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Editorial

Thought for Food

Chemical industry depends strongly on the price and availability of raw materials. On the other hand, its ability to transform otherwise useless or even harmful materials into valuable products is impressive.

We can now observe the growing scarcity of many minerals that are chemically transformed into much needed products. The ups and downs of oil and gas availability are familiar to any informed person in every country but there are reasons for concern over the majority of the elements in the periodic table. Indeed, the list of abundant elements is limited to H, Na, K, Ca, Ti, Fe, Al, C, Si, N, O, S and Cl while He, Zn, Ga, In, Ge, Ag, Te, Hf and As are under serious threat of becoming unavailable within the next 100 years or less. The situation for every element appears in a periodic table created by Mike Pitts and colleagues at the UK's Chemistry Innovation Knowledge Transfer Network and it can be easily obtained from sites and blogs in the Internet.[1]

Facing this situation requires very good knowledge of the various practical uses of each element, the respective life-cycles, availability within low grade ores that can eventually become commercial, recycling procedures and fate in the environment.

Phosphorus is a good example: phosphates are essential for the production of fertilizers and it also enters a number of industrial products, from anticorrosives to surfactants and many specialty chemicals. Known phosphate reserves are concentrated in few countries, they are expected to last for 50 to 100 years only and the peak production is forecast for the year 2030, when it will start to decrease. Phosphorus makes ca. 1% weight of the human body and has no conceivable replacement as plant or animal nutrient. In Brazil, it has been extracted from various minerals, including monazite that is a source of rare earths.[2,3]

On the other hand, a significant fraction of the overall amount of phosphate supplied to plants is not used by them, because it is strongly adsorbed in soil minerals like iron(III) and aluminum hydrous oxides, wherefrom phosphate is not easily recovered. This is exacerbated in tropical, largely weathered soils as in Africa, Australia and Brazil, creating a serious problem, since a scarce good is actually being wasted. A question arises: what do we know about the possibilities for increasing plant accessibility to phosphate trapped in the soil, thus increasing its availability to plant growth?

Currently, the fertilizer industry increases the solubility of phosphate minerals by treating them aggressively with concentrated sulfuric acid at high temperature but this is not a conceivable solution for adsorbed phosphate. Other ways need to be devised to supply plants with the needed phosphate while preventing it to be trapped in the soil. Even more important, we need technology to release trapped phosphate from the soil and from rock, that can allow us to use low-grade ores.

This is currently unavailable knowledge that has to be created. There are fundamental questions to be answered, including much new chemistry. It is not as familiar like making new chemicals or inventing new reactions or nanostructure. This needed new science is not within the currently fashionable research topics. However, our descendants will suffer if we do not do it. Now.

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