Stick it to the Man

Kevin Peng & Steven Liu

Background

Adhesive, more commonly referred to as glue, is a liquid or semi-liquid mixture that bonds objects together. Glue can be made using synthetic materials like Cyanoacrylate, or.natural sources, such as sap, or casein.

Glue has become an important part of everyday life. Many of the modern household items we use glue to hold it together.

Why does glue bond? Due to a phase change, generally liquid to solid, a glue would dry and bond two materials together. This conversion from on state to another is a result of either a physical or chemical process.

In Asia, rice is a food staple. Glutinous rice, also referred to as short grain sticky rice, has glue-like qualities. It is used in foods such as Mochi, a Japanese rice cake dessert. Mochi is made with mochiko, water and various other ingredients. Mochiko is a flour made from short grain sticky rice or sweet rice.

Purpose

Synthetic glues are typically stronger than those made with natural sources; however we wondered if it was possible to create strong glue derived from completely edible household sources. This is the problem that we will be investigating.

Hypothesis

If glue is made using mochiko, water and sugar, then it will be stronger than a leading brand of glue because the ingredients will be stronger and work more efficiently than the commercial glue.

Procedure

Two experiments were done. First, a test was conducted to determine the most effective glue recipe. To determine the strongest ratio of ingredients, an informal test was used. The following is the procedure used to identify the recipe (test 1):

1. Identify ingredients and the ratio of the ingredients.
2. Gather and mix the ingredients in a bowl.
3. Microwave the mixture for 45 seconds at a high setting.
4. Sandwich a quarter teaspoon of the mixture between two popsicle sticks.
5. Place a dab of the mixture on another popsicle stick.
6. Observe the approximate drying time, tackiness, texture and colour.
7. Repeat steps 2-6 for each recipe.
8. Record these observations immediately, again after 24 hours, 48 hours, 72 hour, 5 days, and one week.

Test 1 was repeated seven times for the control and the six other recipes. The control group was test #1. It was mashed and boiled short grain sticky rice. The six other recipes are listed as follows:

Recipe #	Mochiko Tbls	Water Tbls	Sugar Tbls	Molasses Tbls	Observations After 5 Days
1	Short grain sticky rice (control)				Granular, weak adhesiveness
2	1	1	0	½	Messy, opaque, brown, weak to moderate adhesiveness, dries soft
3	1	2	0	½	Messy, opaque, brown, weak adhesiveness, dries soft
4	1	1	½	0	Translucent, white, strong adhesiveness, dries quickly and firm
5	1	2	½	0	Translucent, white, moderate adhesiveness, dries slowly
6	1	1	1	0	Slightly opaque, white, hard to spread, strong adhesiveness
7	2	1	1	0	Nearly Opaque, white, hard to spread, dry texture, strong adhesiveness

No formal data was collected; however, based on appearance, drying time, ease of use and stickiness, we selected recipe 4 as the most effective glue. We called this GLeu.

The second test was to investigate the strength of GLeu versus the strength of LePage glue. The test samples were made using three layers of popsicle sticks that were bonded together by the adhesives. The top popsicle stick (10cm) is longest so the test sample can be pivoted between the two chairs. The second popsicle stick (2cm) is shorter than the third (4cm) so that there is 1 cm of space on either side where the string, attached to a spring scale, is tied. The procedure used to test the strength of the glues follows (test 2):

1. Place two hard surface chairs facing each other about 5cm apart.
2. Place the test sample between the two chairs with the string hanging downward.
3. Using a 50N manual spring scale, hook the spring scale on the string of the test sample.
4. Carefully exert a downward force on the test sample, increasing at about 1N per second.
5. Continue until the test sample is fractured at one of the connecting points.

6. Record the measurement of force used before the test sample snapped.
7. Repeat steps 2-6 for each test sample.

Results and Observations

The force used to separate the popsicle sticks measured the strength of the glue. This was measured in Newtons. Eleven samples were tested for each glue. On average, GLeu (18.8 N) demonstrated a 1.5 Newton advantage over Lepage's glue (17.3 N) on average.

Conclusion

GLeu has triumphed over Lepage's. GLeu should be safe for even young children to use since it is made from food sources. GLeu also dries extremely quickly.

However, GLeu does show some disadvantages too. For example, GLeu is more expensive to produce and if it is not used within a few weeks, it might dry up inside its bottle or go mouldy without added preservatives. Further investigation could be conducted to test the use of a food safe preservative such as alum, which is used in pickling.

Over thirty schools in the world have banned glue because there have been incidents where young children have consumed these unsafe products, resulting in severe poisonings (statistics from Pritts World (Pritts Glue Sticks) Website). If schools were to use GLeu, then these incidents should be prevented. It would be a great substitute for glue in a household. It is easy to make and can be made whenever needed.

In conclusion, we thought that GLeu was very successful. We reached our milestones for our project. The positive aspects show that it could appeal to other people and consumers. Furthermore, our glue could change the way schools and households use glue and it could perhaps develop the industry of children's glue.

Acknowledgment

We would like to thank Ms. Goodall, our Grade 7 teacher for her support.

References

Pritt History, Pritt World. Jan 25, 2010.

<http://www.prittworld.com/about-pritt/pritt-history.html>

Bibliography

Adhesive (chemistry). Encyclopædia Britannica, Science and Technology. Jan 18, 2010.

<http://www.britannica.com/EBchecked/topic/5823/adhesive>

Adhesive.org. Jan 5, 2010.

<http://adhesives.org/>

Glue-Sniffing Epidemic Among Kenyan Street Children. Voice of America. Jan 18, 2010

Website < http://www1.voanews.com/english/news/a-13-2008-12-01-voa48.html>

Video, Youtube. < http://www.youtube.com/watch?v=d4OyqoiF7Ag>

Japanese New Years Tradition-Mochi. A Typical Life. Dec 22, 2009.

<http://www.atypicallife.com/japanese-new-year-tradition-mochi/>

Glue Ingredients. Buzzle.com. Jan 23, 2010.

<http://www.buzzle.com/articles/glue-ingredients.html>

Koda Farms Products, Jan 5, 2010.

<http://www.kodafarms.com/products.html>

LePage's Products, Jan 5, 2010.

<http://www.lepageproducts.com/>