« Heavy Metal » is for Music not for Science!

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The use of the term “heavy metals” is still questioned and was proposed to be banned from the scientific literature, why?

Two years ago, with my colleague Jean-Claude Bollinger, we questioned on the use of the term “heavy metals” : to use or not to use? [1] and last year I proposed to ban this term from the scientific literature[2], why?

In 1980, Nieboer and Richardson[3] had already proposed the replacement of this nondescript term by biologically and chemically significant classification. Moreover, according to the IUPAC[4], the term “heavy metal” is considered imprecise at best, and meaningless and misleading at worst. The use of this term is strongly discouraged, especially as there is no standardized definition of this term.


However, some authors still proposed some definition; in 2010 Appenroth defined them in Plant Sciences[12], or last year, in 2018, Ali and Kahn[13] proposed their own "comprehensive" definition.

Overall, the term “heavy metal” is based on categorization by density or molar mass (zinc or copper have relatively low density and molar mass compared to lanthanides and actinides). It is often used as a group name for metals and metalloids (i.e., arsenic) that are associated with contamination and potential toxicity. The “heavy metals” list is not clearly defined and often mixes metals and metalloids without clear definition. Eventually, the pejorative connotation of “heavy” associated with the toxicity of metal induces a kind of fear amongst society. All so-called “heavy metals” and their compounds may have relatively high toxicity: human exposure to lead by the addition of tetraethyl-lead to gasoline as an antiknock agent, or to lead paint is well documented, however lead–acid battery does not posed direct threat to humans but may generate environmentally hazardous waste. Nonetheless, metals are not always toxic and some are in fact essential: depending on the dosage and exposure levels and the receiving organism/population, it may be essential or toxic. Known for its use in the US five cent coin, nickel is one of the most versatile metals found on Earth. Nickel is essential for life (in some protein) and its deficiency is accompanied by histological and biochemical changes and reduced iron resorption and may lead to anemia.

To be consistent, researchers should only use well-accepted definitions. In the case of “heavy metal”, this term should be replaced by “metal”, “metalloid”, or “trace metal”. The best way to describe the studied elements is clearly to name them or consider them as a group of elements (metals or metalloids).

Here are the updates of some of our figures (Figures 1 & 2; updated from Pourret and Bollinger[11]). The use of the term still increases!

**Figure 1** Number of publications using the term “heavy metal” in the topic (from Scopus and Web of Science using “heavy metal*” search, data accessed on July 14th 2019).
Figure 2 Proportion of publications using the term “heavy metal” in the topic among time for journals that highly used “heavy metal” term (from Web of Science using “heavy metal*” search, data accessed on July 14th 2019).

References

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