

Simultaneously enrichment and extraction of rare-earth elements in ferromanganese nodules

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Rare earth elements (REEs) are have been used in various advanced materials including catalysts, alloys, magnets, optics, and lasers.. However, production of REE is limited in certain areas in the world. Thus, the securing of REE resources has become an important subject for many countries including Japan. In this study, ferromanganese(Fe-Mn) nodules were focused as a new mineral resources, because abundant amounts of Fe-Mn nodules, which contain high concentrations of REEs, are distributed in the exclusive economic zone of Japan. In addition, the present recovery method of REEs is highly costly and environmentally unfriendly. Therefore, this study attempts to establish the simultaneous extraction and enrichment method of REEs from Fe-Mn nodules using iron-reducing bacteria as both low costly and environmentally friendly extraction methods.

S. putrefaciens (=iron-reducing bacteria), powdered Fe-Mn nodules, lactic acid, and mineral salts were added in a HEPES-buffered solution to stimulate iron-reduction reactions. After 10 days, REE adsorbed on *S. putrefaciens* were measured with ICP-MS.

As a result, more than 20% of REEs were adsorbed on *S. putrefaciens*. In this case, La which has the largest ionic radius among the trivalent REE showed the highest adsorption rate, and the adsorption rates decreased with decreasing the ionic radii toward Lu. These results suggested that REE were recovered from Fe-Mn nodules with iron-reducin bacteria, and light and heavy REE can be separated.

