

Study of the Structure and  
Use Nouns in  
English Chemical Manuscripts

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## Introduction

An understanding of Compound nouns which occur frequently in dense scientific and technical writing is essential for communication in English for Science and Technology. Students translating from Spanish to English and vice versa while reading an English bibliography need to recognise compound nouns as a grammar structure. Students need to acquire three major skills: they must comprehend (1) the meaning of three-six noun compounds ; (2) form the plural and (3) use this structure for clear, concise expression. We should also point out that this structure can have two problems:

1- when students face the option of choosing a noun either as a premodifier or postmodifier and

2- whether to choose a noun premodifier or an adjective when both are acceptable.

Because they are concise, compound nouns are the most dynamic and flexible of all structures that occur in scientific English. Thus, nominal compounds are used to shorten the message in an analysis ; they are also prevalent in headlines for scientific newspaper articles.

What do you think of these compounds :

Chain scission reactions

X-Ray Fluorescence Spectrometry

Polymer Process Engineers

A xenon-chlorine blue-green laser

Drug metabolism rates

So the first step is:

## Recognition

Underline all the compound nouns as you read this article in the *Est Journal* and translate them into Spanish:

"Polymer Synthesis: Step growth polymerizations"

Many polymers produced by step growth processes are synthesized in the melt phase .... One advantage of traditional melt phase polymerizations is the ability to produce high molecular weight polymer without the need for organic solvents... Furthermore in a reaction system driven by the removal of a small molecule condensate, any enhancement of condensate removal would be expected to produce a corresponding increase in reaction rate. (Plastics Engineering, Official Publication of the Society of Plastics Engineers. December 1997).

Thus, throughout this presentation we will introduce and present these steps with appropriate exercises and drills that focus on important reading and writing skills. Our goal is to show the contrast between the Spanish and English use

of the noun phrase so students will be better able to understand and use it in both languages. The examples have been taken from chemical manuscripts submitted for international journal publication and from student chemistry translation.

## Results an Discussion

First, we should point out that since we are teaching translation and reading-comprehension to our students, the exercises and grammar points must be included within the context of the study material. That is, our explanations of the nominal grammar and structure should be given as they are encountered in the text and reinforced with the following ideas and suggestions.

*Compound Words* are two or more terms used to express a single idea (examples : heat treatment : treatment with or by heat).

Long compound nouns are sometimes difficult to understand. However, they are not as difficult as they look, if you follow this principle; begin at the end and then work backwards. Look at this example :

A ball tube distillation oven

What is the last word ? ... Oven

Therefore, the most important thing is that it is some kind of oven.

What is the next to last word ? ... Distillation

Therefore, it is an oven used for distilling things.

What is the third word from the end ? ... Tube

Therefore, it is an oven with a tube.

Notice that ball is near tube so it is modifying tube and not oven.

Therefore, this nominal phrase means

An oven for distilling things with a tube that has a ball shape.

Translation: horno para destilar con un tubo redondo.

More examples:

charge transfer processes

the carbon and oxygen basis sets

halogen and alkali ions

cluster size requirements

Exercise1: formation:

Choose one word from Column A that can be combined with a word from Column B to form a compound noun:

**A**

chaintre

soil

equilibration

**B**

atment

reaction

profile

stability	valve
curve	solution
heat	titration
buffer	time
area	dioxide
blank	criteria
magnesium	capacity

However, the just mentioned rule of reading backwards does not always apply in translation into Spanish. In most instances in the case of three-noun compounds, the noun in the middle is the head, then the last one is translated and finally the one in the first position. For example :

"ligand association constant: asociación de la constante del ligando".

We should note that this rule does not apply when we have unit modifiers like a protein-ligand system; we will refer to this point when we talk about unit modifiers.

## Qualifying Words

In scientific English a word which can be used as a noun is also often used as a word to qualify another noun. This happens because many nouns do not have a special adjective form. For example :

Laboratory work

Chemical laboratory vs. Chemistry students

Here, laboratory appears first as a word which qualifies the noun work and, secondly, as a noun which is qualified by chemical.

The question that arises now is why "chemical laboratory" and "chemistry students". The answer is that in the first case, "chemical" is describing a certain kind of laboratory while in the second example, the students are not described but rather we are told what they study, i.e., "chemistry". Another similar example is that of "chemical manuscripts" because there is a description of the kind of manuscripts to which we are referring. However, it is also acceptable to say "chemistry manuscripts" in which case we are not describing the manuscripts but rather referring to the topics they deal with.

Other examples: The word "potential" can be used both as a noun or as an adjective: potential energy, the same potential ; the same applies to "constant", for example: the dissociation constants and the constant rates which means "the rates of the constants".

Simple use : A single noun can be used as a qualifying word.

Heat removal = the removal of heat.

Gas turbine = a turbine driven by a flow of gas.

Turbine gas = the gas in a turbine.

Compound use : a number of nouns and adjectives are used as qualifying words.

Cylinder head design = the design of the cylinder head.

Heat removal plant = the plant for the removal of heat.

Main heat removal plant = the main plant for the removal of heat.

We should point out that the relationship between the two nouns forming the compound can take many different forms. For example, let's compare:

- Laboratory method : a method being employed in the laboratory.

- Laboratory preparation : preparation made in the laboratory.

- Laboratory work : work performed in the laboratory.

The relationship between the nouns in a compound structure can be seen in 6 areas in terms of the meanings they have when they are expanded.

1- A compound nominal in which the second element is "composed of" the first which designates a substance. Thus:

sodium atom : atom of sodium

manganese dioxide films: films of manganese dioxide

Usually, the first element is a substance of some kind though in some cases the first element can operate differently: gas jar which is "a jar in which gas is kept".

2- A compound in which the first element indicates the source of the second:

Laser beam: the beam of the laser

3- The first element is the result of the operation described by the second:

nitrogen fixation: the fixation of nitrogen.

oxide growth: the growth of the oxides.

4- The second element shows the manner or degree of composition of the first:

particle size: the size of the particle.

oxide density: the density of the oxides.

5- The first element indicates the purpose for which the second is used :

a distillation flask: a flask for distilling.

6- It indicates an "instrument".

a- manner of operation : a blast furnace : a furnace that works by blasting air.

b- measurement: percentage composition: composition measured by (means of) percentages.

c) cause: friction losses: losses caused by friction.

Exercise 2: Reading-Comprehension. Cross out the wrong alternatives.

1- A gas turbine is

a- a turbine which works by gas.

b- gas found in or produced by a turbine.

2- A battery car is

a- a car driven by batteries.

- b- a battery for a car.
- 3- A blast furnace is
  - a- a furnace producing blast.
  - b- of the type which works by blasting air.
- 4- A water tube is
  - d- a tube containing water
  - e- a tube with water.

Exercise 3: Explain the meaning of the following:

- 1- nitrogen compounds:
- 2- nitrogen solution:
- 3- nitrogen cycle:

Exercise 4: Write specifying definitions of the following:

- 1- a filter paper:
- 2- a paper filter:
- 3- steam consumption:
- 4- metal tubes:
- 5- sodium atom:
- 6- gas burner:

Definition of compound nominals is therefore necessary and helpful to understand the meaning in English and the translation into Spanish.

## Hyphenation and unit modifiers

With longer compounds hyphens have to be used with care in order to make the meaning clear. For example, the double-layer capacity. This could mean either:

The double capacity of the layer;

The capacity of the double layer.

We mean the second alternative so we solve this situation by writing the compound with a hyphen:

The double-layer capacity.

Unit modifiers are two words used as an adjective ; they may consist of a noun and an adjective (e.g., time-dependent reaction, water-soluble polymer, halogen-free oscillator), an adjective and a noun (e.g., high-frequency transition, small-volume method, first-order reaction) or two nouns (e.g., ion-exchange resin, liquid-crystal polymers, transition-state modelling, charge-transfer reaction, gas-phase hydrolysis).

There are certain rules to keep in mind regarding these unit modifiers. We do not hyphenate the unit modifiers that are chemical names:

amino acid level

barium sulphate precipitate  
sodium hydroxide solution

They are not hyphenated if one of the words is a proper name:  
Lewis acid catalysis.  
Fourier transform technique.

We hyphenate unit modifiers that contain a verb or a present or past participle:

methyl-substituted intermediate      rate-limiting step  
ion-promoted reaction                      problem-solving abilities

The Spanish version may cause more difficulty than the English one because we have to elaborate a little more on the meanings of these unit modifiers.

### Plurals

Charge development vs. Charges development

Notice that the development of the charges becomes the charge development. That is, the first half of a compound is never plural. This is because the first noun is in the place of an adjective and adjectives in English are never plural. Also notice that it is still not plural even with a plural number:

"Samples weighing between 25 and 50 mg"  
become 25- to "50-mg samples".  
"A flask that stores up to 5 litres"  
becomes a "5-litre flask".

Nevertheless, we can write "humic acids affinity", "humic substances solution", "affinity constants distribution", because in these phrases the nouns have an adjective that is qualifying them so they keep their function as a noun and not as modifiers of the last noun.

Exercise 5: Condensing phrases. Write out these sentences changing the words or phrases in italics into parts of compound nouns:

- 1- The pH-rate profile for the kinetics of the degradation of compound 1.
- 2- The rate of the change in frequency

### Premodification or postmodification

The complexity of compound nouns usually makes it impossible to give simple rules for when to use a compound (like the deposition conditions) and when to use the+noun+of+noun (like the conditions of deposition). Choosing the better alternative is something that only comes with practice. To get this practice students should try to use compound forms whenever they think they are possible. However, the difference in meaning between the compound and

thenoun+of+noun structures is clear in one area: containers. Consider the difference between this very simple example:

the reaction cell: the cell where the reaction is carried out the reaction of the cell: the way the cell reacted+

If there is no container involved there may be no difference in meaning, as in "irradiation source" and "source of irradiation".

Exercise 6: Study the following pairs of expressions. Decide whether they are the same or different in meaning. If they are different in meaning, explain the difference.

- 1- an aluminium alloy and an alloy of aluminium
- 2- a heat source and a source of heat
- 3- the structure of the macromolecule and the macromolecule structure
- 4- a laser beam and a beam of a laser
- 5- a radical source or a source of radicals
- 6- the ion stability constant or the stability constant of the ion

Exercise 7: Make this passage more concise by using compound nouns.

The parts in *italics* could be changed.

Extensive work about the selective "phosolysis of the laser" has been undertaken to generate molecular free radicals to study such reactions. The "deposition of amorphous silicium" by chemical deposition "of photoassisted vapours" illustrates the relationship between "the dynamics of reactions in gas phase, the chemistry of gas-surface", and analysis by "spectroscopy of laser" to dilucidate the "mechanisms of dissociation and deposition".

In principle, we find no strict rules for using noun premodifiers or post-modifiers. We should continue to research this topic and draw conclusions from the manuscripts we use for student practice.

## Proper names

The names of people used as qualifying words comprise a compound structure: Kelvin scale = the scale invented by Kelvin.

Bohr atom = the atomic structure proposed by Bohr.

Bunsen burner = a burner used for providing heat in a laboratory.

Note that proper names are not used as qualifying words in the names of laws, theories, theorems or diseases. In these cases we use the possessive genitive

- Avodagro's hypothesis
- Einstein's theory
- Maxwell's equations
- Chagas ' disease



### Rules

1- Reference to single people who have made inventions take the compound noun structure.

2- References to single people who have made discoveries take the possessive genitive.

3- The naming of methods, techniques and reactions may follow either rule 1 or rule 2. It is necessary to learn which form is usually used in each particular case.

Exercise 8: Identify the following examples and explain the structure:

- 1- Fourier's theorem
- 2- The Faraday effect
- 3- The Stern-Volmer plot
- 4- Lavoisier's experiments
- 5- Faraday constants

This should help students understand what they are reading in English and/or put in English what they already know in Spanish.

At this stage, we propose the following exercises:

Exercise 9 A: Turn into English the following phrases:

- 1- la excitación de la molécula
- 2- proceso de absorción láser
- 3- la presión de  $\text{PhSiH}_3$
- 4- las condiciones de trabajo
- 5- analizador de espectros de  $\text{CO}_2$  mm.

Exercise 9 B: Turn into Spanish the following phrases:

- 1- the ball tube distillation accessory
- 2- a rotation drying flask
- 3- silver and gold surfaces
- 4- the bulk metal distance
- 5- rotation drying and sublimation

Exercise 10 A: Turn into English the following titles of chemical publications:

- Irradiación láser de  $\text{SiH}_4$ : Distribución de tamaños de los polvos de Si obtenidos.
- Influencia del cambio de pH local en la transición activa-pasiva de titanio en soluciones de sulfato a distintos pH.
- Disolución anódica de electrodos de tungsteno en soluciones alcalinas de hidróxido de sodio.

- Diferencia de energía para estados rotacionales puros del HF, su importancia en relajaciones R-R,T.

Exercise 10 B: Turn into Spanish the following headlines from journals:

- Corona treatment and surface force measurements.
- A flow chart for trouble shooting problems of high melt temperature.
- Twin-screw extrusion technology.
- Surface forces apparatus.

## Conclusions

Although we are not chemists, we are scientific translators who have the grammar knowledge to support the choices we give our students. So we can draw several conclusions from this theoretical and practical noun study. The shorter form of a nominal is used for a definition, purpose, operation, materials, purpose of application, professional engagement of a person, shape/form and derivation of structure. Although several nouns can be used as premodifiers, these nouns should go in the singular except in those cases when they are premodified by an adjective.

Taking into account that translation backwards in English does not always apply and that only practice can solve ambiguous cases, then it is proposed that semantics be considered over grammar as a parameter of choice in both languages.

Thus, our twofold goal:

- 1- make EST (English for Science and Technology) students aware of compound nouns and challenge them to use this concise structure;
- 2- give our translation students the tools to be able to translate to/from English and Spanish.

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