

## **Comparative Analysis of the Latent Value of Elements in Sewage Sludges from the United States, Mexico, the United Kingdom, and Ireland.**

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Research on sludge and biosolids have been largely characterized by studies expounding on their toxicity, highlighting elements that have adverse effects on human health and ecosystems, but very few studies have looked at characterizing the latent and economically valuable elements in sludge. This study looks at 64 elements in sewage sludge that are of economic value including various precious, heavy and rare-earth metals in London, Ireland, the United States and Mexico. Samples were furnace, microwave and acid digested on hot plates in a metal free clean lab before being tested by ICP-MS. The results showed that Fe, Na, P, Zn, Cu, Mn and Cr were found in high concentrations ranging from 1,000 to 10,000 mg/kg and corresponded to an average annual economic value of \$10,000 in 2020. We also found that the affinity towards solid phase was most pronounced by P, Fe, Cu, Ti, Al, Pb, Ba which indicate a proclivity towards extraction from dried sludge. Comparatively, London and Mexico had more economically valuable elements than the other economic regions, and Zn, Cu, Mn were found in high concentration (approx. 10,000 mg/kg) all geographic locations. Given that worldwide consumption and the amount of sewage sludge is expected to grow, the potential economic and ecological gains of extracting metals from sludge might become increasingly significant. It is also in the interest of the circular economy movement to recover valuable resources from waste. In the future, it may be economically valuable to dedicate entire landfills to stabilizing and reclaiming valuable elements from sewage sludge to satisfy the need for critical raw metals. It is therefore in the interest of governmental and private agencies to plan for and implement resource recovery.