Effectiveness of Detergents With and Without Enzymes

Introduction

The simplicity of washing clothes with soap and water has been advanced in recent years with the addition of enzymes in laundry detergents. Enzymes have been used in detergents since the 1960s and now the majority of detergent companies are using enzymes in their products (Soaps and Detergents). The enzymes that are used in detergents are amylase, lipase, cellulose and protease (Enzymes in Laundry Detergents). This experiment investigates and compares the overall effectiveness of different detergents and tests the limits of the enzymes function in varying levels of pH.

Materials

- 6 Blood Stained pieces of cloth
- 2 beakers
- 2 Detergent brands.
- PH strips
- Droppers WI 0.1 Hydrochloric Acid and 0.1 Sodium Hydroxide
- Stirring rod
- Water
- Sharpie Marker

Methods

The study site was in a controlled lab environment on the campus of XXX College. The detergents being tested were Wisk and Dynamo 2x Ultra. The effectiveness of the detergents on blood stained clothing was being tested to determine if a detergent with enzymes (Wisk) was more efficient than a detergent without enzymes (Dynamo 2x Ultra). After determining which was more effective, the pH limit of the enzyme would be tested to see at what pH level the enzyme would no longer function.

To start the test, we began dividing up the blood stains and putting them in groups for

each detergent. The first two were used to compare the Wisk and Dynamo directly using water with a normal pH level of 7. The second group of two tested the Wisk with water at a pH level of 8 and 9. The third pair was used to test the Wisk with water at a pH level of 5 and 6. After dividing up the samples, the detergents were diluted to form a solution of 1% Wisk and 1% Dynamo 2x Ultra in separate containers. 6 drops of the Wisk solution was then placed on the first stain. This step was repeated using the Dynamo solution on stain 2. Both stains were set in different beakers of water with a pH level of 7 for 3 minutes each. For stains 3 and 4 only the Wisk solution was used and 6 drops were placed on each stain. 0.1 Sodium Hydroxide was used to rise the pH Level of the water. Three drops were used to raise pH to 8 then five drops to raise it to 9. Stain 3 was placed in water with a pH level of 8 while stain 4 was left in water with a pH of 9, both stains were left in the water for 3 minutes then set aside to dry. Blood stains 5 and 6 were also used for only the Wisk solution and 6 drops were used on each stain. 0.1 Hydrochloric Acid was used to lower the pH level of regular water. Thirteen drops were used to lower the water pH to 5 and six to lower the pH to 6. Stain 5 was left in water with a pH level of 5 while stain 6 was left in water with a pH of 6. Both stains were left in the water for 3 minutes then set aside to dry.

Results

Table 1.0

Detergent/Stain Number	PH Level	Appearance
Wisk, Stain 1	7	Slight dark white color where drops were placed.
Dynamo 2x Ultra, Stain 2	7	Slightly less brown, Little to no change in color.
Wisk, Stain 3	8	Slight dark white color where drops were placed.
Wisk, Stain 4	9	Light brown color where drops where placed.
Wisk, Stain 5	5	Tan tint where the drops had been placed.
Wisk, Stain 6	6	Tan tint where the drops were placed.

Blood stains 1 and 2 were observed after they had dried and it was clear that out of the two detergents, the detergent that contained enzymes was far more effective than the detergent without them. Stain 1 was far less brown where the drops had been placed while stain 2 had only slight color changes.

The enzyme detergent had continued to work effectively against the blood stains in group two despite the rise in pH level. Blood stains 3 and 4 both had color changes that were observed; however, Stain 3 was slightly less brown than stain 4. The enzyme detergent continued to work despite the drop in pH level. Stains 5 and 6 both had color change and became less brown but, there was little to no change of color between the two stains.

Discussion

The Data that was recorded was Qualitative; our findings were determined through visual comparisons between the blood stains. The results show that the detergent with enzymes does work more effectively than the detergent without enzymes. It also shows that the pH level affects the function of enzymes at certain levels. Due to time constraints there was not enough time to test a wider range of pH levels to determine the actual peak and trough of enzyme function. Another way the experiment could have been changed is by letting each sample sit in the water longer than three minutes in order to see if there would be any further change in the stain. The data shows that the enzyme detergent is more efficient, because the enzymes break down the proteins and lipids in the stain when they are in the water through hydrolysis. This makes the cleaning of the cloth much easier. In conclusion the hypothesis being tested was not completely supported. The Enzyme detergent was more effective, but the pH level did not change the outcome as drastically as first predicted.

References:

"Soaps and Detergents: Chemistry". *Cleaning Institute.* American Cleaning Institute, n. d. Web. September 20 2014.

"Enzymes In Laundry Detergents". *Science in the box.* Proctor and Gamble, n. d. Web. September 20 2014.

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Work Sample Evaluation

Subject Area: Biology
Task Title: Soapy Enzymes
Student Work Sample Title: Effectiveness of Detergents with and Without Enzymes

The document was scored using the *CCR Task Bank Rubric for Scientific Research Plans and Reports.* The final scores are indicated in the following chart.

Scoring Criteria	Insufficient Evidence	Developing	Progressing	Accomplished	Exceeds
Hypothesis Development				**X**	
Research Plan			**X**		
Results and Interpretation				**X**	
Communication			**X**		
Organization			**X**		
Accuracy			**X**		

Annotations: The following evidence from the work sample and the reviewer's comments support the scores above. Page and line numbers refer to the original work sample.

Scoring Criteria	Page #	Line #	Commentary about the work sample
Hypothesis Development: *Locating resources in order to develop a thesis or hypothesis*	1	4-10	It is evident in the student's work sample that they researched the explanation of what the concepts are and why enzymes may be added to detergents.
			References are provided at end of the paper and also cited within the text. Bases behind laundry detergents, and additives are provided within the work sample.
	3	11-23	The writer links the information in the introduction with the results they observed and in the discussion provided.
Research Plan: *Planning, conducting, and describing an experiment or study*	1, 3, 4		While the student provides a good experimental design, there are two variables here. Both variables need to be presented and discussed separately. The results found by the student are reasonably supported and discussed.
Results and Interpretation: *Describing and interpreting results in relation to the hypothesis*	2 & 3		The writer provides a chart with results and interpretations presented in the discussion.
	2 & 3		The writer provides reasonable supporting explanations in the discussion.
Communication: *Using subject appropriate language and considering audience*	3	11-23	The student uses good scientific writing and explanations of concepts.
			The student uses some scientific terminology and concepts that are linked throughout the paper.
Organization: *Structuring main ideas and incorporating supporting information*	1 & 2		In regards to demonstration of ideas/concepts they had hoped to show, the student uses a good design and explained the experiment very well.
	1	2-3	While the student's expectations of their results are supported, they should have expanded the introduction to include information from the discussion.
Accuracy: *Attending to detail, grammar, spelling, conventions, citations, and formatting*	2 & 3		The results of the experiment are presented in the form of a chart.
			The writer provides a good discussion of results located in the chart.