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# Characterization of Bioleaching Efficiency by Acidophilic Iron Oxidizing Bacteria isolated from Abandoned Mining Area in South Korea

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Bioleaching is one of the biohydrometallurgical processes for recycling of lithium-ion batteries. Bioleaching is well known as eco-friendly and cost-efficient technology instead of heat-based pyrometallurgy and acid-based hydrometallurgy. This study focuses on isolation and identification of aerobic, autotrophic ferrous iron-oxidizing bacteria for bioleaching. To isolate of iron-oxidizing bacteria, sediment samples were collected from abandoned mine sites of Daegu, Moonkyung and Janghang in South Korea. The 9K liquid medium with FeSO4·7H2O (33 g L-1) as the energy source (pH 2.0) with 1% of powdered nickel, cobalt, and manganese (1:1:1) or pyrite was used to the enrichment culture of iron-oxidizing bacteria. After three subcultures at 30°C, autotrophic bacteria were isolated on 9K agarose medium. Based on 16S rRNA gene sequence, a total of 45 isolates were successfully obtained and these strains were identified as belonging to the genera Acidithiobacillus (Ac), Alicyclobacillus (Al), and Ferroacidibacillus. Thirty strains with notably high iron oxidation rates were identified as belonging to the species Ac. ferriphilus, Ac. ferrooxidans, Ac. ferrivorans, Al. ferrooxydans, and F. organovorans. Strains belonging to Ac. ferriphilus, Ac. ferrooxidans, Ac. ferrivorans, Al. ferrooxydans, and F. organovorans were showed high iron oxidation rates. Additionally, bioleaching of Li, Ni, Co and Mn (NMC, 1:1:1) was tested using several iron oxidizing strains, as a result, stains 9-P1 and N10 were showed over 90% of bioleaching efficiency. Genomic properties and potential application of these isolates will be characterized and discussed.