Effects of Common Foods on Bacteria in Water

Group ID: 1-030

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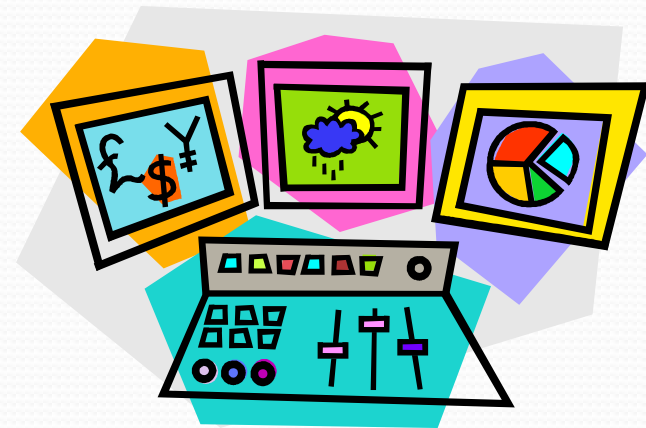
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Picture from:
Microsoft

Objectives and Rationale

- We were inspired to find out how to get rid of the bacteria in water.

- We intend to find common food substances, which we encounter in our daily lives that have anti-bacterial characteristics to make the water cleaner for consumption.
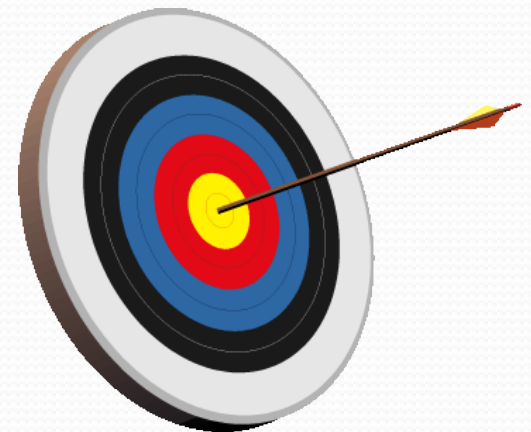
Food, water sources and micro-organisms used

Food extracts

- Lime
- Coffee grounds
- Onion
- Garlic

Water sources

- Rainwater

Micro Organisms

- *E. coli*
- *M. luteus*
- Yeast

www.teachengineering.org

Lime	Garlic	Onion	Coffee Grounds
It has been found to be protective against the transmission of cholera, and to be effective against yeast

Antibacterial properties of acidic lime extracts: average amount of viruses and bacteria in waste water had drastic drops of up to 96% | Contains a disulfide, Ajeone, prevents infections with yeast *Candida albicans*

Crushed garlics prevent infection of *Pseudomonas aeruginosa* in burn patients | Quercetin was extracted from the onions and tested on different species of Bacteria, such as *M.luteus*

Quercetin had an inhibitory effect on all the strains of bacteria that were studied | Coffee grounds has been tested on *E. coli* and other bacteria Coffee Grounds was more effective at inhibiting bacterial strains than was the antibiotic ampicillin |
| W.O.K Grabow, Nerrie C. Basson , 1997. National Institute for Water Research of the Council of Scientific and Industrial research | Alan.J.Sulsarenko, Anant Patel, Daniela Portz, 2007, 27th September | Jonathan Santas; María Pilar Almajano; The University of Barcelona, Spain, 2010. The International Journal of Food Science and Technology | Greenwood, B. 2011, September 29. Retrieved from http://www.livestrong.com/article/545173-does-caffeine-affect-bacteria |

Our Hypothesis

Lime extracts have the best anti-bacterial properties

General Timeline for Experiments

1. • Preparation of Food Extracts
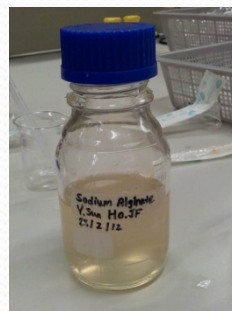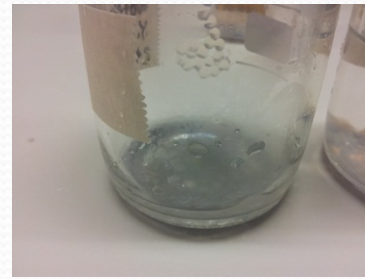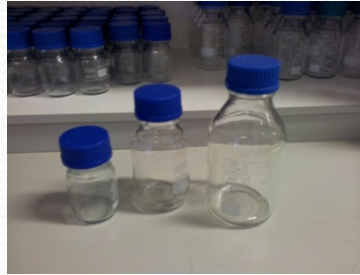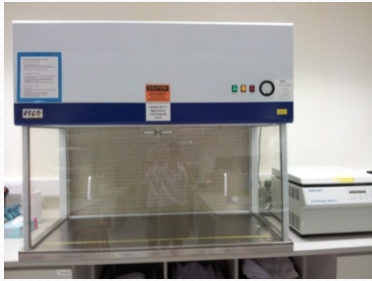
2. • Zone of Inhibition (ZOI)

3. • Colony Count (CC) *(Time point Experiment)*

4. • Food Extract on Water Samples as a Proof of Concept

Materials and Apparatus

Materials and Apparatus
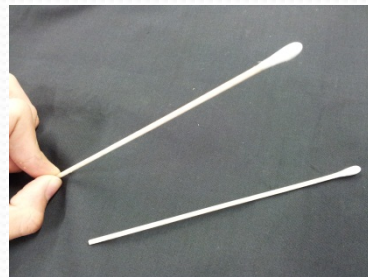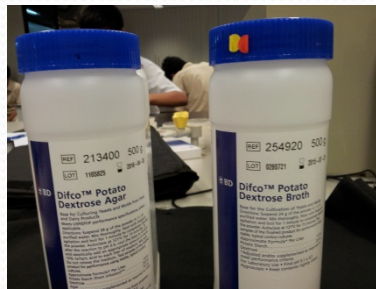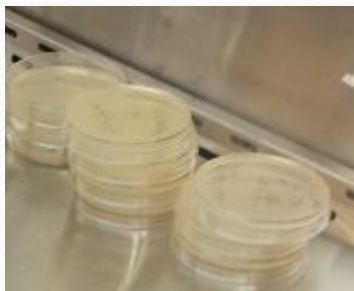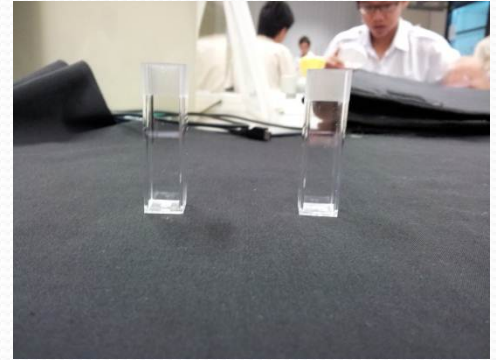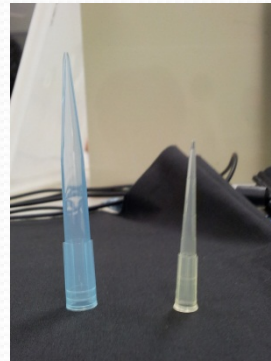
Preparation of food extracts

Garlic, Onion, and Coffee Beans are blended separately. The lime is squeezed to extract the juice. They are then made into 50% extracts (M/V).

The blended extracts with water are centrifuged and then filtered to extract any solid residue left in them.

The liquefied food extracts are then frozen

Variables – Preparation of Food Sources

Controlled Variable	Dependent Variables	Independent Variables
Mass of food to grind up	Concentration of food extract	Type of food extract
Volume of water added to food extract		

Zone of Inhibition

Micro-organisms used: *E.coli, M. luteus* and *Yeast*

The bacterium and Yeast are then swabbed on separate agar plates. Food samples are then introduced on small paper discs, together with a control (sterile water), which are then placed on the agar plates. The plates are then left in the incubator to grow overnight.

The next day, the agar plates are removed from the incubator. The diameter of the zone of inhibition for each of the food sources are then measured and recorded.

The food substance which produced the largest zone of inhibition is the best anti-bacteria food

Variables - Zone of Inhibition

Controlled Variable	Dependent Variables	Independent Variables
Time allowed for the bacteria to grow	Diameter of Zone of Inhibition	Type of micro-organism
Temperature which bacteria grows at		Type of food extract

Colony Counting (Time Point Experiment)

The micro organisms are adjusted to a concentration of 10^7 CFU/ml

The food extracts are then introduced in liquid suspensions

Every 20 min, samples of the mixture were taken, diluted and plated

After overnight incubation, the resultant colony numbers were then recorded and used to calculate the final numbers of microorganisms

Variables – Colony Count

Controlled Variable	Dependent Variables	Independent Variables
Amount of liquid suspension plated	The colony left in each agar plate (resultant CFU)	Type of micro-organism & food extract in mixture
Time given for bacteria to grow		

Extracts on Rainwater

Using a pipette, a fixed volume of rainwater is mixed with food extracts

The mixture is then plated on agar.

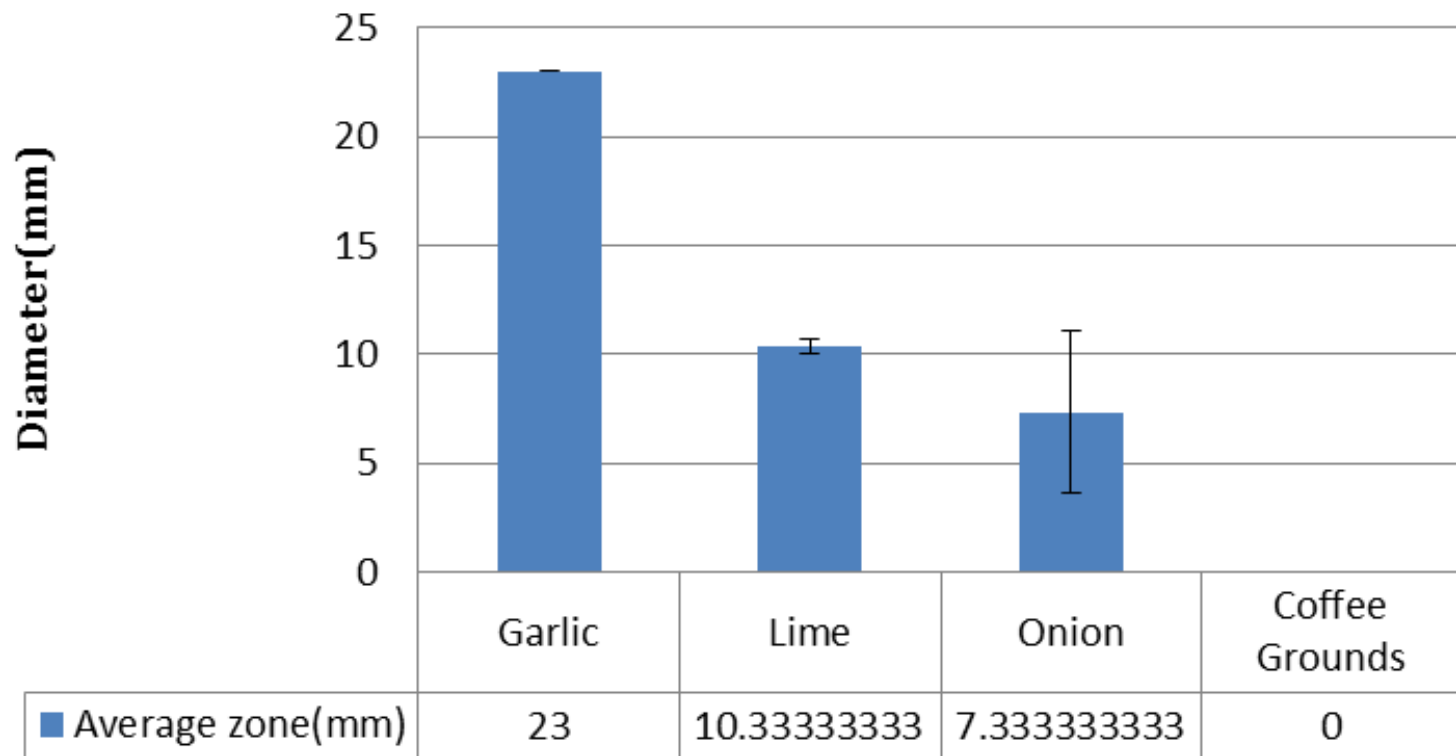The samples are then left to grow overnight at 37° C

The next day, the plates are removed. The resultant micro-organism growth was compared, relative to a negative control
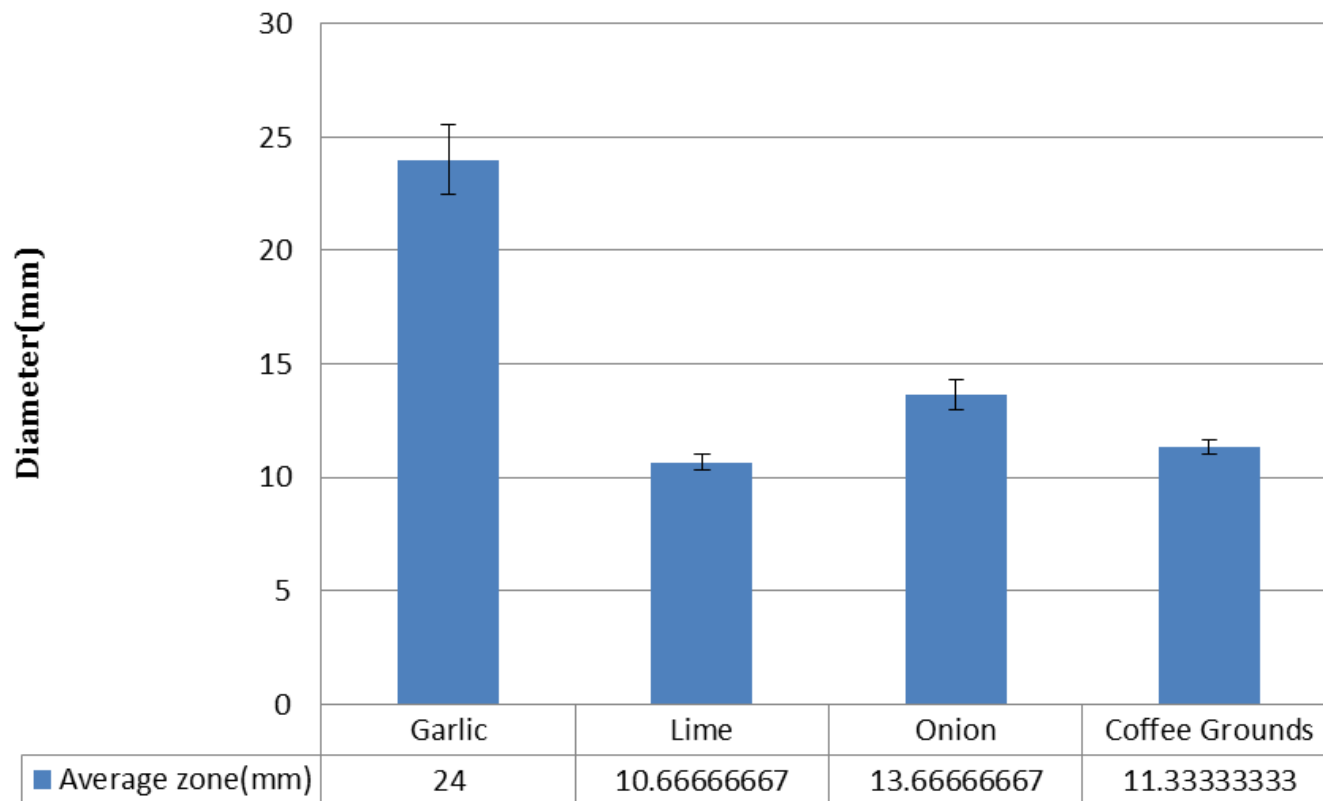
Results

Zone of Inhibition
Colony Count
Extracts on Water

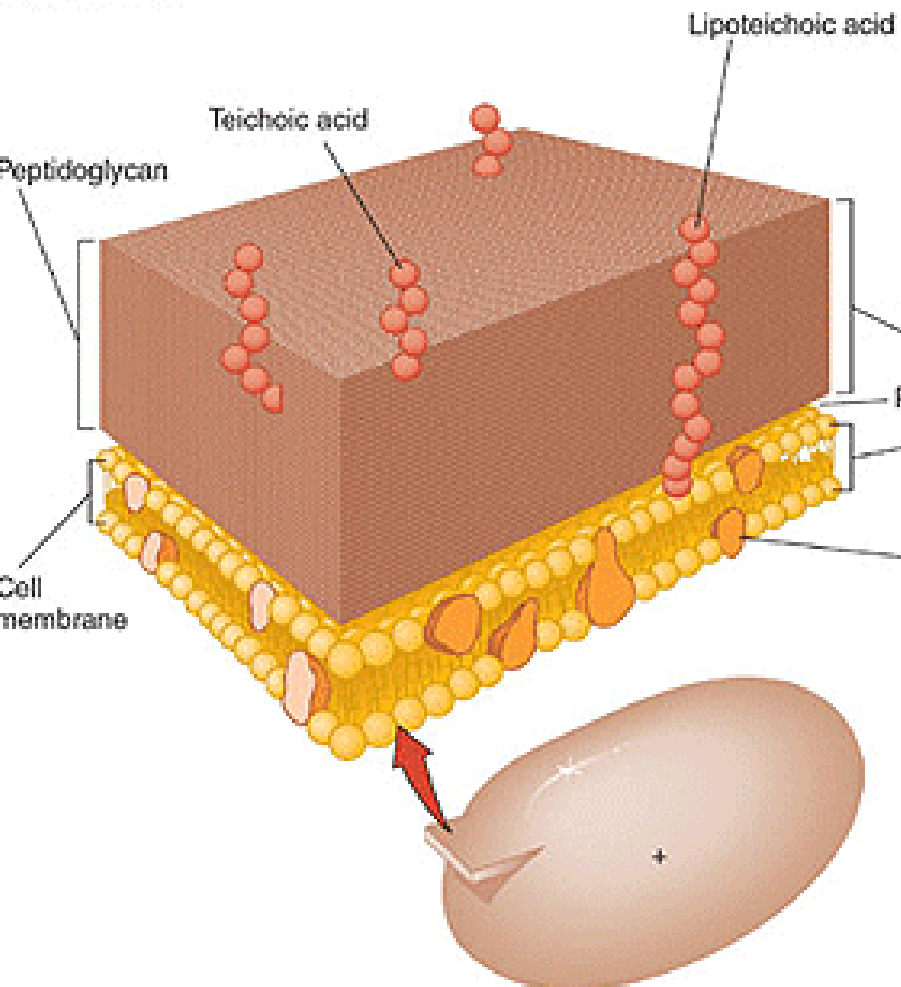| Standard error | 0 | 0.333333333 | 3.711842909 | 0 |

Standard error	1.527525232	0.333333333	0.666666667	0.333333333

http://water.me.vccs.edu/courses/env108/clipart/cellwall.gif
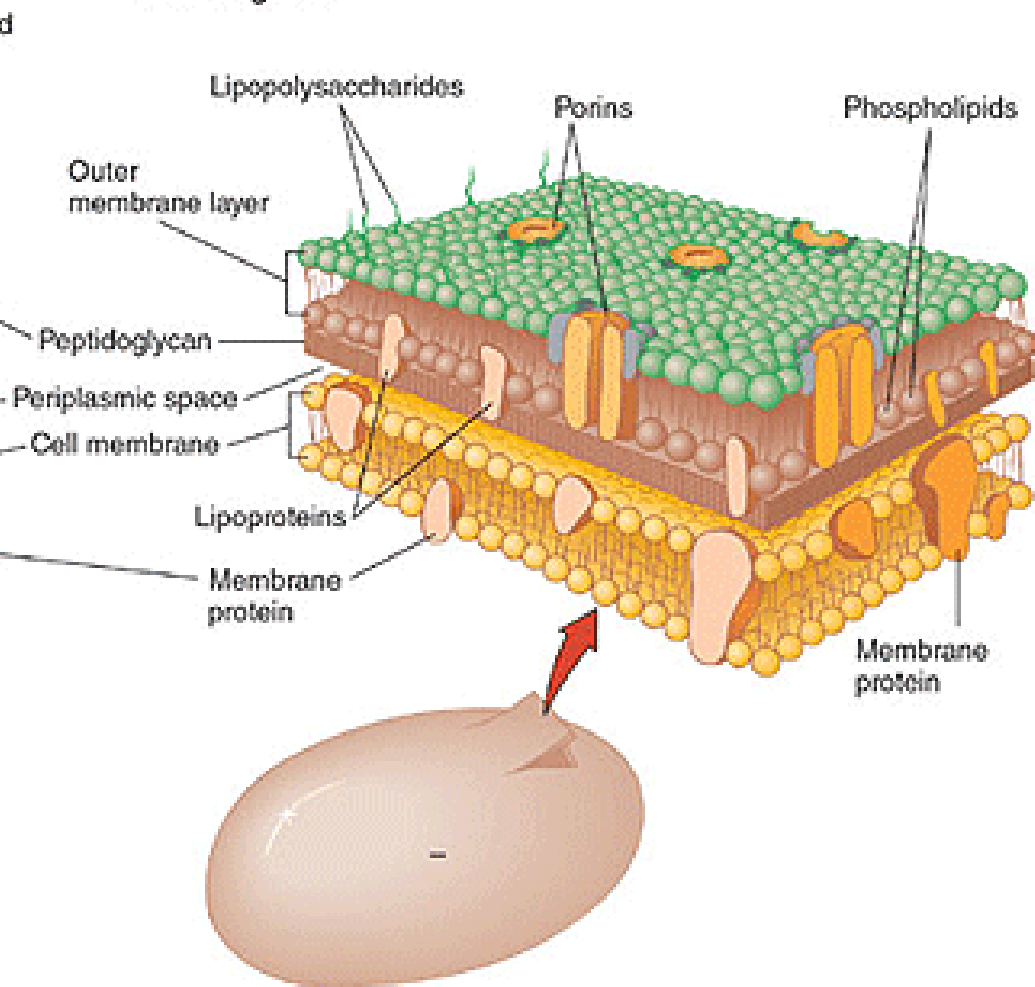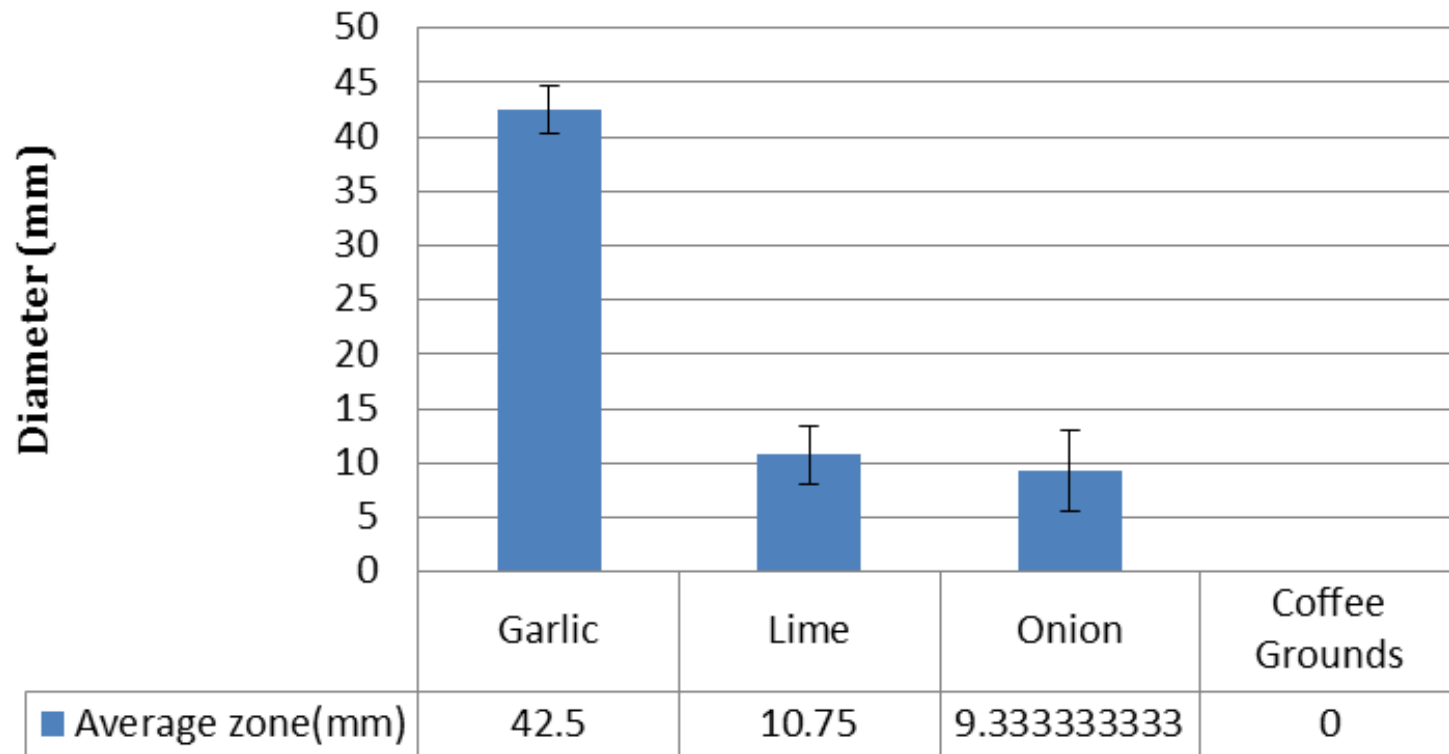
	Garlic	Lime	Onion	Coffee Grounds
■ Average zone(mm)	42.5	10.75	9.333333333	0
Standard error	2.254624876	2.688710967	3.711842909	0

Colony Count Results

E. Coli + Lime

	0 Min	20 Min	40 Min	60 Min
CFU	14	22.4	21.4	21

y-axis: x10^7 CFU/ml
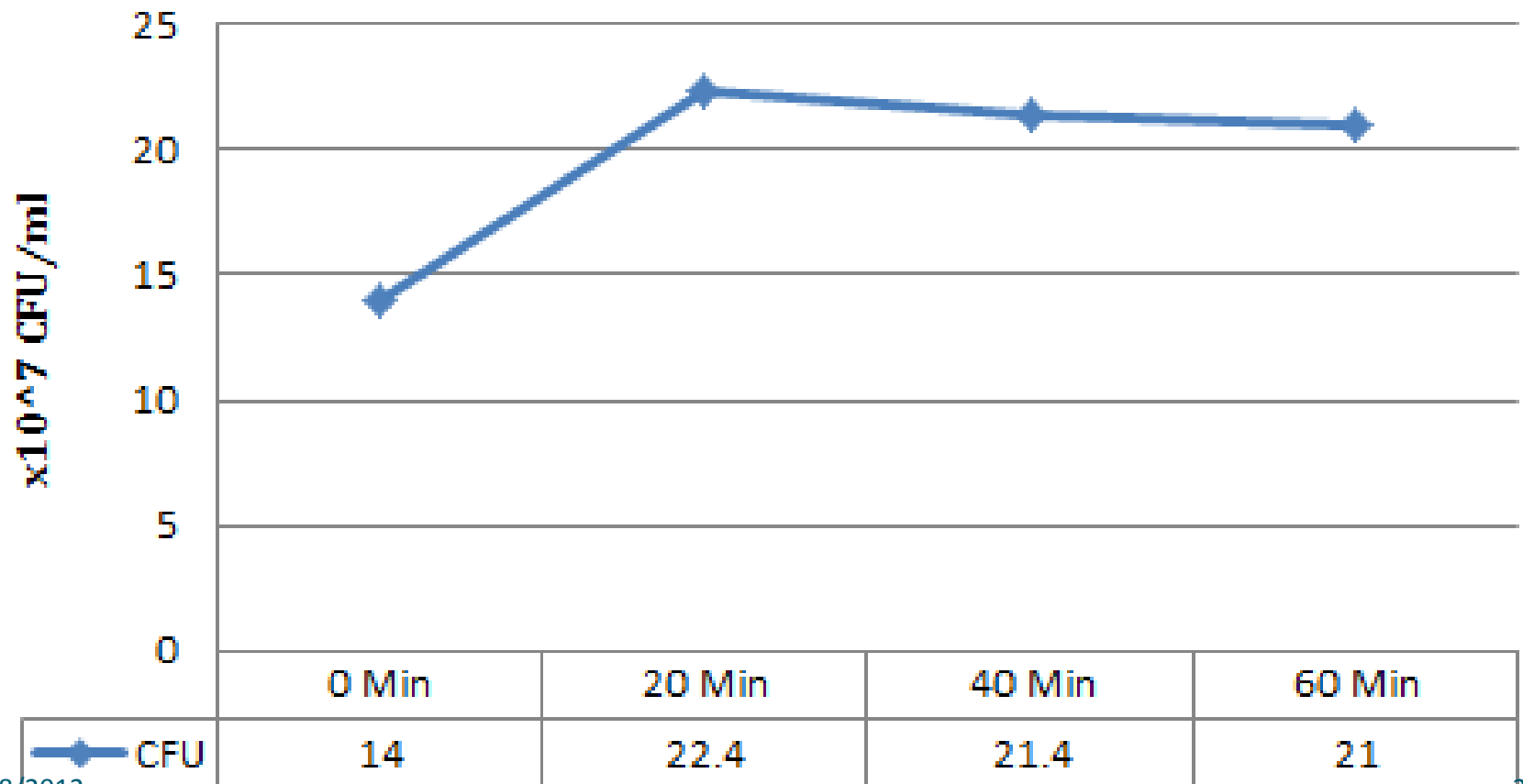
Colony Count Result

E. Coli + Garlic

	0 Min	20 Min	40 Min	60 Min
CFU	0.7	1.7	9	7.5
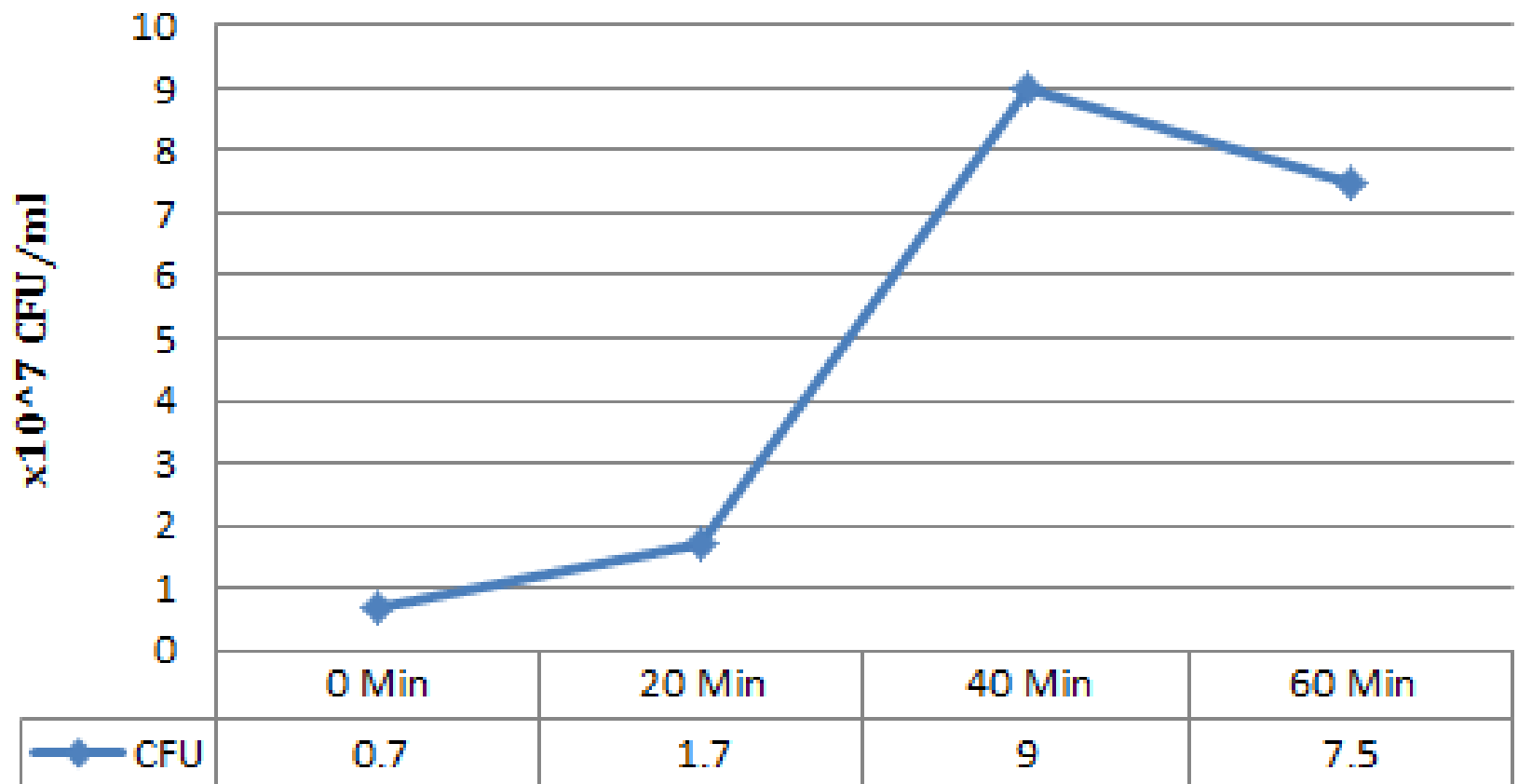
Garlic & Lime Mixture

Zone of Inhibition (*E.coli*)
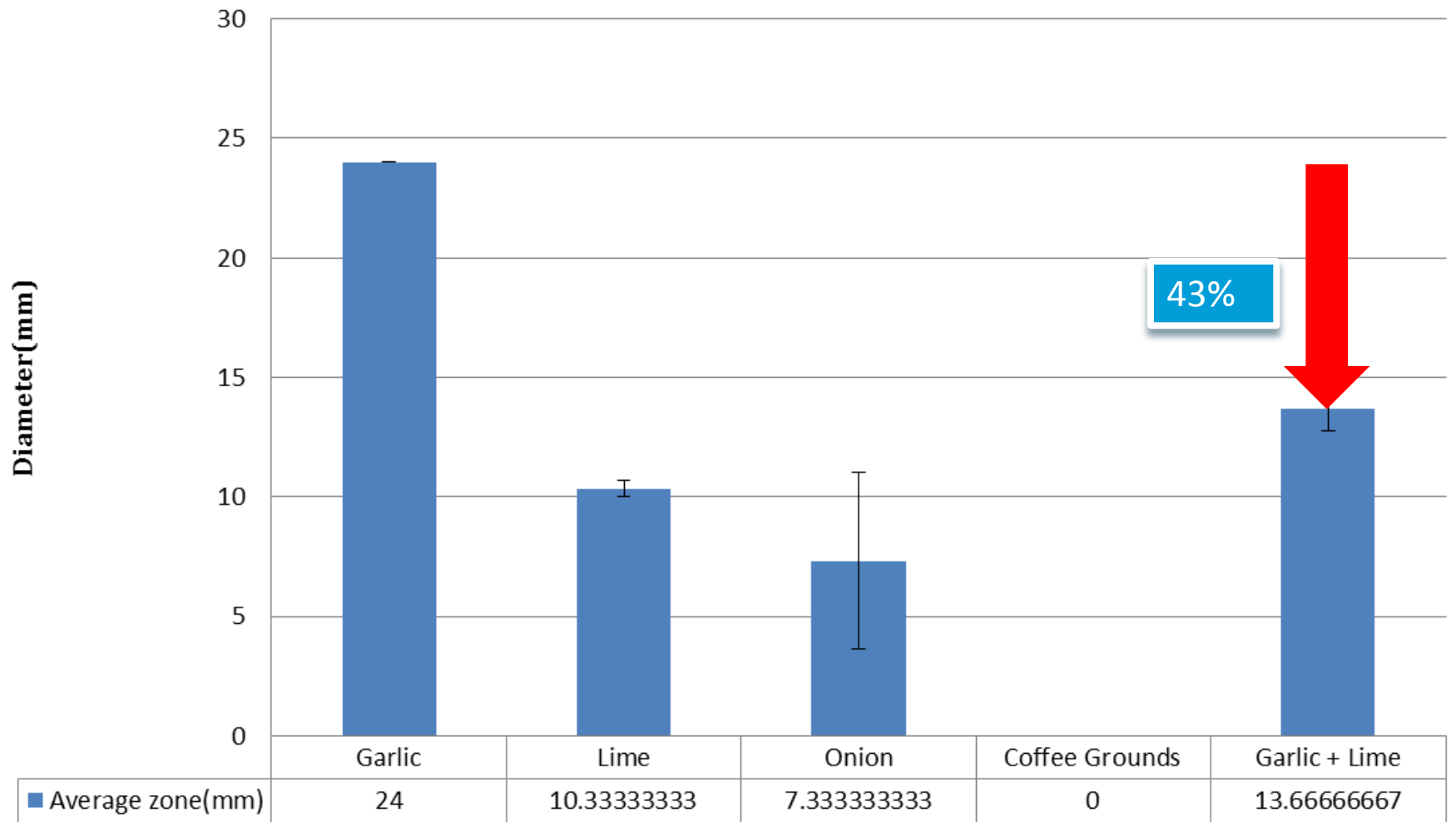
	Garlic	Lime	Onion	Coffee Grounds	Garlic + Lime
■ Average zone(mm)	24	10.33333333	7.333333333	0	13.66666667
Standard error	0	0.333333333	3.711842909	0	0.881917104

Colony Count

E. Coli

	0 Min	20 Min	40 Min	60 Min
Garlic + Lime	7.866666667	9.433333333	26.5	21.4
Garlic	0.7	1.7	9	7.5
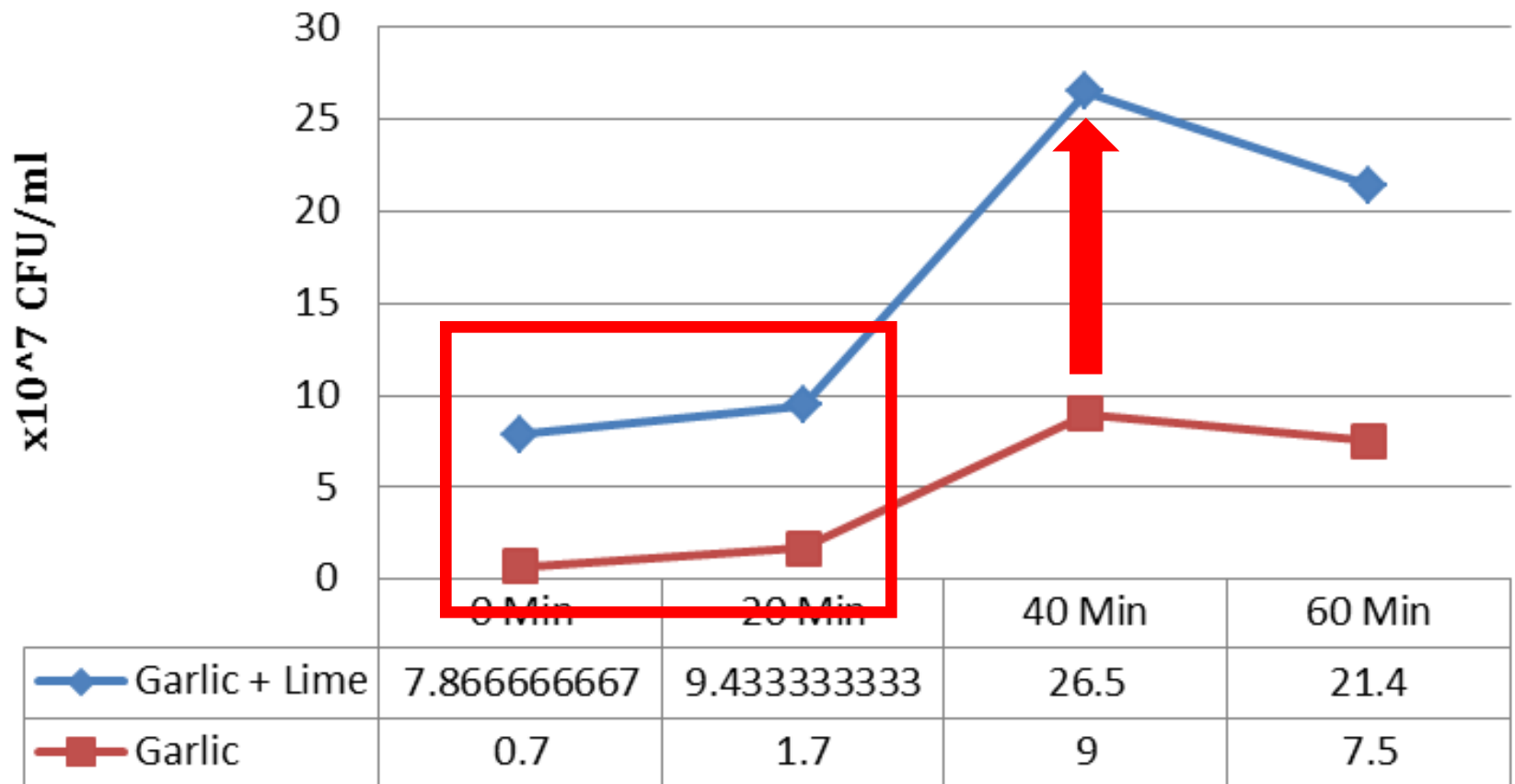
Extracts on Rainwater (Field Test)

Extracts + Rainwater
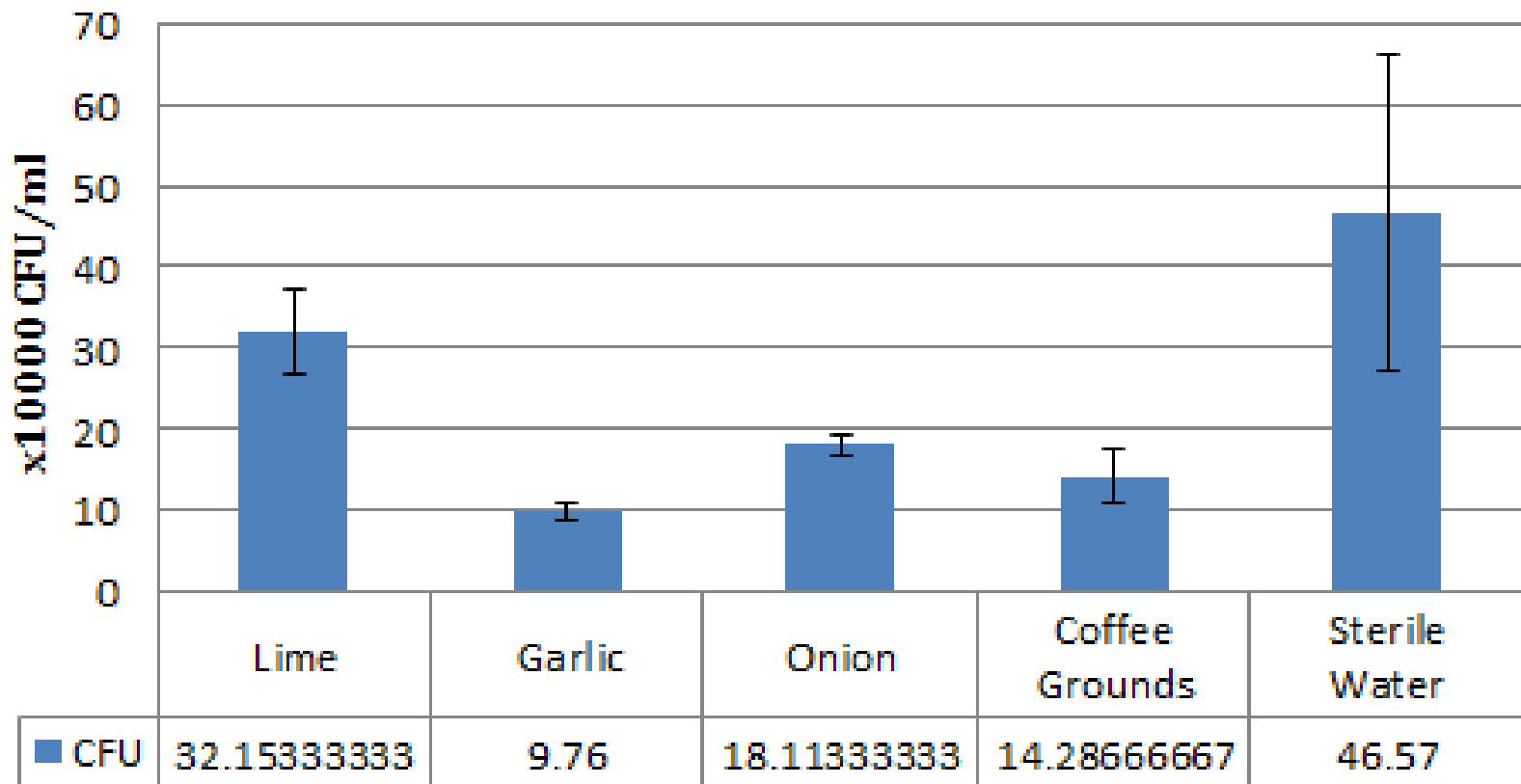
	Lime	Garlic	Onion	Coffee Grounds	Sterile Water
CFU	32.15333333	9.76	18.11333333	14.28666667	46.57
Standard error	5.321279086	1.01128631	1.220619151	3.348279824	19.52523239

Conclusions

- Garlic has the best anti-bacteria properties across a variety of microorganisms

- Coffee extracts seems to target Gram-positive specific structures

- Garlic and Lime have antagonistic effects on each other.

Applications

Picture from:
http://www.mwdws.com/

- For use in places where there is
  - Abundant rainfall
  - Lack of H_2O treatment facilities
  - Poor sanitation
- Using the extracts to make a product
  - Use in filters to purify water
  - Soap, detergent and other related products.
- Practicality
  - Environment friendly
  - Cheap
  - Can be mass produced

Picture from:
http://images.china.cn/

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The End

Thank you for your time :D