The Process of Producing Specialty Chemicals

Specialty chemicals have an enormous variety of uses; in fact, it's more accurate to say that in most cases, it's possible to produce a specialty chemical that suits whatever the needs of a particular process might be.

What are Specialty Chemicals?

Most chemicals are categorized in one of two groups: commodity chemicals, and specialty chemicals. Commodity chemicals are those that are produced in vast quantities, and are fairly basic and inexpensive to produce. These tend to be produced in a plant that produces enormous amounts of just one or two different chemicals.

Specialty chemicals are somewhat different, in that most specialty chemical manufacturers tend to produce much smaller amounts of their products. These specialty chemicals tend to be more expensive than their commodity counterparts (in part due to the effects of economies of scale), and are used less frequently for more specific and refined purposes. Specialty chemicals include inert greases, oils, and waxes, chemicals used in laboratories, water treatment chemicals, epoxies and resins, food additives, pharmaceuticals, and photographic chemicals.

How are Specialty Chemicals Designed and Produced?

A useful aspect of specialty chemicals is that they can be custom designed to meet the specifications of a particular product or process.

The important thing to understand is that every chemical is made up of molecules that are in turn made up of different combinations of atomic elements. Each element has its own special set of chemical and physical properties, and depending on the combination of elements that are used, the chemical substance will have certain chemical and physical properties of its own.

These chemical properties are, overall, dependent on one hugely important factor: the number of electrons that a single atom of a single element is made up of. Amazingly enough, for example, the sole basic difference between elemental oxygen and elemental carbon is that an atom of oxygen has eight electrons, while an atom of carbon has six. This basic difference means that each element has entirely different physical and chemical properties.

This might seem like a rather long-winded explanation, but it's important for understanding how a chemist can design various types of specialty chemicals, because the ways in which various different elements react is also determined largely by the number of electrons an atom of each element contains.

Another important concept is that an atom of any element has a series of layers of electrons, called shells, and with the exception of the innermost shell, each can hold up to eight electrons. An atom that doesn't have a filled outer shell will form chemical bonds with other atoms, if it can, to fill that outer shell.

An atom of elemental fluorine, for example, has a total of nine electrons, and has an outer shell that is 'missing' one electron. It's this atomic structure that makes fluorine a highly reactive element when it's present in its pure form. You could say that fluorine 'wants' to react with other chemicals so badly that it will react with almost anything in its efforts to fill up that outer shell. This makes fluorine-and other halogen gases-quite important in the production of certain specialty chemicals. These halogen gases form compounds that are highly stable, because of their special atomic structure.

This made seem like an incredibly complicated business to an 'outsider' who isn't familiar with chemical processes. To the chemists who design and produce specialty chemicals, it's second nature. Chemists have the background knowledge-the understanding of all the different properties of each element-that allows them to design specialty chemicals that have the desired properties.

With knowledge of the different chemical and physical properties of elements and molecules, specialty chemists can design and produce chemicals that are inert and non-reactive at high temperatures, chemicals that repel water or dirt, that are used as lubricants, or as pharmaceutical drugs. The key is that the designer understands how to combine elements and chemicals to come up with a finished product with the chemical and physical properties that are needed.

Applications of Specialty Chemicals

The various applications of specialty chemicals are even more diverse than the chemicals themselves. Specialty chemicals are used in a vast array of

industrial processes, and are produced as finished products.

Top applications include pharmaceuticals (in fact, more than half of current pharmaceuticals can be classified as specialty chemicals, they are fluorinated during the manufacturing process, to improve the bioactivity and stability of the finished product), fertilizers and pesticides, dyes, surfactants, plastics, elastomers, and photographic chemicals. Inert lubricants are widely used in automotive industries (including aviation and marine) and in many industrial processes. Specialty chemicals are themselves very often used in the production of other chemicals and finished products.

About the Author

About Author: Stephanie Larkin is a freelance writer who writes about issues and topics pertaining to the use of chemicals such as Anesthetic Gas

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