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Review Article

Allicin - An After Digestion Antimicrobial Agent

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Abstract

Allicin is the active substance in plants of the leek family, like garlic and bear leek, and supposed to have many health benefits. It is formed through contact of alliin and alliinase, only when plant cells are damaged. Published data concerning the properties and effects of the molecule are incoherent. The aim of this project was to study the effects of extraction, temperature and pH on the stability of allicin to examine the suitability as an antibacterial compound. My experiments demonstrated that allicin has an antibacterial effect *in vitro.* It is destroyed by cooking but is stable at room temperature and only partially stable in digestion. It could thus have an effect on bacteria in the large intestine. To be effective in the human body it would have to pass the lining of the small intestine. *In vivo* effects remain to be shown. The dependency of the allicin content in garlic extracts on time might have an impact on meal preparation for maximum allicin content.

Keywords: Allicin; Digestion

Introduction

Allicin is the active substance in plants of the leek family, like garlic and bear leek, and supposed to have many health benefits. It is formed through contact of alliin and alliinase, only when plant cells are damaged. Published data concerning the properties and effects of the molecule are incoherent. The aim of this project was to study the effects of extraction, temperature, and pH on the stability of allicin to examine the suitability as an antibacterial compound.

Experimental setup

[1] Allicin was determined and quantified by adapting and improving an HPLC protocol [2]. The relative size of the peak area was used as a reference for the allicin content [3]. Agar diffusion tests were performed with E.coli and different allicin preparations [4]. Thermostability of allicin was tested with extracts from fresh samples (garlic 2.5 g, bear leek 5 per 100 ml H_2O) exposed to 100 C, 80 C and 60 C for 2 h [5]. Stomach conditions were simulated by adjusting the extracts to pH 1.5 or 2.5 with HCl, pepsin (0.002%) and BSA (1%) and monitored for 2h [6]. To simulate digestion in the small intestine the previous extracts were adjusted to pH 8 with NaOH and again monitored for 2 h [7]. Additionally, the influence of time on maximum allicin content of the extracts was tested. Samples were taken at times indicated and subjected to HPLC analysis.

Observation

Table 1 shows the HPLC peak area of four different samples taken at different time intervals Figure 1 represents the effect of time on Allicin peak area and Figure 2 shows peak area in samples.

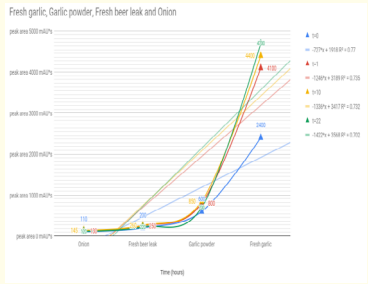

Figure 1

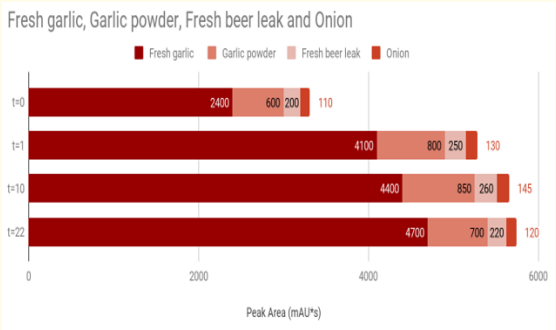

Figure 2

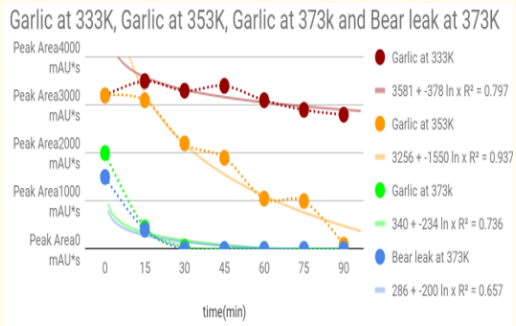

Figure 3

Time (hours)	Fresh garlic peak area (mAU*s)	Garlic powder peak area (mAU*s)	Fresh beer leak peak area (mAU*s)	Onion peak area (mAU*s)
t=0	2400	600	200	110
t=1	4100	800	250	130
t=10	4400	850	260	145
t=22	4700	700	220	120

Table 1

Table 2 shows the HPLC peak area of Allicin in Garlic samples at three different temperature 333k, 353K, and 373K, and Bear leak sample, at 373K, all readings were taken at different time intervals of fifteen minutes. figure 3 represents the effect of temperature on Allicin peak area at different time intervals.

Time (min)	Peak area of Garlic at 333K	Peak area of Garlic at 353K	Peak area of Garlic at 373k	Peak area of Bear leak at 373K
0	3200	3200	2000	1500
15	3500	3100	450	400
30	3300	2200	50	0
45	3400	1900	0	0
60	3100	1050	0	0
75	2900	1000	0	0
90	2800	90	0	0

Table 2

Table 3 shows Agar diffusion tests were performed with E.coli taking ampicillin as positive and distilled water as negative control. Figure 4 shows the zone of Inhibition by Allicin with positive and negative control.

Extract	Zone of Inhibition (mm)
Distilled water	00.00
Ampicillin	22.12
Extract garlic	15.06
Extract Bear leak	07.09

Table 3

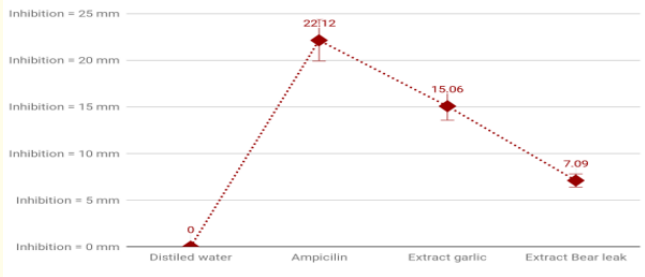

Figure 4

Table 4 shows the HPLC peak area of Allicin in Garlic samples at two different pH, pH 1.5 from the time interval of 15 minutes ranging from 0 minutes to 120 minutes and pH 8 from the time interval of 15 minutes ranging from 120 minutes to 240 minutes, figure 5 represents the effect of ph on Allicin peak area at different time intervals mentioned above, figure 6 represents the condition of pH during the digestion and its effect on Allicin peak area.

Time(min)	Garlic at pH 1.5	Garlic at pH 8
0	3400	N/A
15	3200	N/A
30	3300	N/A
45	3200	N/A
60	3400	N/A
75	3450	N/A
90	3300	N/A
105	3450	N/A
120	3500	2900
135	N/A	2500
150	N/A	1800
165	N/A	1900
180	N/A	1600
195	N/A	1700
210	N/A	1500
225	N/A	1450
240	N/A	1300

Table 4

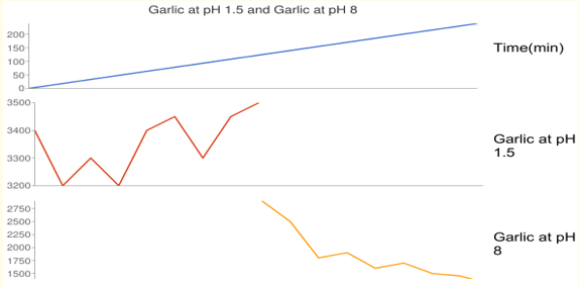

Figure 5

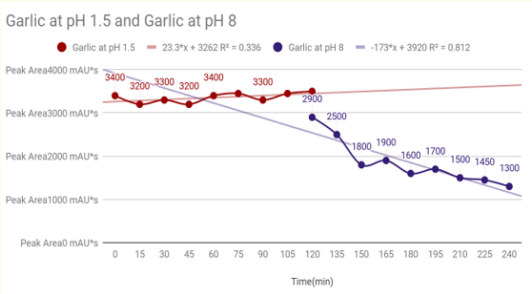

Figure 6

Results

The highest content of allicin is found in fresh garlic,10 times less is found in bear leek and roughly 20 times less in onion. Agar diffusion tests showed a growth inhibition zone around extracts.

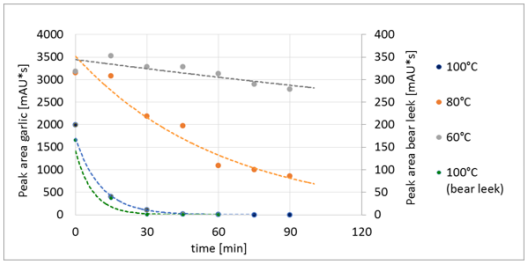

Figure 7: Stability of allicin from fresh garlic and bear leek at different temperatures.

Allicin is destroyed very fast by exposure to 373K but is more stable at lower temperatures. Allicin is not destroyed by stomach conditions. Combined stomach and small intestine conditions lowered the allicin content to about 40% of the start content in fresh garlic extracts (Figure 8). Allicin content in aqueous extracts increased significantly for several hours after extraction, the effect was most prominent in fresh garlic (Figure 9).

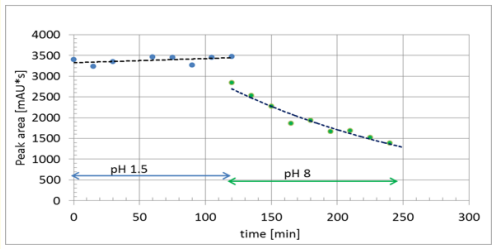

Figure 8: Stability of allicin in simulated digestion (stomach pH 1.5 and small intestine pH 8).

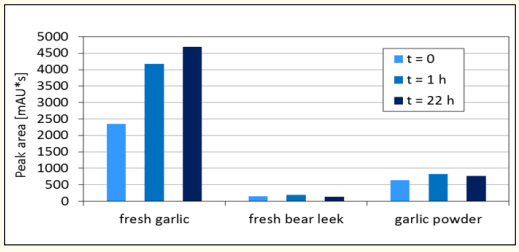

Figure 9: Allicin content after extraction.

Conclusion

My experiments demonstrated that allicin has an antibacterial effect *in vitro*. It is destroyed by cooking but is stable at room temperature and only partially stable in digestion. It could thus have an effect on bacteria in the large intestine. To be effective in the human body it would have to pass the lining of the small intestine. *In vivo* effects remain to be shown. The dependency of the allicin content in garlic extracts on time might have an impact on meal preparation for maximum allicin content.

Bibliography

1. Borlinghaus J., *et al*. "Allicin: Chemistry and Biological Properties". *Molecules* 19 (2014): 12591-12618.

2. Fujisawa H., *et al*. "Biological and Chemical Stability of Garlic-Derived Allicin". *Journal of Agricultural and Food Chemistry* 56 (2008): 4229-4235.

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