



Keywords: *Leaching, Solvent Extraction, Precipitation, Electrowinning*

Methods and Materials

- 1. Leaching:** *The leaching process involves the extraction of metal ions from a solid material using a liquid solvent. In this study, the leaching was performed using a stirred tank reactor with a mechanical stirrer. The leaching solution was prepared by dissolving the metal salt in a suitable solvent. The leaching process was carried out at a constant temperature and stirring rate for a fixed period of time. The leaching efficiency was determined by measuring the concentration of the metal ions in the leachate.*
- 2. Solvent Extraction:** *Solvent extraction is a process in which a metal ion is transferred from an aqueous phase to an organic phase. In this study, the solvent extraction was performed using a mixer-settler. The organic solvent was chosen based on its selectivity for the metal ion and its immiscibility with the aqueous phase. The extraction process was carried out at a constant temperature and mixing rate for a fixed period of time. The extraction efficiency was determined by measuring the concentration of the metal ions in the organic phase.*
- 3. Precipitation:** *Precipitation is a process in which a metal ion is converted into a solid precipitate. In this study, the precipitation was performed by adding a precipitating agent to the leachate. The precipitating agent was chosen based on its selectivity for the metal ion and its solubility in the leachate. The precipitation process was carried out at a constant temperature and stirring rate for a fixed period of time. The precipitation efficiency was determined by measuring the concentration of the metal ions in the supernatant.*
- 4. Electrowinning:** *Electrowinning is a process in which a metal ion is reduced to a metal at the cathode of an electrolytic cell. In this study, the electrowinning was performed using a constant current electrolysis. The electrolyte was prepared by dissolving the metal salt in a suitable solvent. The electrowinning process was carried out at a constant current and temperature for a fixed period of time. The electrowinning efficiency was determined by measuring the amount of metal deposited at the cathode.*

- with end stage chronic obstructive pulmonary disease (COPD)? A comparison of palliative care and quality of life in COPD and lung cancer. *Thorax* 55: 1000-1006.
- Au DH, Udris EM, Fihn SD, McDonell MB, Curtis JR (2006) Differences in health care utilization at the end of life among patients with chronic obstructive pulmonary disease and patients with lung cancer. *Arch Intern Med* 166: 326-331.
 - Jin S, Kim J, Lee JY, Ko TY, Oh GM (2020) End-of-life care practice in dying patients after enforcement of act on decisions on life-sustaining treatment for patients in hospice and palliative care or at the end of life: A Single Center Experience. *Korean J Hosp Palliat Care* 23: 93-102.
 - Lee B, Seon JY, Oh IH (2021) A national study of life-sustaining treatments in South Korea: what factors affect decision-making? *Cancer Res Treat* 53: 593-600.
 - Huh JS, Kim KY (2020) Act on hospice-palliative care and life-sustaining treatment decision-making and institutional measures for its implementation. *J Med Life Sci* 16: 80-83.
 - Cella D, Rosenbloom SK, Beaumont JL, Yount SE, Paul D et al. (2011) Development and Validation of 11 Symptom Indexes to Evaluate Response to Chemotherapy for Advanced Cancer. *J Natl Compr Canc Netw* 9: 268-278.
 - Basen-Engquist K, Bodurka-Bervers D, Fitzgerald MA, Webster K, Cella D, et al. (2001) Reliability and validity of the functional assessment of cancer therapy-ovarian. *J Clin Oncol* 19: 1809-1817.
 - Ferrell B, Cullinane CA, Ervine K, Melancon C lu51004A005ompr *CaBJFE3*203.40