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To Determine which Antacid could Neutralize the most Stomach Acid.

(Chemistry Project)

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OBJECTIVE

The purpose of this experiment was to determine which antacid could neutralize the most stomach acid.
I became interested in this idea when I saw some experiments on medicines and wanted to find out some scientific facts about medicines.
The information gained from this experiment will help people know which antacid they should look for in the stores. It will also let them know which antacid will give them the most comfort. This could also save consumers money and provide better health.

INTRODUCTION

Digestion in the stomach results from the action of gastric fluid, which includes secretions of digestive enzymes, mucous, and hydrochloric acid. The acidic environment of the stomach makes it possible for inactive forms of digestive enzymes to be converted into active forms (i.e. pepsinogen into pepsin), and acid is also needed to dissolve minerals and kill bacteria that may enter the stomach along with food. However, excessive acid production (hyperacidity) results in the unpleasant symptoms of heartburn and may contribute to ulcer formation in the stomach lining. Antacids are weak bases (most commonly bicarbonates, hydroxides, and carbonates) that neutralize excess stomach acid and thus alleviate symptoms of heartburn. The general neutralization reaction is:

Antacid (weak base) + HCl (stomach acid) —› salts + H_2O + CO_2

The hydrochloric acid solution used in this experiment (0.1 M) approximates the acid conditions of the human stomach, which is typically 0.4 to 0.5% HCl by mass (pH ~ 1).Antacids help people who have or get heartburn. The following information will help people understand how stomach acid works and what antacid will help those most.

ACIDS

Acids are a group of chemicals, usually in liquid form. They can be recognized by their sour taste and their ability to react with other substances. Acids are confirmed as an acid by their pH. The pH of acids ranges from 0-6.9 (below 7). The two main acids are: mineral acid and organic acid. The three well known acids that are sulphuric acid (H_2SO_4), nitric acid (HNO_3), and hydrochloric acid (HCl).

STOMACH ACID

Stomach acid is very dangerous. If a person was to have an ulcer and the stomach acid was to escape it would irritate their other organs. Stomach acid is highly acidic and has a pH of 1.6. Stomach acid is hydrochloric acid produced by the stomach. If there is too much stomach acid it can cause heartburn. Heartburn is when stomach acid is produced in abnormal amounts or location. One of the symptoms of heartburn is a burning feeling in the chest or abdomen.

SOME FOODS CONTAINING ACIDS

Almost all foods and drinks and even medicines have ingredients that are different acids. Here are some examples: Aspirin (acetylsalicylic acid), Orange Juice (ascorbic acid/Vitamin C), Sour Milk (lactic acid), Soda Water (carbonic acid), Vinegar (acetic acid), Apples (malic acid), and Spinach (oxalic acid).

ANTACID

An antacid is any substance that can neutralize an acid. All antacids are bases. A base is any substance that can neutralize an acid. The pH of a base is 7.1-14(above 7). All antacids have chemical in them called a buffer. When an antacid is mixed with an acid the buffer tries to even out the acidity and that is how stomach acid gets neutralized. In an antacid it is not the name brand that tells how well it works it is something called an active ingredient. Not all antacids have a different active ingredient. Some have one of the same active ingredients and some have all of the same active ingredients. Almost all the antacids that have the same active ingredient work the same amount as the other. The active ingredient of most of the antacids is bases of calcium, magnesium, aluminium.

ACTION MECHANISM

Antacids perform neutralization reaction, i.e. they buffer gastric acid, raising the pH to reduce acidity in the stomach. When gastric

hydrochloric acid reaches the nerves in the gastrointestinal mucosa, they signal pain to the central nervous system. This happens when these nerves are exposed, as in peptic ulcers. The gastric acid may also reach ulcers in the esophagus or the duodenum.

Other mechanisms may contribute, such as the effect of aluminium ions inhibiting smooth muscle cell contraction and delaying gastric emptying.

Antacids are commonly used to help neutralize stomach acid. Antacids are bases with a pH above 7.0 that chemically react with acids to neutralize them. The action of antacids is based on the fact that a base reacts with acid to form salt and water.

INDICATIONS

Antacids are taken by mouth to relieve heartburn, the major symptom of gastro esophageal reflux disease, or acid indigestion. Treatment with antacids alone is symptotic and only justified for minor symptoms. Peptic ulcers may require H_2- receptor antagonists or proton pump inhibitors.

The usefulness of many combinations of antacids is not clear, although the combination of magnesium and aluminium salts may prevent alteration of bowel habits.

SIDE EFFECTS

- Aluminium hydroxide: may lead to the formation of insoluble aluminium phosphate complexes, with a risk for hypophosphate and osteomalacia. Although aluminium has a low gastrointestinal absorption, accumulation may occur in the presence of renal insufficiency. Aluminium containing drugs may cause constipation.

- Magnesium hydroxide: has a laxative property. Magnesium may accumulate in patients with renal failure leading to hypo magnesia, with cardiovascular and neurological complications.
- Calcium: compounds containing calcium may increase calcium output in the urine, which might be associated to renal stones. Calcium salts may cause constipation.
- Carbonate: regular high doses may cause alkalosis, which in turn may result in altered excretion of other drugs, and kidney stones.

PROBLEMS WITH REDUCED STOMACH ACIDITY

Reduced stomach acidity may result in an impaired ability to digest and absorb certain nutrients, such as iron and the B vitamins. Since the low pH of the stomach normally kills ingested bacteria, antacids increase the vulnerability to infection. It could also result in the reduced bioavailability of some drugs. For example, the bioavailability of ketocanazole (antifungal), is reduced at high intragastric pH (low acid content).

EXPERIMENT DESIGN

The constants in this study were:

- Type of acid
- Consistency of procedures

The variables in the study were:

-Different types of antacid used

The responding variable was:

- The amount of stomach acid each antacid could neutralize measured in ml..

MATERIAL REQUIRED

Burette, pipette, titration flask, measuring flask, beaker, weighing machine, concentrated sulphuric acid, methyl orange, antacid samples.

PROCEDURE

- Prepare half litre of N/10 HCl solution by diluting 10 ml of the concentrated acid to 1 litre.

- Prepare N/10 sodium carbonate solution by weighing exactly 1.325 g of anhydrous sodium carbonate and then dissolving it in water to prepare exactly 0.25 litre of solution.
- Standardize the HCl solution by titrating it against the standard sodium carbonate solution using methyl orange as indicator.
- Take 20 ml of standardized HCl in the conical flask, use methyl orange as indicator and see the amount of base used for neutralization.
- Powder the various sample of antacids tablets and weigh 10 mg of each.
- Take 20 ml of standardized HCl solution in the conical flask; add the weighed samples to it.
- Add two drops of methyl orange and warm the flask till most of the powder dissolves. Filter off the insoluble material.
- Titrate the solution against the standardized Na_2CO_3 solution till a permanent red tinge appears.
- Note the amount of base used for titration and note the reduction in the amount of base used.
- Repeat the experiment with different antacids.

OBSERVATIONS AND CALCULATIONS

1. Standardization of HCl solution

Volume of N/10 sodium carbonate solution taken=20.0 ml

S. No.	Initial burette readings	Final burette readings	Volume of acid used (in ml)
1	0.0 ml	15 ml	15.0
2	0.0 ml	14 ml	14.0
3	0.0 ml	15 ml	15.0

Concordant reading=15.0 ml

Applying normality equation

$N_1V_{1(acid)} = N_2V_{2(base)}$

N_1 (15) = (1/10) 20

Normality of HCl solution, N_1 = 0.133 N

2. Neutralization of standardized HCl solution used

Volume of HCl taken= 20.0ml

S. No.	Initial burette reading	Final burette reading	Volume of HCl used (in ml)
1	0.0 ml	26.6 ml	26.6
2	0.0 ml	26.5 ml	26.6
3	0.0 ml	26.6 ml	26.6

Concordant reading= 26.6 ml

3. Analysis of antacid tablets

Weight of the antacid tablet powder= 10 mg

Volume of HCl solution added= 20.0 ml

S. No.	Antacid	Initial reading of burette	Final reading of burette	Volume of Na_2CO_3
1	Gelusil	0.0 ml	15.0 ml	15 ml
2	Aciloc 150	0.0 ml	22.0 ml	22 ml
3	Fantac 20	0.0 ml	25.0 ml	25 ml
4	Pantop 20	0.0 ml	20.0 ml	20 ml
5	Ocid 10	0.0 ml	7.0 ml	7 ml

RESULT

The most effective antacid out of the taken samples is acid 10.

PRECAUTIONS

- All apparatus should be clean and washed properly.
- Burette and pipette must be rinsed with the respective solution to be put in them.
- Air bubbles must be removed from the burette and jet.
- Last drop from the pipette should not be removed by blowing.
- The flask should not be rinsed with any of the solution, which are being titrated.

Bibliography

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