

Experiment: Investigating an indigestion medicine

Introduction

Indigestion tablets also known as antacids are 'anti' acids, i.e. against or opposite of acids.

Indigestion tablets, i.e. antacids neutralize acids to form salts and water. Therefore antacids are bases.

The stomach produces between 1 L and 2 L of gastric juice daily, during the process of digestion, of which the main constituent is hydrochloric acid, $\text{HCl}_{(\text{aq})}$, at a pH of 1, which means that it is at a concentration of 0.1 M. If the concentration of hydrochloric acid in the stomach is too high, one would feel stomach discomfort resulting in acid indigestion.

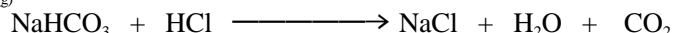
Acid indigestion, also known as upset stomach or dyspepsia, is discomfort or a burning sensation in the upper abdomen, often accompanied by nausea, and abdominal bloating.

[If excessive secretion of stomach acid occurs over a long period, then the stomach wall itself is digested and a crater-like sore or ulcer forms.]

Indigestion tablets neutralize excess acid and give express relief from indigestion and heartburn.

The most common indigestion tablets contain carbonates and bicarbonates, such as magnesium carbonate, MgCO_3 , calcium carbonate, CaCO_3 , and sodium hydrogencarbonate, NaHCO_3 .

Sodium hydrogencarbonate, NaHCO_3 , (a.k.a.: baking soda), reacts with hydrochloric acid producing carbon dioxide gas, $\text{CO}_2(\text{g})$:



Sodium hydrogencarbonate, NaHCO_3 , is cheap, readily available and dissolves easily and therefore can be effective. However, if excess baking soda is present, it can pass into the intestine and from there be absorbed by the bloodstream. This can upset the acid-base balance of the body fluids and in extreme cases cause a medical condition known as alkalosis.

Other active ingredients commonly found in indigestion tablets include aluminum hydroxide, $\text{Al}(\text{OH})_3$, magnesium hydroxide, $\text{Mg}(\text{OH})_2$, magnesium oxide. Each of these ingredients, as well as magnesium carbonate, MgCO_3 and calcium carbonate, CaCO_3 , can be used alone or combined with other ingredients. Since none of these ingredients dissolve easily, therefore they are much less likely to be absorbed in the intestine, hence are preferable to sodium hydrogencarbonate.

Indigestion tablets also contain 'filler' materials, usually starch or sugar, to hold the tablet together. These fillers can also mask the bitter taste of the base. Their natural peppermint flavour and smooth texture make them pleasant to take and peppermint tea is also used as a homeopathic medicine for upset stomachs.

The effectiveness of a given indigestion tablet may be determined by the amount of stomach acid it will neutralize. The speed of the neutralization reaction is also important, but a very fast rate of reaction is also not suitable, since it is less likely to cause the stomach to produce excess gastric juice in response to the indigestion tablets presence.

Planning Reaction: Hydrochloric acid and indigestion tablets to give a neutral solution

Your Task:

- < Devise an experiment to test how long the above reaction takes when tablets are in powder form and also in solid form (i.e. simulating chewed and sucked tablets).
- < Try to compare two different indigestion tablet brands (Rennie®, Rolaid®, etc.)

You will be provided with:

small, medium and large beakers, measuring cylinders, pipettes, balance, universal indicator, stopwatch, permanent marker, 1 M hydrochloric acid, distilled water, 2 brands of antacid tablets.

From the Introduction, formulate problems statements. Provide a hypothesis. Design a procedure to test your hypothesis. Choose a method of controlling the variables and testing the results in each of your experiments, taking into account of all safety features. Make a suitable data table for all your data collection.