



Increased demand for chemical elements of emerging technologies. Is it a concern for environmental health?

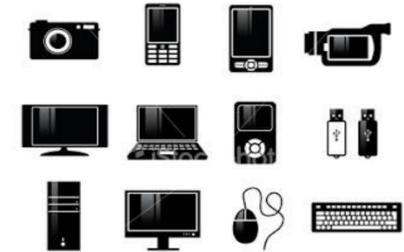


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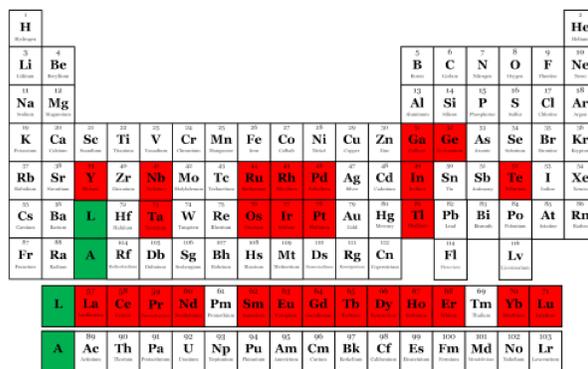
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In recent years there has been an increase in the manufacture of several emerging technologies (computers, cell phones, robotics and all the gadgets we know). Similarly, there is an increase in the production of products used in renewable energy (photovoltaic and electricity). To be able to produce these are necessary some elements that are critical for their manufacture as it is very difficult to replace in addition to its scarcity in the environment. These are the so-called technology critical elements and energy critical elements.



Technology critical elements



Energy critical elements

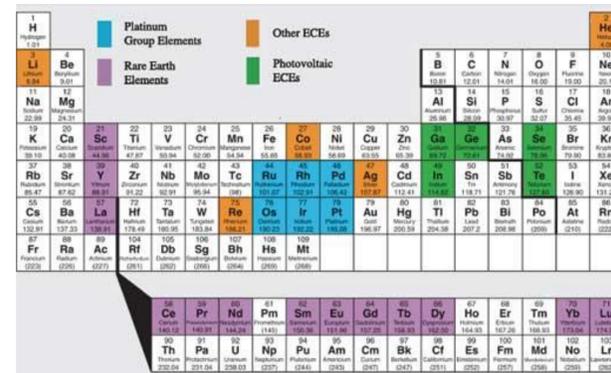


Fig. 3 Technological and renewable energy products .

Fig. 2 Periodic tables of elements showing which are the critical elements of technology and critical elements of energy.

- It has been observed that some of these elements (REEs) have the capacity to bioaccumulate and produce biological effects. On the other hand, we recently observed that Tantalum shows biomagnification in aquatic ecosystems. It has been reported that REEs levels have increased due to anthropic activities in China (China has started REE monitoring program).

•Globally, it has been reported that these elements have not increased, which may be due to the recent use of these elements.
•If there is no adequate life cycle of these elements and good recycling and e-waste disposal this could become a global problem.

There is a lack of studies for these elements (baseline, biogeochemical process, effects on the environment as on human health), mainly on tantalum, gallium, germanium, indium, niobium, tellurium, thallium.

References:

Espejo, W., Galban-Malagon C., Chiang G. "Risks from technology-critical metals after extraction." Nature 557.7706 (2018): 492-493.
 Espejo, W., Kitamura, D., Kidd, K. A., Celis, J. E., Kashiwada, S., Galbán-Malagón, C. Chiang, G. (2018). Biomagnification of tantalum through diverse aquatic food webs. Environmental Science & Technology Letters, 5(4), 196-201.
 Santos-Echeandia, J., Neira Del Río, P., Cobelo-Garcia, A. (2019). Less-Studied Technology-Critical Elements (Nb, Ta, Ga, In, Ge, Te) in the Marine Environment: Review on their Concentrations in Water and Organisms. Frontiers in Marine Science, 6, 532.
 Celis, J. E., W. Espejo, and D. González-Acuña. "Chemical elements of emerging technologies are being increasingly demanded worldwide: a possible menace for wildlife conservation?." Animal Conservation.



Fig. 3 Scheme of Circular Economy

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