

Garlic as a Natural Anti-Fungal

*Yeast Fermentation Lab
Names deleted to protect the innocent!*



Objective

- According to popular culture, Garlic works as a cure for yeast infections.
- Our lab attempted to determine if garlic has any natural anti-fungal properties that would allow it to prevent yeast fermentation.



Hypothesis

If Garlic does contain natural anti-fungal compounds, then we will see a lower rate of fermentation in the results taken with higher concentrations of garlic.

Variables

- Controlled variables:
 - Temperature of Water Bath (attempted)
 - Time and temperature of Incubation
 - Total Volume
 - Concentration Yeast
 - Concentration Sucrose
 - Time over which rate is calculated
- Independent variable: Concentration of Garlic %(v/v)
- Dependent variable: Rate of Reaction

Materials

- Total volumes of all test tubes increased to 10 mL
 - Total volume equalized with DI water
- 2.5 mL Yeast and 2.5 mL sucrose used in each tube
 - 25% effective concentration each
- Concentrations of Garlic ranging from 0.5 to 5.0 mL
 - Concentrations from 5% to 50%



Controls

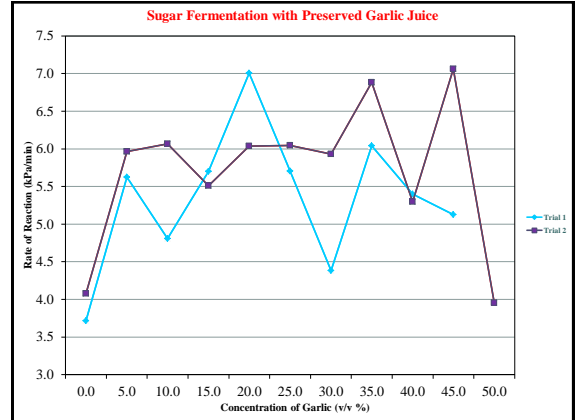
Table 1. Control Data for Sugar Fermentation of Yeast when mixed with Garlic Juice

Trial #	5% Sucrose (mL)	Yeast (mL)	Garlic Juice (mL)	DI Water (mL)	Rate of Reaction (kPa/min)
1				10.0	0.116
2	2.5			7.5	0.192
3			2.5	7.5	0.093
4		2.5		7.5	1.092
5		2.5			2.453

Trials with Preserved Garlic

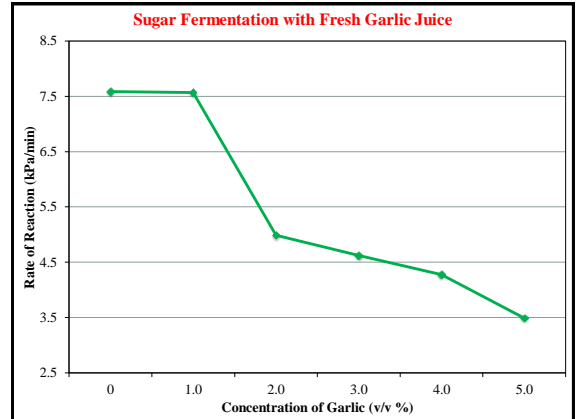
Table 2. Trial Data for Sugar Fermentation of Yeast when mixed with Garlic Juice

Trial #	5% Sucrose (mL)	Yeast (mL)	Garlic Juice (mL)	DI Water (mL)	Rate of Reaction (kPa/min)	
					Trial 1	Trial 2
1	2.5	2.5	0.0	5.0	3.717	4.078
2	2.5	2.5	0.5	4.5	5.625	5.964
3	2.5	2.5	1.0	4.0	4.809	6.066
4	2.5	2.5	1.5	3.5	5.699	5.510
5	2.5	2.5	2.0	3.0	7.006	6.035
6	2.5	2.5	2.5	2.5	5.706	6.043
7	2.5	2.5	3.0	2.0	4.381	5.930
8	2.5	2.5	3.5	1.5	6.040	6.881
9	2.5	2.5	4.0	1.0	5.398	5.295
10	2.5	2.5	4.5	0.5	5.125	7.061
11	2.5	2.5	5.0	0.0	na	3.954



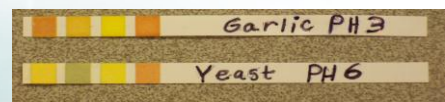
Theoretical Reasoning

- All preserved garlic contains phosphoric acid, giving the juice a pH of 2.
- Garlic must contain some "active ingredient" that is broken down during preservation in phosphoric acid.
- Garlic contains lots of sugars that, when introduced to the yeast, provide extra fuel for fermentation.



How Garlic is supposed to work

- According to the USDA garlic is extremely rich in Thiosulfate compounds which are known to kill yeast cells
- The active ingredient in a prescription medication for yeast infections (sold commercially as Versiclear) is Sodium Thiosulfate.
- Thiosulfate compounds are only stable at Basic and Neutral pH. At acidic pH they decompose to Elemental Sulfur and a Sulfite ion which will not kill yeast.



- Minced Garlic is preserved in Phosphoric Acid giving it a pH of 2 which is very acidic, resulting in all of the Thiosulfate compounds being broken down.
- This reaction explains the lack of inhibition exhibited in our experiment using preserved garlic.
- Garlic naturally contains fairly high sugar concentrations which explains the increase in fermentation exhibited with the preserved garlic present.

Conclusion

- According to our results preserved garlic did not inhibit fermentation at all, and in most cases actually accelerated it.
- Fresh Garlic, at similar concentrations showed a dramatically different effect, fermentation was substantially inhibited at concentrations above 1%.
- Possible Further experiment(s)
 - Minimum concentration thiosulfate(s) required to inhibit fermentation
 - Effect of different thiosulfate compounds (at same relative concentration on fermentation)

Works Cited

- Lexi-Comp, Inc. (n.d.). *Halifax Health: Sodium Thiosulfate* [Medical form of Thiosulfate used to treat yeast infection]. Retrieved November 23, 2008, from <https://www.halifaxhealth.org/HealthInformation/Content.aspx?chunkid=340383>
- MetaCyc. (n.d.). *MetaCyc: Nucleic Acids Res. 34:D511-6, 2006* [Information on Thiosulfates]. Retrieved November 23, 2008, from <http://biocyc.org/META/NEW-IMAGE?object=PWY-5350>
- Tokarz, L. (2007, September 18). Garlic's Goodness Best Released With a Crush. In *News from the USDA* [Health benefits of garlic and related compounds.]. Retrieved November 23, 2008, from United States Department of Agriculture Web site: <http://www.ars.usda.gov/IS/pr/2007/070918.htm>