

Dependency on critical raw materials for energy, medicine and biology

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Abstract

Several terms for naturally occurring minerals resources have been used viz. heavy metals, trace elements, noble metals, rare earth elements etc..in literature. These are non-renewable resources. Certain metals are abundant on earth crust, while several others are less than 1% of the total matter which are called trace elements. How long these naturally occurring resources last at the current pace of consumption is a big question. One of the classic e. g. is phosphorus and naturally available rock phosphate is confined to a few countries and demand for phosphate fertilizers is growing and finding solution for its sustainability is yet to be answered for India [1,2]

Seventeen of the metals having unique physicochemical properties are referred to as rare earth elements (REEs) encompassing the Lanthanoids, Scandium and Yttrium. Most of them are not rare at all; for instance, Cerium is the 25th most abundant element (more abundant than Sn and Pb, just after Zn). “Rare” relates to the considerable difficulties in separating one REE from another because of their close similarity in chemical and physical properties. Chemists are generally interested in REEs due to their unique chemical properties. However, currently, environmental biologists, plant and molecular biologists have also discovered that REEs are a hotspot. Even though these elements—also known as metals—have been the subject of numerous studies on their biology, biologists still know very little about the mechanisms by which these elements act in different organisms (particularly with regard to lowering their toxic effects at high doses) and about the domains in which these metals can be employed as biotechnology. One unique property of REEs is their ability to attach to other molecules and increase a number of physiological processes, including growth and development. Other eight essential metals (Y, La, Ce, Pr, Nd, Gd, Tb, and Dy) belonging to the so-called group of rare-earth elements (REEs) commonly referred to as lanthanides, which are characterized by unusual physical and chemical properties, in particular magnetic and optical properties, are utilized in a smart-phone. Some REEs are essential to the manufacture of smartphones, tablets, and computer flat-panel screens, and also in computers hard disk drives, special alloys, fluorescent and LED lightings, catalytic converters, medical imaging devices, etc. There are 15 REEs which are classified into two groups: light REEs (La, Ce, Pr, Nd, Sm, Eu, and Gd) and heavy REEs (Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y). The REEs commonly occur together in the Earth’s crust in carbonatites, alkaline igneous rocks, ion adsorption clay deposits, and monazite-xenotime-bearing placer deposits.

Keywords: raw materials, energy, metals, rare earth elements, biotechnology

References:

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