# Simple Chemistry for the Golf Course[1]

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*Part I*

Persistent requests for a simple discussion of the chemistry of materials with which the greenkeeper has to work are offered as justification for an article on the subject. Chemistry is a science in which almost all intelligent persons are interested either directly or indirectly. Chemical phenomena occur about us every day. Perhaps if we understood some of the common chemical reactions better we would be able to utilize them to greater advantage. Furthermore, a knowledge of them brings with it a reward of satisfaction which is sufficient in itself. Chemistry plays a tremendous part in the world in which we live. In fact, life and what goes on about us, to a very great extent, are the results of one chemical change after another.

**Elements.**—To understand more fully the materials which are used in our regular golf course work we must think of them all as chemicals. Any form of matter is a chemical. Matter may change in every conceivable way; it may pass beyond our recovery, but it is never lost. Matter is indestructible. We need not concern ourselves with the question of what is the simplest form of matter. We have heard of atoms and molecules and ions, but we will leave them for the chemists to struggle with and will start with the element, which is the simplest form that we can well appreciate. Examples of elements are oxygen, hydrogen, nitrogen, gold, silver, copper, sulfur, and chlorin. They may occur commonly as gases, liquids, or solids. There are upwards of seventy elements known and described in chemistry. While the substances we see every day are composed of elements, it is rarely that we see the elements themselves. They are usually found in combination with other elements in one form or another. For example, oxygen—the most abundant of all elements—is a colorless gas; likewise is hydrogen; but when these two combine they form water, the liquid of the universe.

**Chemical Compounds and Mixtures.**—When one element combines with another in a true chemical combination, as in the case of oxygen and hydrogen in the formation of water, we have what is known as a chemical compound. The oxygen and hydrogen can not be separated except by chemical means; but if we stir some chalk into the water we get a mechanical mixture which may be separated into its component parts, simply by allowing the mixture to stand until the chalk settles to the bottom of the vessel. We should understand clearly the difference between a true compound and a mechanical mixture. It is very important, and a knowledge of it will help us very much in our work. Not all elements will unite directly with all other elements to form chemical compounds. Sulfur does not combine with chlorin, one of the constituents of common salt. Numerous other examples might be cited.

**The Elements Classified—Acids, Alkalies, and Salts.**—It is difficult properly to classify the elements into their natural groups, but for our purpose we may divide them into two general divisions, namely (1) acid-forming elements and (2) base or alkali-forming elements. Strictly speaking, not all base-forming elements are alkalies, but the alkalies make

[1]This is the first installment of *Simple Chemistry for the Golf Course*. The second installment will appear in an early issue of The Bulletin. It will treat of the various chemicals, including earthworm eradicators, weed killers, fungicides, insecticides, and fertilizers.

up a very important proportion of the bases, and for our purpose the two may be generally regarded as the same. Some of the common acid-forming elements are sulfur, nitrogen, chlorin, and carbon. Most of the bases or alkali-forming elements are metals, such as sodium, calcium, magnesium, copper, iron, lead, and zinc. Some elements are both basic and acid, but again it may be said that the general classification here given is satisfactory for our simple consideration of the subject. Our common inorganic acids are sulfuric acid, hydrochloric or muriatic acid, nitric acid, and carbonic acid. Our common inorganic bases or alkalies are caustic soda, caustic potash, quicklime, and ammonia.

When an acid and an alkali are combined in proper proportions one neutralizes the other. A chemical change takes place, and what is known as a salt is formed. When the word "salt" is mentioned we at once think of the salt used to season food. This salt is a very common one. It is chemically known as sodium chlorid, and is formed by combining caustic soda and hydrochloric acid. When we see or hear of the word "salts" we think of Epsom salts or Rochelle salts, but there are a great many other salts, such as bluestone and copperas, and they are quite as important as acids or alkalies.

If we wish to know whether a certain chemical is an acid or an alkali we may find out in a general way by testing it with litmus paper. If it turns blue litmus paper red it has acid properties; if it turns red litmus paper blue it has basic or alkaline properties. If it does not change the color of either it is neutral. This is not a very accurate test, but for our purpose it is quite satisfactory.

**Chemical Changes.**—The chemical change that takes place when two or more chemicals come in contact with each other is called a reaction, and the chemicals themselves are called reagents. The simplest and most common reaction is caused by the uniting of oxygen with other elements. Broadly speaking, this reaction is called oxidation. Burning or combustion is a very common form of oxidation. Decay is likewise a form of oxidation. Rusting is another form.

In our common every-day practice in greenkeeping we use, or at least should use, considerable compost. Oxidation plays a very important part in the decaying of the organic matter and the general breaking down of the materials put in compost piles before they are suitable for use as a top-dressing for turf. There are many other chemical changes, of course, as when water is added to freshly burnt lime. We are all familiar with what occurs when these two substances come together.

**Chemical Symbols and Formulas.**—The chemist has symbols, or abbreviations, for each of the elements. The following are some of the common elements and their symbols:

Oxygen, O; hydrogen, H; nitrogen, N; carbon, C; sulfur, S; manganese, Mn; chlorin, Cl; iodine, I; calcium, Ca; magnesium, Mg; mercury, (*hydrargyrum*), Hg; phosphorus, P; silicon, Si; copper (*cuprum*), Cu; iron (*ferrum*), Fe; lead (*plumbum*), Pb; zinc, Zn.

When the chemist desires to express the name of an element or compound, or to indicate a chemical reaction, he does so by means of these symbols. Instead of writing the word "water," for example, he uses the formula $H_2O$. This not only means water but it indicates that the substance water is composed of two parts of hydrogen and one part of oxygen. Formulas for some of the common substances or compounds are as follows: Carbon dioxid, $CO_2$; nitrate of soda, $NaNO_3$; limestone, $CaCO_3$; bluestone, or copper sulfate, $CuSO_4$; sulfuric acid, $H_2SO_4$; hydrochloric acid, HCl; common salt NaCl.

**Chemical Terms Defined.**—For a more complete appreciation of the subject of chemistry, particularly writings on the subject, it is necessary to have quite clearly in mind what is meant by the various special terms that are commonly used. A few of these terms and their simple definitions are given here. The order in which they are given is without reference to their relative importance.

**Analysis.**—The determination of the composition of a substance. This is called qualitative analysis. If the proportions of the parts that make up the substances are determined the analysis is called quantitative analysis.

**Synthesis.**—Unlike analysis, which is really a tearing apart, synthesis is a building up. A synthetic compound is one that is artificially made from simpler parts or substances.

**Effervescence.**—When vinegar comes in contact with soda, gas bubbles up from the mixture. This bubbling is called effervescence. The gas in this case just cited is carbon dioxid, one of the most common gases occurring in nature.

**Solvent.**—Anything that dissolves another substance or compound—that is, puts it into solution or in liquid form—is called a solvent. Water is the greatest known solvent.

**Reagent.**—Any chemical that is used to treat or mix with another chemical or substance is a reagent. The effect produced is called a **reaction.**

**Dehydrate.**—To remove the water from a substance, as in the process of drying fruits or vegetables.

**Anhydrous.**—Free from water. When the crystals of bluestone (copper sulfate), which naturally contain water, are heated to a sufficient degree they break down and turn white or a greenish white. The substance is then free from water and is called anhydrous copper sulfate. Lime free from water is called anhydrous lime or quicklime. When water is added it is called hydrated lime.

**Emulsion.**—A combination of one or more oils with water or a water solution of some substance.

**Precipitate.**—To cause to fall; for example, as water from the clouds in the form of rain or snow. When certain liquids are mixed together a solid substance is formed, which falls to the bottom of the vessel in which the mixing takes place. This substance is called a precipitate.

**Saponification.**—The reaction that takes place when lye and fat are boiled together in the making of soap.

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## Supplies of Creeping Bent Stolons for Vegetative Planting

The indications are that supplies of bent stolons will be available from commercial sources for planting in June, 1923. Nurseries of these stolons planted in midsummer and given careful attention should be in excellent condition to go through the winter.