A SURPRISING ROLE FOR PHOSPHATES

Phosphates are **necessary nutrients** for plants, animals, and people.

Plants need phosphorus for compounds that are **key to photosynthesis.**

UNDERSTANDING PHOSPHATES

Phosphates are natural salt compounds that contain phosphorus and other minerals. Phosphorus, of course, is one of the elements on the Periodic Table.

PHOSPHATES IN BEVERAGES Most people don't realize that many beverages have phosphates in them. The phosphates make drinks taste better and it also makes the drinks more effective in your body. What kinds of beverages use phosphates? The following list contains some common, but probably surprising, examples:

- The most obvious category, and the one you are probably most likely to be familiar with, is the use of phosphates in isotonic drinks and sports beverages that replenish electrolytes. These phosphates have cations such as sodium and potassium. (For those who have not taken any chemistry classes for a while, a cation is a positively charged ion that has more protons than electrons.) Athletes use sports drinks after strenuous exercise. To be more specific, sports drinks generally contain monopotassium phosphate and monosodium phospate. These two incredients provide sodium and potassium electrolytes, and they also provide pH buffering.
- Soft drinks have phosphoric acid in them. For colas, the percentage of phosphoric acid is about 0.05 percent. For root beer, it is 0.1 percent. Soft-drink manufacturers like phosphoric acid because it enhances the flavor, lowers the pH, and keeps the carbonation stable.
- Meal replacement drinks are fortified so they can provide the nutrition of an entire meal. The phosphates add magnesium and phosphorus, and they protect the drink's vitamin C so that it doesn't oxidize if there are metal ions present.
- Beverages that use soy have phosphate in them. The phosphate keeps the soy protein dispersed and adds calcium minerals. That last is important because soy milk only has about a third as much calcium as milk from a cow.
- Whey drinks have protein, and the protein has to be protected, stabilized, and dispersed within the drink.

Manufacturers use phosphates in order to do just that.

- Beverages such as fruit drinks and tea also can be fortified with phosphate. For example, tricalcium phosphate can be added to juice for the calcium but doesn't affect the taste of the juice much. Other phosphate salts in juice provide potassium or keep the color stable.

ABOUT SPORTS DRINKS

Electrolyte drinks are used as part of oral rehydration therapy. If an athlete is participating in unusually strenuous activity over a long period of time, such as a marathon or triathlon, then after three or more hours, the athlete can become quite dehydrated. The body is a marvelously complex thing and can sometimes compensate for the problem of dehydration, but a sports drink is a quick and simple way to fix the problem.

Athletes are not the only ones who sometimes could use a good sports drink. Anyone who has lost a lot of body fluids should consider drinking one. For example, someone who has had too much alcohol or is drunk, is sweating heavily, has diarrhea, is vomiting, or is starving may well benefit from such a drink.

PHOSPHATES AND LIFE

Phosphates are necessary nutrients for plants, animals, and people. Plants need phosphorus for compounds that are key to photosynthesis. For people, phosphates are involved in the following:

- DNA and RNA genetic material
- Cell membranes
- Bones and teeth
- Energy systems
- Cell signaling systems, controlling everything from pH balance to hormones

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as a supplement because they provide both calcium and phosphorus. Most people already know you need calcium for strong bones and teeth and in order to prevent osteoporosis; what you may not know is that calcium is also the most abundant mineral in your body and is necessary for normal metabolic functions in the nervous, muscular, and skeletal systems of your body.

A MINING CONNECTION

Miners get phosphate salts from minerals that occur naturally. It is possible to get phosphorus from animal bones and urine — in fact, when phosphorus was first isolated, it was isolated from urine by an alchemist named Hennig Brandt in 1669 — but people need more phosphorus than you can get from the available bones and urine, so people turned to mining instead.

Once mined, the phosphate salts are crushed, refined and purified for use. it also generally contains clay and other minerals. The goal is to take the phosphorus and turn it into phosphoric acid by letting the phosphates react with sulphuric acid. After phosphoric acid has been produced, it can be combined with alkaline salts; specifically, salts with calcium, potassium, and sodium. The reaction between the phosphoric acid and the salts creates purified phosphates. The simplest compound that can be created from phosphoric acid is salts of orthoposphates, which is also called monophosphoric acid. Orthophosphates can be used directly, or heat can be used to transform them into something else.

Although most people don't know much about phosphates, this is one mining product whose importance is hard to overstate. ✷

COMPREHENSION QUESTIONS

1. What are phosphates?

2. What is a cation?

3. How much phosphoric acid is in root beer?

4. How much calcium does unfortified soy milk have compared to cow milk?

5. What does tricalcium phosphate add to fruit juices such as orange juice?

6. Who should drink sports drinks?

7. Name the most abundant mineral in your body.

8. Name the man who first isolated phosphorus in 1669.