TECHNICAL EDUCATION AND SKILLS DEVELOPMENT AUTHORITY
TESDA Complex, East Service Road, South Superhighway, Taguig City

USE OF PINEAPPLE PEELS AS ORGANIC STAIN REMOVAL AND WHITENING AGENT ON FABRICS

Conducted by:

Lead Researcher
ANA MARIE O. ALDESIMO

WENNY B. CABANTOG
MARIA REGINA C. ANSAY

TESDA Women's Center

USE OF PINEAPPLE PEELS AS ORGANIC STAIN REMOVAL AND WHITENING AGENT ON FABRICS

ABSTRACT

This study involves the determination of the effect of pineapple (*Ananas comosus*) peel extract, (with and without salt), on fabrics stained with grease, ink, hair dye, deodorant, mud, and rust. An 8" X 9" cotton white cloth was used. The fabric was smeared with the 0.01 g stain in the center, (except for the deodorant where 4 strokes were applied). The different stained fabrics were set aside for 10 hours, after which were treated with 5 grams each of Clorox, and pineapple extract (with and without salt) for 10 to 20 minutes. This study was limited to the conduct of visual observation. The ranking test was considered to determine the degree of preference of stain removed. Results showed that removal of stains depends on the possible reaction of specified stain against the chemical composition of anti-stain solutions used. The effect of the above three solutions gave significant effect as stain removal. Commercially available Clorox was used as the control. This was able to reduce most of the above stains. However, the degree of reduction depends on the stain. Pineapple waste extract (acid) and salt (sodium chloride) were effective against rust, mud, and deodorant. The effect of the fabric whitening was not noticeable from the three stain removal solutions due to the spread of smears contributed by different stains in the fabrics.

INTRODUCTION

Stains are part of everyday life. There are more than 100 tough stains and effectivity of stain removals depends on the kind of stain and the chemical reaction once it gets in contact with the stain removal. These are some of the solvents that can be used for stains, such as oxidizing solvents (hydrogen peroxide), reducing solvents (sodium hydrosulfite, sodium hypochlorite, and sodium chloride), lacquer solvent, inert solvents, detergents, acids, etc. There are different commercially available stain remover but consumers are not aware of its effectiveness and/or the kind of stains that they are capable of removing. The common stain remover and bleaching agent is Clorox. The active ingredient in Clorox, a popular commercialized stain remover, is sodium hypochlorite which comes from seawater and breaks down into salt and water.

Oxalic acid and acetic acid are cited as possible stain removal when properly used (Consumer Guide, nd). Oxalic acid's main applications include cleaning or bleaching,

especially for the removal of rust (iron complexing agent). It acts as rust removal agents due to its forming a stable, water-soluble salt with ferric. Fruits that contain citric acid may act as stain removal. These are effective on fruit stains as “like dissolves like”. However, its acid is considered a weaker acid than the oxalic acid. Concentration, pH, time and temperature are the various conditions that affect the action of bleach on fabrics.

Halvorson, C.(nd), cited that vinegar with salt is effective against rust. Others cited that grass and ink are removed by vinegar. Halvorson (nd) also mentioned that salt is recommended to remove grease, ink, and deodorant. Investigative study (Mendoza, K, 2016) show that pineapple waste with baking soda was effective as stain remover but needs scrubbing in order for the stain to disappear. However, it was not made mention of the stains tested.

The use of pineapple waste as stain remover may be very applicable in the Philippines area, where pineapple is extensively cultivated. Some of these areas are in the Northern Mindanao, SOCCKSARGEN (Southern Cotabato, Cotabato Province, Sultan Kudarat, Sarangani, General Santos City), Bukidnon, Bicol and CALABARZON (Cavite, Laguna, Batangas, Rizal, Quezon). Moreover, it is noted that the Philippines is the second biggest pineapple-exporting country in the world next to Thailand. In 2009, 57,687 ha were planted to the crop with a total production of 2,198,497. This means that more wastes are generated.

The use of pineapple waste is noteworthy, thus, this study focuses on the effect of acids from pineapple wastes and salt on different common stains such as grease, printer ink, deodorant, hair dye, mud, and rust. It also focuses on the degree of whitening once stain removal is applied. Pineapple contains citric acid, malic acid, ascorbic acid and pantothenic acid.

Filipinos who can't afford commercialized stain remover could use waste materials such as pineapple waste. Furthermore, stain remover is oftentimes not available in remote places. Hence, this study considered acid as the main ingredient from pineapple wastes together with salt as a stain removal. Clorox serves as a control. However, this paper is limited only to visual observations supported by literature reviews. It is hypothesized (H_o) that there is no significant difference between and among the three stain removers when treated in fabrics with grease, ink, deodorant, hair dye, mud or rust.

METHODOLOGY

1. **Material Preparation and Pineapple Waste Profiling**

   Commercially available Clorox with 52, 000 ppm sodium hypochlorite was used as one of the stain removals and/or bleaching agent which served as the control. Other major agents used were pineapple peel extract(table ripe) with and without salt.

   Pineapple waste profile such as weights of pineapple peels, core, crown, pineapple peel extract, core extract was gathered.Ten pineapples were used in this data gathering. Pure extract and extract with salt were considered in this experiment. The ratio of pineapple peel extract with salt was 2 parts extract:1-part salt.

   Procedures for preparing the pineapple extract. Two pineapples with almost the same size and weight were washed and peeled. The pineapple wastes were weighed and chopped finely. After chopping, the wastes were put inside a clean white cloth and squeezed to extract the juice.

The acidity of pineapple extract was analyzed using a pH Meter. Citric acid and oxalic acid

were analyzed using titratable acidity test (AOAC Official Method, 942.15, 19th ed., 2012).

The conduct of titratable analysis was sourced out from a recognized laboratory, the

Department of Science and Technology (DOST).

2. **Preliminary Study**

` The following types of stains were used in this study: grease, printer ink, hair dye, deodorant, mud, and rust. Each stain weighing approximately 5 grams were spread in a 4" X 4" 100% cotton cloth (white T-shirt). These were treated with chlorox, pineapple waste extract (with and without salt).

3. Experimental Design and Procedure

3.1. Five yards of cotton cloth was purchased. These were measured and cut into 8" X 9" and used as fabric to be stained. Each stain was spread in each fabric as follows: grease (.01g), ink (.01g), hair dye (.01g), deodorant (4 strokes), mud (.01g) and rust (.01grams).

3.2. Stains were allowed to stay in the cloth for 10 hours. The period of exposure to stain was based on the actual practice that when the fabric is blemished it is not usually treated at once.

3.3 After 10 hours, each cloth with stain was treated with approximately 5 grams each of Clorox, pure pineapple extract with salt (2:1) and pure pineapple extract without salt (both from pineapple peels). The stained cloths were exposed to different stain remover for 10-20 minutes after which was rinsed under running water.

Table 1 shows the experimental design. Two trials were conducted.

Table 1. Experimental design on determination of an effective stain remover

and bleaching agent

Stains	Treatments		
	Chlorox	Pineapple waste extract with salt	Pineapple waste extract without salt
grease (.01g)	XX	XX	XX
ink (.01g)	XX	XX	XX
hair dye (.01g)	XX	XX	XX
deodorant (4 strokes)	XX	XX	XX
mud (.01g)	XX	XX	XX
rust (.01grams)	XX	XX	XX

Legend: XX – two trials conducted

3.4. Evaluation and Statistical Analysis

The removal of stain in the fabric and the effect as a whitening agent was evaluated by 20 panels with 20/20 vision. Two trials were made using its visual observation. The ranking was used to evaluate the preferred stain most removed with the least stain removed. Kramers rank sum test was used to determine if there were differences between and among samples on the stain removed. Annex A shows the questionnaire for ranking the most stained removed.

The effect of the different whitening agents was observed on the same stained fabrics by the same twenty panelists. The treated fabric was subjected to visual observation by ranking the panel's preference: 1 as the most bleached and 3 as the least bleached. Kramers rank sum test was used to determine if there were differences between and among the bleached fabric by preference. Annex B shows the questionnaire for ranking the most preferred bleached fabric.

RESULTS AND DISCUSSION

1. Pineapple Waste Extract Profile

The pineapple waste extract had an approximate pH of 4.9. The said pH falls within the normal pH range of pineapple juice (3.5 to 5.2 pH). This exhibits less acidic juice. Maturity played a major role in its high pH content. This means that it may contribute to a weaker acid. The pineapple sample used was table ripe. It contains 0.39% citric acid and 0.254% oxalic acid. When the extract was mixed with salt, it contains 0.366% and 0.235% citric acid and oxalic acid, respectively.

Forty-eight percent (48%) of the raw table ripe pineapple was the pineapple waste. The materials used in this experiment was limited only in its peels which were 27% of the whole pineapple (as purchased pineapple, AP). The core was not included since it could still be used as juice. The extract to be used stain remover and/or bleaching was 7% of the As Purchased (AP). Table 2shows the profile of table ripe pineapple.

Table 2. Table ripe pineapple profile

No	Weight of Whole Pineapple, AP (grams)	Weight of (in grams)				Weight of Pineapple extract from peels(grams)	Weight of pineapple extract from core(grams)	Weight of Edible parts
		Peels	Core	Crown	Total			
1	1,600g	390g	110g	260g	400g	90g	40g	790g
2	1,600g	430g	130g	350g	910g	80g	50g	730g
3	1,700g	440g	110g	410g	960g	160g	50g	760g
4	1,650g	530g	130g	340g	1000g	90g	60g	730g
5	1,500g	430g	140g	230g	800g	140g	100g	750g

6	1,650g	420g	120g	330g	870g	130g	60g	740g
7	1,750g	450g	130g	120g	700g	115g	60g	830g
8	1,750g	530g	130g	70g	730g	170g	70g	600g
9	1,750g	490g	140g	100g	730g	120g	100g	800g
10	1,750g	430g	140g	340g	910g	150g	70g	780g
MEAN 1,670g		454 (27.2%)	128 (7.7%)	255 (15%)	801g (48%)	126g (7.4%)	660g (39.5%)	751g (45%)

2. Preliminary Study

The preliminary study conducted showed that the initial design of the experiment of using 5 g stain to be spread in the fabric was too thick. Such concentration did not exhibit a reduction of stain. Thus, only 0.01 g stain was spread in the fabric in the succeeding experiments.

3. Evaluation and Statistical Analysis

Table 3shows the results of the ranking based on preference on stains from most removed to least removed (lower scores represent most removed). This Table shows that fabrics stained with grease, ink and hair dye and treated with Clorox were significantly preferred to have reduced the above stains versus pineapple extract with and without salt. Annex C shows that Clorox reduced the stains. The pH of Clorox was around 12 thus the stain was loosened by the solvents/mixtures. The stain consisting of molecule chains may have been broken down by the stain removal into smaller pieces which caused the spread in the fabric but with time and exposure to constant washing and stain removal, the stain may disappear.

Deodorant stain could be decreased by pineapple waste with salt and result of statistical analysis (Kramers Rank Sum test) showed that there was a significant preference in terms of stain reduction when compared with the other two (2) stain

removers. This was followed by pineapple waste without salt. This may be due to the loosening of stain made by the different stain remover but eventually stains maybe be reduced in the succeeding washing. The mud stains could be reduced with the application of pineapple waste without salt. The said stain removal was the most reduced stain on the fabric. Lastly, the majority of the rust was removed by pineapple waste without salt. Most probably the active and effective ingredient was the acid. Contrary to the photo in Annex C, Table 3 exhibited that results of statistical treatment showed pineapple extract with salt was the least removed

Table 3. Ranking on most preferred stain removal

Stains	Treatments			Statistical Result Kramers rank sum test 5% 32 – 48 1% 30 - 50
	Clorox	Pineapple waste extract with salt	Pineapple waste extract without salt	
grease (.01g)	20*	56*	44	significant
ink (.01g)	20*	45	55*	significant
hair dye (.01g)	26*	46	48	significant
deodorant (4 strokes)	54*	24*	42	significant
mud (.01g)	53*	39	28*	significant
rust (.01grams)	37	56*	27*	significant

Legend: * Significant at 1% level (the least value with asterisk show the most preferred
reduction of stain, the highest value with asterisk showed the least preferred in terms of stain reduction)

The same fabrics stained by the different materials were also used in evaluating the effect of Clorox and pineapple waste with or without salt as bleaching salt. The effect of the different solutions as whitening agents could not be evaluated because different stains smeared after each treatment. Whitening of fabrics could not be visibly detected as shown in Annex C. Result of Kramer' rank sum test (Table 4) shows that there was no significant preference between the two stain removal solutions when treated on grease and ink. However, the same Table shows that there was a significant preference on hair dye treated with Clorox, deodorant treated with pineapple extract with salt, mud, and rust treated with pineapple extract without salt.

Table 4. Ranking on stain most preferred bleach

Stains	Treatments			Statistical Result Kramers rank sum test 5% 32 – 48 1% 30 - 50
	Chlorox	Pineapple waste extract with salt	Pineapple waste extract without salt	
grease (.01g)	32	40	48	non-significant
ink (.01g)	35	38	47	non-significant
hair dye (.01g)	30*	48	42	significant
deodorant (4 strokes)	50	27*	43	significant
mud (.01g)	44	46	30*	significant
rust (.01grams)	37	53*	30*	significant

Legend: * significant at 1% level(the least value with asterisk show the most preferred bleached fabric, the highest value with asterisk showed the least preferred in terms of whitening of fabric)

CONCLUSION

There was a significant preference for the effects of Clorox, pineapple waste with and without salt between and among samples for all stains. The most preferred for stain removal for grease, ink and hair dye was the Clorox, deodorant- pineapple waste extract with salt, and mud and rust – pineapple without salt. As for a whitening agent, panelist did not find any difference in fabrics with grease and ink. However, panelists significantly preferred Clorox as a bleaching agent on fabrics with hair dye, pineapple extract with salt on fabric with deodorant, and pineapple extract without salt on fabrics with mud and rust.

RECOMMENDATION

1. The formulation and procedure should be disseminated as a livelihood project specifically in the areas where pineapple abounds. However, more trials should be conducted to further validate results.
2. Other stains should be tested with the pineapple waste extract.
3. Further study should be conducted on the reasons of the reaction between and among basic solutions(Clorox), acid (pineapple waste extract) and sodium chloride.

4. Standardize time of treatment of stain removals. Method of washing should be further improved and should be based on a scientific background, including the period of exposure.
5. Monitor the shelf life of the pineapple waste extract.
6. TESDA students should develop their critical analysis in conducting other research and development in the above areas.

REFERENCES:

AOAC Official Method 942.15, 19th ed., 2012

Chemical composition and sensory analysis of fresh pineapple juice ... https://pdfs.semanticscholar.org/22e4/8ef77903bddd70871aadabdc62a1e84e85ba.pdf retrieved on Dec. 2017

Consumer Guide (ND) Stain Removing Chemicals - Stain Removal Tools | HowStuff WorksRetrieved from https://home.howstuffworks.com › Home & Garden › Stain Removal on Dec 2017.

Cleanipedia (ND) Stain removal tips for clothes retrieved from https://www.cleanipedia.com/gb/ laundry/how-to-remove-stains-from-clothes-a-handy-stain-removal-guide on Dec 2017

Halvorson, C (ND) Uses Of Vinegar: Doing Laundry (Cleaning Colors and Removing Stains) retrieved from https://home.howstuffworks.com/home-improvement/household-hints-tips/cleaning-organizing/uses-for-vinegar-doing-laundry-ga1.htm retrieved on Dec 2017

Halvorson, C (ND Uses for Salt: Doing the Laundry: **A Guide to Stain Removal retrieved from https://home.howstuffworks.com/home-improvement/household-hints-tips/cleaning-organizing/uses-for-salt-doing-the-laundry-ga3.htm on Dec. 2017.**

https://www.veolia.com/sites/g/files/dvc1131/f/assets/documents/2015/11/stain-removal.pdf

https://www.veolia.com/sites/g/files/dvc1131/f/assets/documents/2015/11/stain-removal.pdf

https://en.wikipedia.org/wiki/Oxalic_acid

Mendoza, K. (2016), Feasibility of Pineapple (Ananas comosus) as a Stain Remover,

Retrieved from https://www.scribd.com/document/329722294/Feasibility-of-Pineapple-docx
On Dec. 2017.

Remove stains: Stain of any sort yield to scientific treatment (ND) retrieved from https://drive.google.com/file/d/1nCIv905aZGb7hpaA14AcppSZzcIo4MZg/viewlocate and include

Sweet, D. (2012), Surfactant replacement. The newborn lung: neonatology questions and controversies (second edition).

Stambolov, T. 1968 Notes on the removal of iron stains from calcareous stone Studies in Conservation Vol 13, 1968 Issue 1 pp 45-47 https://www.tandfonline.com/doi/ abs/10.1179 /sic.1968.004?journalCode=ysic20 on 2014

Susan Rahfield, Pine Brook; Benjamin Newman, Elizabeth, both of N.J. Assignee: Boyle-Midway Household (ND), Rust removal and method of use thereof for household products, United States Patent (19) Rahfield et al. 54) (75) 73 (21) 22 51 52) (58) (56) retrieved from https://patentimages.storage. googleapis.com/ae/a3/9f/08d6ccf93d1912/US4828743.pdf

Veola (ND) retrieved from https://www.veolia.com/sites/g/files/dvc1131/f/assets/documents/ 2015/11/stain-removal.pdf on Dec. 2017

What is the pH of pineapple juice and what is its color on the pH. Retrieved from https://www.quora.com/ What-is-the-pH-of-pineapple-juice-and-what-is-its-colour-on-the on Dec. 2017.

Young, J. (2017) What Type of Acid Is in a Pineapple? retrieved from https://www.livestrong. com/article/282662-dried-pineapple-nutrition/ on Dec. 2017

Annex A

Forms Used in Conducting Ranking Preference Test on Stain Removal

UTILIZATION OF PINEAPPLE WASTES EXTRACT AS FABRIC STAIN REMOVER

Name of Panelist (Optional): _____ Date: _____

Sex: _____ Age: _____

Instructions:

Please evaluate and use the appropriate scale below to rate your preference on the extent of stain removed.

STAIN _____

201	**202**	**203**

Comments:

_____

Rating Scale:1 - The most stain removed 2 - Stain moderately removed 3 - The less stain removed

Annex B

Forms Used in Conducting Ranking Preference Test on Whitening the Fabric

UTILIZATION OF PINEAPPLE WASTES EXTRACT AS BLEACHING AGENT

Name of Panelist (Optional): _____ Date: _____

Sex: _____ Age: _____

Instructions:

Please evaluate the whole fabric and use the appropriate scale below to rate your preference on the whitest cloth. Evaluate the whole fabric.

STAIN _____

201	**202**	**203**

Comments:

_____

Rating Scale: 1 – Whitest 2 - Moderately white 3Least white

Annex C

Photo Documentation on the Effect of Chlorox, Pineapple Waste Extract With or Without Salt

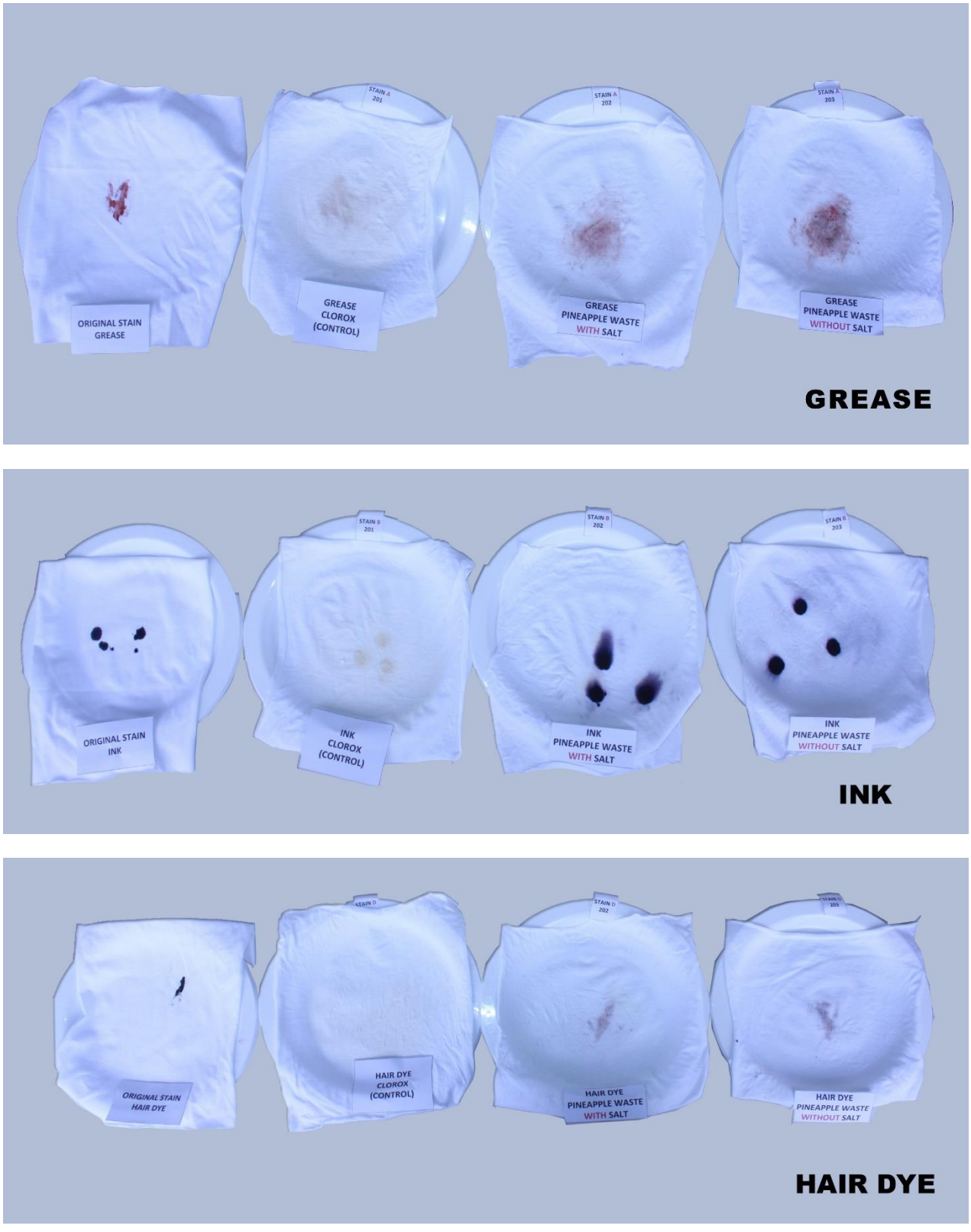

Figure 1a. Effect of chlorox, pineapple extract with and without salt on grease, ink and hair dye

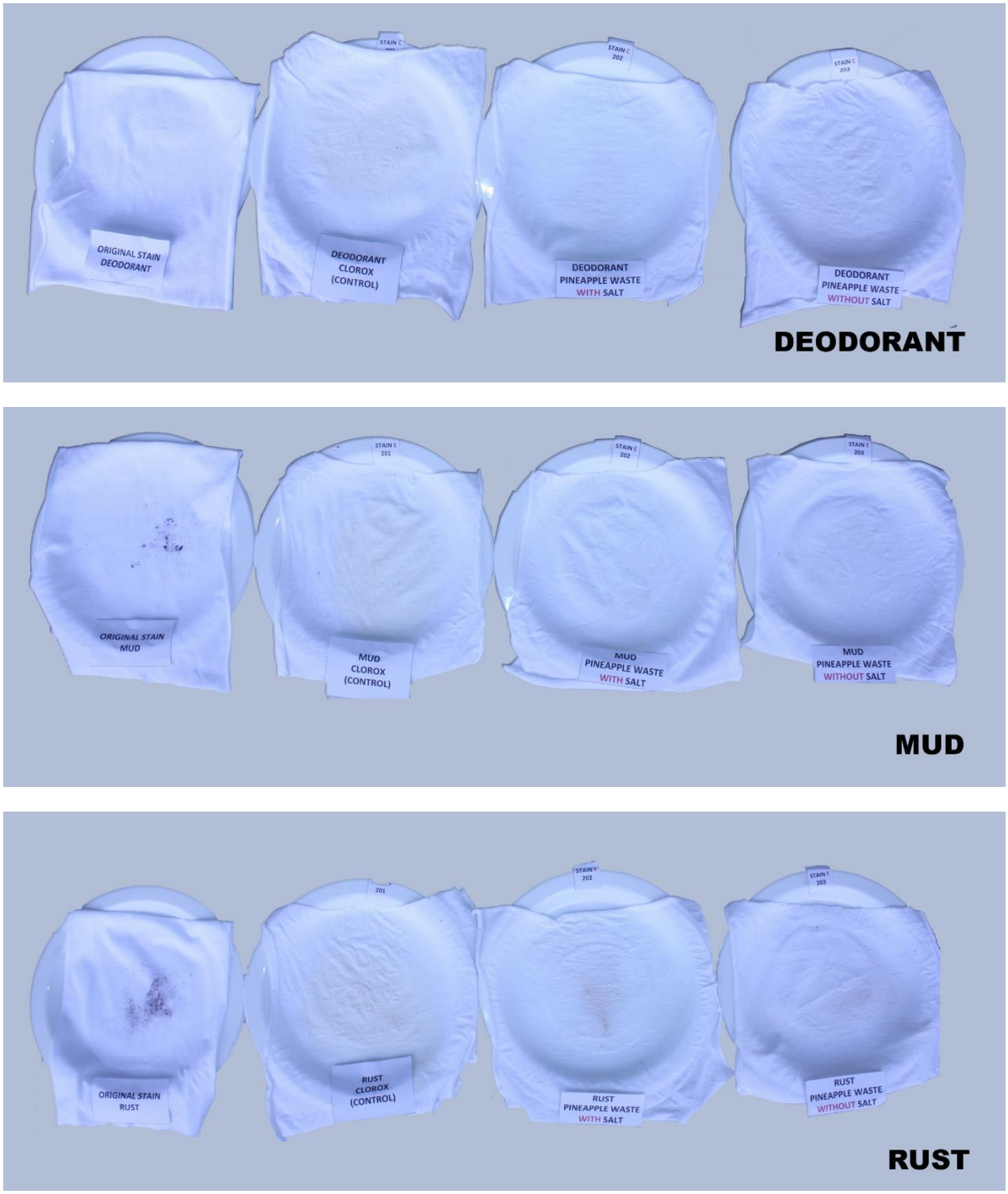

Figure 1b. Effect of chlorox, pineapple extract with and without salt on deodorant, mud, and rust