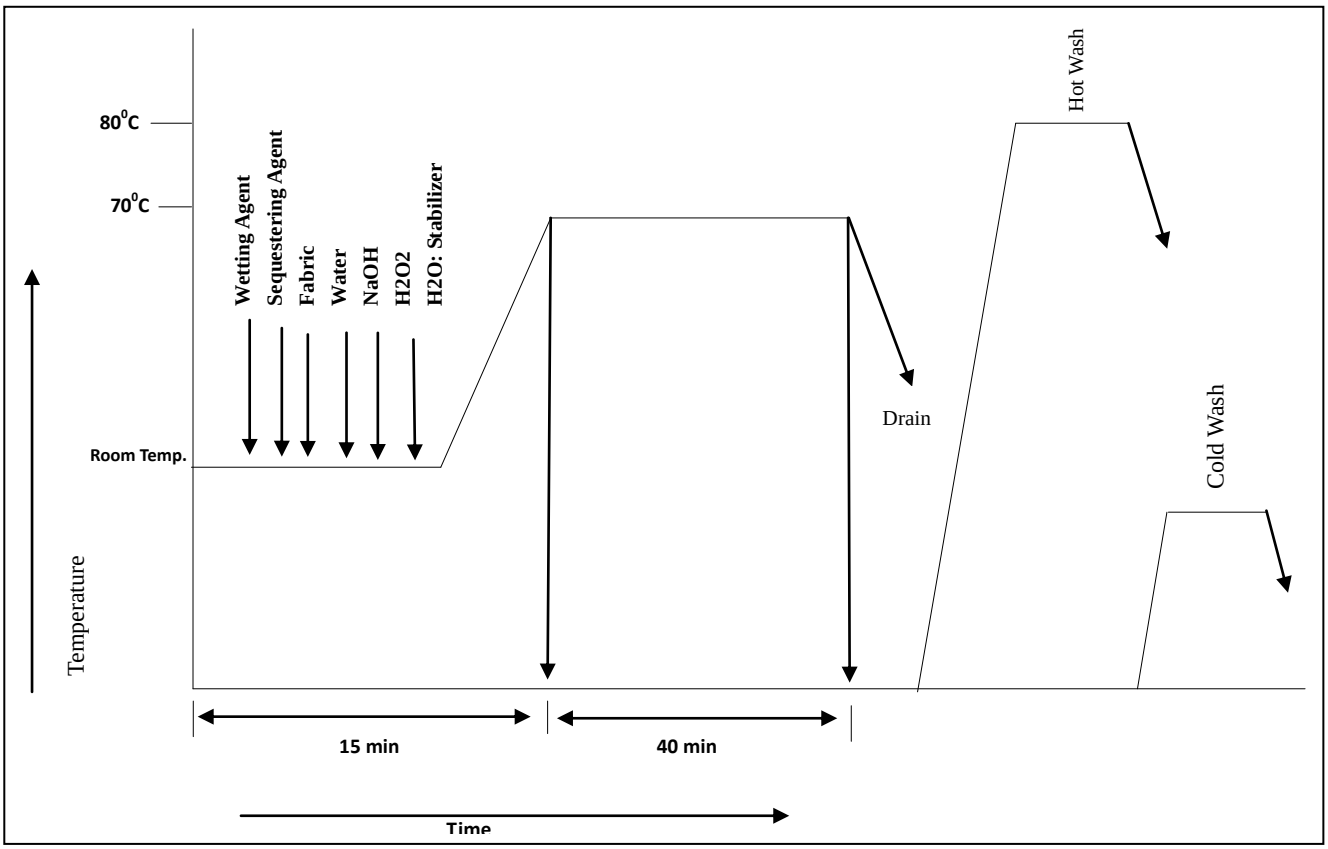


Figure 4: Process Curve for Dyeing

Description:

- In the dyeing process, at first the fabric is taken in the dye bath.
- The dyeing process is run with the fabric at room temperature with required amount of water.
- Then required amount of wetting agent, Sequestering agent, Sodium Hydroxide (NaOH), H_2O: Stabilizer are added in the dye bath and the bath is run at 15 minutes at Room temperature up to rise the temperature at 70^0C.
- When the process is reach at 70^0C then the bath is run at this same temperature for 40 minutes.
- After completing the process drain out the liquor from the dye bath.
- Then hot wash is done in the fabric at 80^0C temperature and at last cold wash is done in the fabric.

V. RESULTS AND DISCUSSION

A. Results

As it is directly related with color, appearance, absorbency and strength, here thereby The following tests has been carried out like strength test, absorbency, weight loss, whiteness, color difference. This results will determined the project fates.

TABLE 1: Strength loss

Combined (Desizing, Scouring and Bleaching)	14%
Individual (Desizing ,Scouring and Bleaching)	17%

From the table-1, it shows that the strength of the fabric is higher for individual Desizing, Scouring and Bleaching. And the variation of strength loss is about 3%.

TABLE 2: Absorption test

Combined (Desizing ,Scouring and Bleaching)	40mm
Individual (Desizing ,Scouring and Bleaching)	42 mm

From the table-2, it shows that the absorbency of the fabric for individual Desizing, Scouring and Bleaching. Is increased (2%) due the three consecutive processes and the processing time.

TABLE 3: Weight loss (%)

Combined (Desizing, Scouring and Bleaching)	{(205-185)/205}*100 = 9.7%
Individual (Desizing, Scouring and Bleaching)	{(210-182)/205}*100 = 13%

From the table-3, it shows that the weight loss (%) of the fabric is higher for individual Desizing, Scouring and Bleaching. And the variation of weight loss (%) is about 3.3%.

TABLE 4: Whiteness (%)

Combined (Desizing, Scouring and Bleaching)	50.62
Individual (Desizing, Scouring and Bleaching)	61.33
DELTA WI	10.71

From the table-4, it shows that the whiteness (%) of the fabric is higher for individual Desizing, Scouring and Bleaching. After evaluating the results of the two samples combined Desizing, Scouring and Bleaching and individual desizing and scouring-bleaching the whiteness % DELTA value is 10.71%. There for it is not conve-

nient for white fabric.

TABLE 5: Color change (Red Color)

Fabric	L*	C*	h	DE*
Combined (Desizing, Scouring and Bleaching)	58.43	37.71	-	356.48
Individual (Desizing, Scouring and Bleaching)	58.66	36.49	-	357.79
Deltas	-0.10	0.55	-0.55	0.78

TABLE 6: Color change (Yellow Color)

Fabric	L*	C*	h	DE*
Combined (Desizing, Scouring and Bleaching)	81.13	47.49	-	74.13
Individual (Desizing, Scouring and Bleaching)	80.74	45.94	-	75.58
Deltas	0.14	0.63	-0.96	1.16

TABLE 7: Color change (Blue Yellow)

Fabric	L*	C*	h	DE*
Combined (Desizing, Scouring and Bleaching)	71.93	12.74	-	239.12
Individual (Desizing, Scouring and Bleaching)	71.55	14.05	-	240.99
Deltas	0.15	-0.94	-0.45	1.05

From the table-5-7, it shows that the color change (Red, Yellow and Blue) of the fabric is higher for individual Desizing, Scouring and Bleaching. And the Deltas value for yellow color is higher than Red and Blue. The color change results that are DELTA 0.78, 1.16 and 1.05 which are very close to warm value. And other testing value lies in the acceptable range

V. CONCLUSION

This project study shows a great prospect of combine Desizing, Scouring and Bleaching. For white fabric it is quite difficult but for a darker color shade it is very much possible. After evaluating the results of the two samples combined Desizing, scouring and bleaching and individual Desizing and scouring-bleaching the whiteness % DELTA value is 10.71%. There for it is not convenient for white fabric. It has compared the color change results that are DELTA 0.78, 1.16 and 1.05 which are very close to warm value .And other testing value lies in the acceptable range. Which is very much energy saving and cost efficient. It will give great advantages in price negation. Finally it is said that the Desizing, scouring and bleaching steps can be done in a combine bath event without cocktail enzyme for a darker shade.

AUTHOR CONTRIBUTIONS

The objectives and methodology of this works were proposed by T.I., and J.A.C. The specimen fabrication, characterization and data treatment carried out by J.A.C., S.S., M.D.H., and C.S. with the help of M.A., and S.S.A. The article was written by T.I., J.A.C., and. S.S. and finally revised by T.I., M.A., J.A.C., and S.S.A.

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