



ENERGIZING KENYA



THE PERIODIC TABLE OF ELEMENTS AND LUBRICANTS

Yes, definitely sounds familiar to an afternoon high school double lesson in chemistry, but we shall try to make it short, sweet and business minded because that is what we are here for, and not another take away “feline” test.

Today, we look at the diversity of elements found in lubricants and how they are combined to form the useful and complex constituent parts. The understanding of the periodic table of elements predictive power helps us appreciate that in business, it may not be the properties of a material you may be using that are the most important factor but that legislation or market forces could influence your business model, and also market share.

Some cases to note include controls on environmental pollution instigated the ban of lead additives and other toxic substances derived from chlorine, boron and cadmium, and on the other hand, although strontium would be a better option, barium is the preferred grease additive to date since strontium was in high demand in the manufacture of the old school cathode ray TV screens since its invention. Most recently, increased demand for lithium for electronic batteries and the push for environmentally friendly electric cars that also rely on lithium batteries may affect the dominant position of lithium as a grease additive.

Global geopolitics in production, supply and distribution of crude, base oils and rare earth metals will also continue to determine the availability, accessibility and affordability of these elements, or rather, their very useful complex compounds that we find in every service or every day lubricant.

Element(s)	Compound(s)	Application(s)
Carbon	Graphite	Solid grease additive, simplest lubricant (graphite)
Carbon + Hydrogen	Naphthenes, paraffins, polyalphaolefins, polybutenes	Base oils and viscosity modifiers
Carbon + Hydrogen + Nitrogen	Amines	Antioxidants, dispersants, corrosion inhibitors
Carbon + Hydrogen + Sulphur	Olefins, polysulphides	Extreme pressure and antiwear additives
Carbon + Hydrogen + Oxygen	Polymethacrylate, phenols	Pour point depressants, viscosity modifiers, antioxidants
Carbon + Hydrogen + Nitrogen + Oxygen	Polyurea, amides, alkanolamines	Grease thickener, friction modifiers, dispersants, metal working fluids
Carbon + Hydrogen + Sulphur + Oxygen	Esters, fatty acids, thiosulphites	Base oils, additives, antiwear additives
Carbon + Hydrogen + Sulphur + Oxygen + Nitrogen	Dithiocarbamates	Ashless dispersants
Carbon + Hydrogen + Sulphur + Nitrogen	Thiadiazole	Metal deactivators
Carbon + Hydrogen + Oxygen + Phosphorous	Phosphates, phosphonates	Extreme pressure additives, antioxidants for fire resistant hydraulic fluids, detergents
Carbon + Hydrogen + Oxygen + Phosphorous	Thiophosphates	Extreme pressure additives
Carbon + Hydrogen + Oxygen + Phosphorous + Nitrogen	Amine phosphates	Antiwear additives
Calcium	Calcium sulphonates	Detergents
Sodium	Sodium sulphonates	Emulsifiers, corrosion inhibitors for metal working fluids
Zinc	Zinc compounds	Antiwear additives
Magnesium	Magnesium compounds	Detergents for low speed pre-ignition in modern passenger cars
Boron	Boron compounds Boric acid	Dispersants, antiwear and corrosion inhibitors Complexing agent for greases
Silicon	Silicon compounds	Antifoam agents and greases
Silicon + Oxygen	Bentonite clay	Clay grease thickener
Aluminium, Calcium Sodium + Oxygen	Oxides	Grease thickeners
Lithium or Aluminium or Calcium + Carbon + Hydrogen + Oxygen	Hydroxystearates	Grease thickeners
Molybdenum + Sulphur	Molybdenum sulphides	Solid grease additives
Tungsten + Sulphur	Tungsten sulphides	Solid grease additives

The understanding of these elements and critical role each plays has an important role in determining the quality of our lubricants. For example, a deficiency in calcium or magnesium will affect the lubricants ability to clean the engine, a lack of molybdenum may render grease useless in dusty, water prone and high temperature environments, too much silicon may impact oil analysis interpretation on service drain intervals, and a wrong combination of carbon + hydrogen will affect the performance of the oil in very low temperature environments or its ability to ensure power transformer reliability.

When testing lubricants for whatever application, it is essential that the new oil has the right quantities and combination of each element, so that when the used oil obtained is analysed, the reference point is clear in order to effectively assist reliability professionals make sound and timely maintenance decisions to enhance equipment life, enhance equipment availability and support business objectives.

Chemistry means business!!!

References: *Lubes 'n' Greases, April 2019, Sat at the Top Table by Trevor Gauntlett.*