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Pepsi the Most Popular Soft Drink Perilous to Health

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Key Words

Pepsi, Sugar, Phosphoric acid, Caffeine, Carbonated Drinks

Abstract

The experiment was conducted in order to prove that Pepsi is harmful to human health as it contains an excess amount of sugar and many harmful components, such as pesticides, phosphoric acid and caffeine. This experiment is significant because soft drinks like Pepsi are consumed by a major population and consumption of such liquids directly affects the health of the population, hence making it important to know the components within the drink. The experiments were prepared with an immense amount of contemplation and speculation and demonstrated with the aid of a distillation apparatus, titration apparatus, pH probe, litmus paper, dissolved oxygen probe, TI-83 Calculator, Top Pan Balance, and a chemical laboratory. The experiments executed were: distillation – separation of Pepsi components, evaporation, pH level tests, titration, precipitation reactions, dissolved oxygen test, artificial bacterial growth, affect of bacterial growth when Pepsi is added, test for sugar -use of Benedict solution and the decomposition of calcium (egg submergence) , steel and iron (nail submergence) in Pepsi. Pepsi was detected to contain phosphates (found in pesticides), phosphoric acid, chlorine, an excessive amount of sugar, a pH of 2.87, a low quantity of oxygen mg/l, bacterial growth and chemically destructive towards calcium and iron. These results were constructive to our hypothesis and confirmed that Pepsi is harmful to human health and contains an excessive amount of sugar and harmful chemicals in addition to the low pH and oxygen concentration. This experiment has enabled us to think twice before we accept a soft drink such as Pepsi.

Hypothesis

Pepsi is harmful to human health because it contains an excess amount of sugar and many harmful chemical components, such as pesticides, phosphoric acid and caffeine.

Introduction

Pepsi over a short period of time has become one of the most popular soft drinks. Attractions to this drink are many: high rate of sugar, caffeine, fizzing property and even the over all taste. Pepsi is mainly composed of carbonated water, sugar, color (caramel), Acidulant (phosphoric acid), Caffeine, Emulsifier (Gum Arabic) and Natural flavors (Refer to figure 1.1). Whatever the attraction may be, people love Pepsi. Yet surprisingly all these components are harmful to human health. For example sugar is said to "suppress the immune system (3 pops will wipe out the immune system for the day);

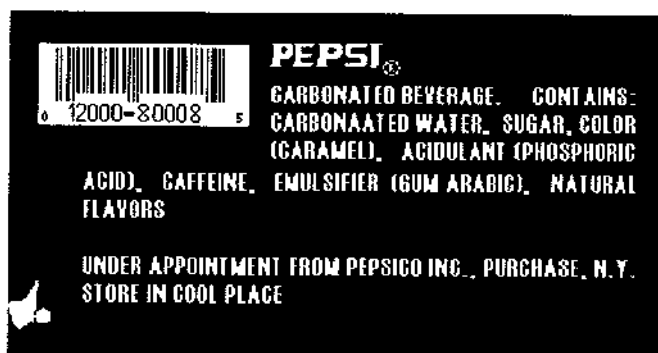


Figure 1.1: Picture of Pepsi bottle showing the ingredients of Pepsi.

upset the minerals in the body; cause hyperactivity, anxiety, difficulty concentrating; produce a significant rise in triglycerides; cause reduction in defense against bacterial infection, cause kidney damage; reduce high density lipoproteins; lead to chromium deficiency; lead to cancer of the breast, ovaries, intestines, prostate, and rectum; increase fasting levels of glucose and insulin; cause copper deficiency; interfere with absorption of calcium and magnesium; weaken eyesight raise the level of neurotransmitters called serotonin; cause hypoglycemia; produce an acidic stomach; cause aging, arthritis, asthma, candida, gallstones, appendicitis, heart disease, multiple sclerosis, hemorrhoids, varicose veins, and periodontal disease; increase cholesterol, migraine headaches, interferes with the absorption of protein; cause toxemia during pregnancy, impair the structure of DNA; cause cataracts, emphysema, atherosclerosis; can cause free radicals in the blood stream; and it can cause hunger pains and overeating." (Website, 1).

Refractive shift also occurs in patients, who may not know that they have diabetes. This occurs when blood sugar level unexpectedly or abruptly spurts up to a level of 300 or more, which results in the vision to become extremely blurry for weeks. This arises because high blood sugar affects the lens inside the eye in such a way that it swells, resulting to a swift change in the patient's vision. Proliferative diabetic retinopathy is another consequence of diabetes which is caused by changes in the blood vessels of the eye. High blood sugar levels generate modifications in the veins, arteries and capillaries including the tiny blood

vessels in the retina. The retinal blood vessels become so impaired that they close off. As a result, the retina grows new, fragile blood vessels. These new blood vessels are abnormal and grow on the surface of the retina and do not provide the retina with blood. The new blood vessels may leak and hence cause a vitreous hemorrhage. Blood in the vitreous, prevent the retina from receiving the light. Small amounts of blood in the vitreous will initiate the presence of dark floaters and a large hemorrhage could block the entire vision. The development of cataract may also take place because of diabetes. Usually the cataract which arises due to diabetes forms at a much quicker rate than age-related cataracts. Several eye problems may occur due to diabetes (Website, 2). "Carbohydrates such as sugar drive blood insulin production that causes cancer. There are strong associations between a high-carbohydrate diet and many diseases that present a secondary cancer risk. Cancer risks are greatly increased with diabetes, inflammatory bowel disease and many other unhealthy conditions caused by the high-blood glucose and high-blood insulin levels." Some researchers have concluded that caramel coloring in cola drinks (such as Pepsi), cause genetic effects. Caramel is also considered as the "cancer-causing suspect" (Website, 1) (Website, 7).

These are just a few of the effects of sugar. Caffeine is another harmful component, if taken in excess it can cause nervousness and loss of sleep. It has been tested on animals and results in birth defects. Pregnant women have been told to avoid consumption of caffeine (CD, 3). Caffeine artificially stimulates the body and increase the heart rate. As the body tries to resist the poison which has entered its system, excess stimulation occurs which drains vital energy required for the body. Caffeine increases bladder and stomach cancer, damages the stomach lining, increases heart rate, raises blood pressure and aggravates diabetes. Caffeine can cause at least six different kinds of cancer and it does not supply the body with any nutrients (Website, 1). Phosphoric acid (also used in toilet cleaners) is an additional harmful component of Pepsi. The bubbles and fizz in soft drinks can be potently harmful to humans and can burn them from the inside. This occurs due to the presence of phosphoric acid and carbon dioxide. (Website, 1) (Website, 7) Also, phosphoric acid can affect one when inhaled. Inhalation of the vapor can cause irritation of the nose, throat, and lungs. Higher levels can cause pulmonary edema. Moreover it is a corrosive chemical which can severely burn the skin and eyes. A continuous exposure to the Phosphoric acid may cause drying and cracking of the skin (Mcuser, 1989). "The phosphorus in the acid upsets the body's calcium-phosphorus

ratio and dissolves calcium out of the bones. This can eventually result in osteoporosis, a weakening of the skeletal structure, which can make one susceptible to broken bones. Also, the phosphorus fights with the hydrochloric acid in human stomachs and renders it ineffective. This promotes indigestion, bloating and gassiness in many individuals.” (Website 1). Phosphoric acid also brings down the pH level. Our body constantly fights to maintain its pH level, on the consumption of drinks such as Pepsi, the pH drops and the body has to work even harder. This wears off organs much faster than it should (Website, 5). This makes pH a very important factor when conducting an experiment on Pepsi. Another factor is bacterial growth. The presence and absence of bacterial growth are both very significant. Excessive bacterial growth would indicate that the drink has a bacteria friendly environment. This would be bad for the human body because it may upset the human stomach. The absence of bacterial growth would signify the environmental harshness of the drink. This would also be bad for humans because it would kill the good bacteria in the stomach.

Pepsi is a carbonated drink and hence may raise the risk of esophageal cancer, which is usually a fatal disease. Carbonated soft drinks cause the stomach to bloat, which results to gastric reflux associated with esophageal cancer. Researchers have found that the number of esophageal cancer cases raises when the intake of carbonated soft drinks increases. (Reuters, 2004) Another thing to note is that CO₂ is exhaled from the human body; consumption of carbonated drinks increases the intake of CO₂, which can be potentially harmful. Cancer may be related to some soft drinks because, “cancer is like a plant cell; it can't live in an oxygen-rich environment. Cola drinks make our bodies poor in oxygen.” (Website, 7) Therefore increasing the risk of getting cancer. Moreover “Cola drinks can interact adversely with antacids, possibly causing constipation, calcium loss, hypertension, nausea, vomiting, headaches and kidney damage. Soft drinks can decrease the antibacterial action of penicillin and ampicillin.” (Website, 7) Furthermore, 16 organo chlorine and 12 organo phosphate pesticides were found in soft drinks like Pepsi and Coke in India. Thus the presence of phosphorus ions called phosphates and chloride ions will show some evidence that it contains pesticides (Website, 8).

Over all the components of Pepsi are detrimental to human health. The fact that the components of Pepsi are harmful for human health has instigated our research on this field. Pepsi being one of the drinks that we

drink the most has swelled our concern for our health. Not only ours but of everyone who drinks it. We as a group want to investigate how much of each ingredient is present in it and find out if any other components are present in it which is not mentioned in the ingredients. We also intend to use molecular chemistry to find out how these components may affect our health. To attain our purpose, we will run through a series of experiments: titration, pH testing, distillation, dissolved oxygen, dissolved CO₂, dissolved calcium, submerging iron and steel nails, submerging egg shell, precipitation reactions, evaporation and bacterial growth. We chose Pepsi because it is the drink that we drink the most and the favorite of many other people, especially in Pakistan. Pepsi is being used as an example of soft drinks, since it is drunk by most people. The results that we may obtain may be similar for other brands, such as high rates of sugar: but our experiment is done on a more popular and personal based scale. We hope that through our findings and results, we will try to avoid drinking Pepsi and live a better life. We also hope that through our experiments people would think twice before they pick up a soft drink such as Pepsi and refer to the slogan "Dare to Drink More."

Methodology- We used various methods to for finding the components of Pepsi like the amount of sugar, phosphoric acid, Phosphates, chlorides etc. We used different methods based on the physical and chemical properties of Pepsi. For example distillation was one method which was based on physical properties of Pepsi; on the other hand precipitation reactions and Benedict's test were based on chemical properties of Pepsi. The first method we used was **evaporation** to find the amount of sugar in Pepsi and to find the substance which gives the black color to Pepsi. We took the mass of the beaker in the top pan balance. Then we added a given volume of Pepsi in the beaker. We heat the Pepsi till all the liquid in the Pepsi is evaporated and the solid black caramel is left at the bottom of the beaker. Then subtract the initial mass of the beaker without caramel from the final mass of the beaker with caramel to get the amount of sugar in that volume of Pepsi. The other method we used was **distillation**. First set a distillation apparatus. (Refer to Figure 3) Place the round- bottom flask containing a given volume of Pepsi on a hot plate. As Pepsi starts evaporating the vapors will run through a long tube where cold water is flowing and the vapors will get condensed into water droplets and enter