Paper ID: A378

Modelling of Leaching Process of Rare Earth Element Praseodymium (Pr)

N.I.S. Ramle[1,2], W.H.W.Ibrahim[1,2]*, A. Hisham[1,2]

Faculty of Chemical and Natural Resources Engineering, Pahang, Malaysia, [2]Rare Earth Research Centre (RERC), University Malaysia Pahang, Gambang 26300, Pahang, Malaysia.
*Corresponding author: anisah@ump.edu.my

EXTENDED ABSTRACT
Rare earth elements have their unique physical and chemical properties character that makes them important elements in several of high-tech application. It's very important to ensure the efficient separation of REE is carried out optimally. In order to achieve this, understanding the fundamental process is essential. Thus the purpose of this study is to relate how the leaching process occurs by using shrinking core model for a better understanding. Rare earth separation process usually passed through a cascade of physical processing steps including beneficiation process. After filtration, leaching solution is passed through a sequence of solvent extraction process with several mixer-settler steps to separate individual or mixed rare earths compounds. The aims of this work are to study and develop a model for leaching process of rare earth elements, Praseodymium (Pr). It was conducted for the purpose of the recovery of the rare earth element from ore. The mathematical model of this work was developed based on the shrinking core model (SCM). The effect of temperature ranging from 30°C – 80°C and concentration (1.5 mol/L – 3 mol/L) of the reagent was carried out in this work. The developed model from this work can be used to predict the recovery of Praseodymium (Pr) from the solid liquid leaching process which can be a good reference for future research.
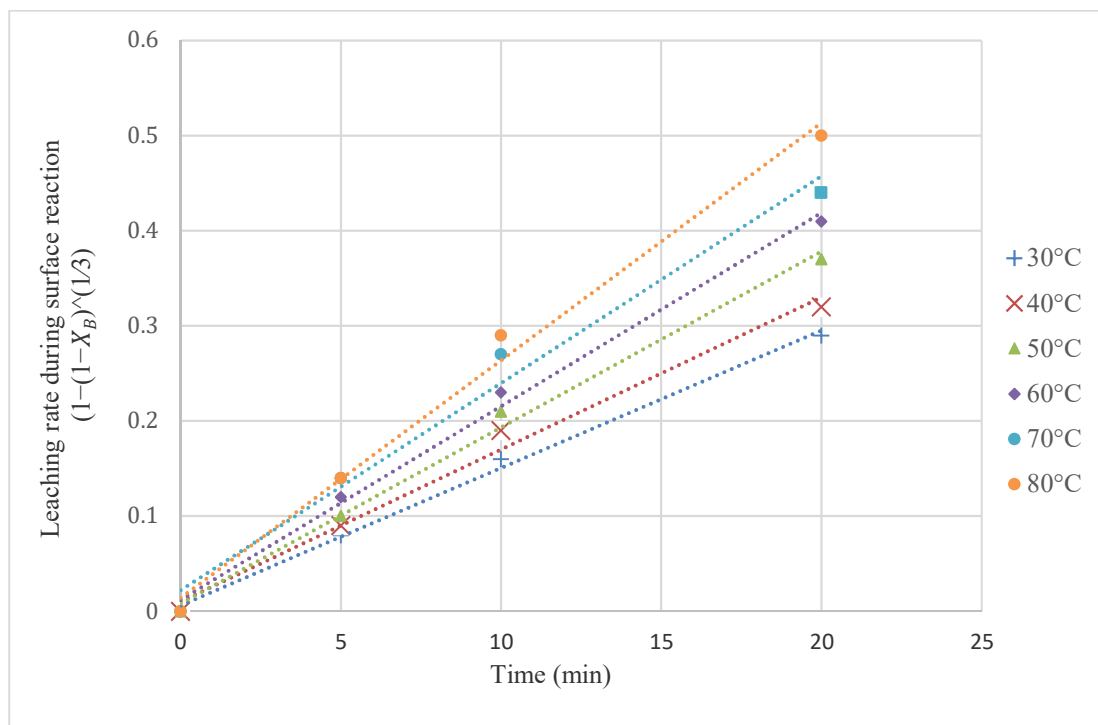
Figure 1: Effect of temperature on RE leaching rate during surface reaction stage
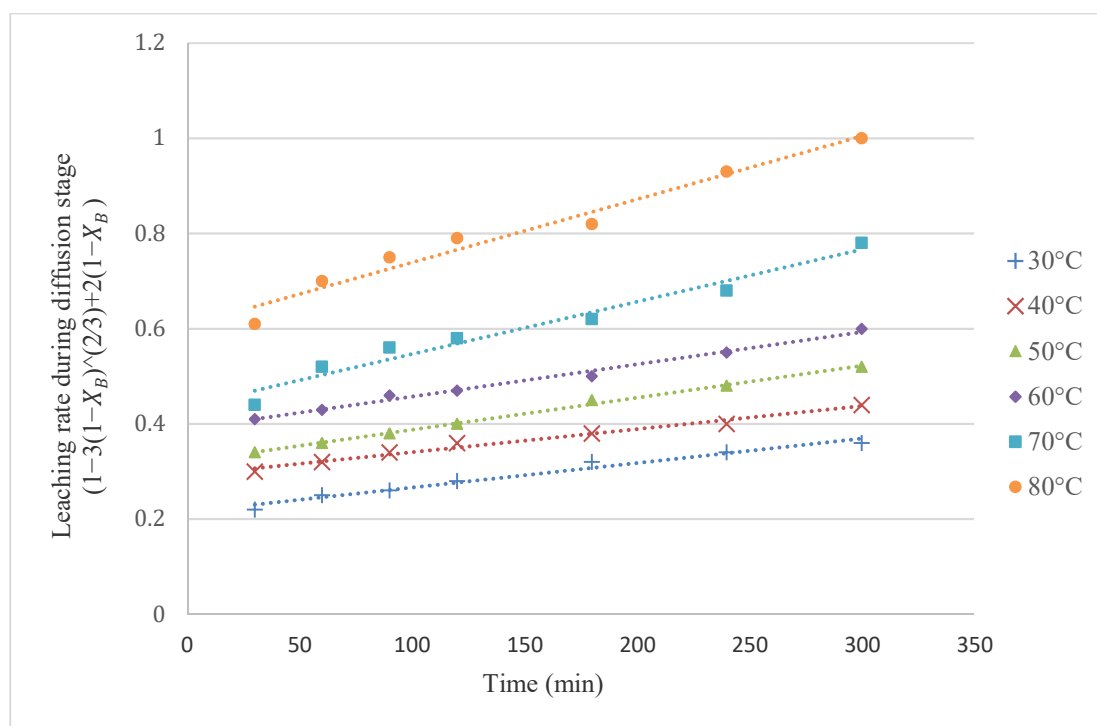
Figure 7: Effect of temperature on RE leaching rate during ash layer diffusion stage

The results in Figure 1 and 2 shows that the leaching process is well described by shrinking core model and the rate limiting step is in two step stages, chemical reaction and ash layer diffusion.

Keywords: Leaching Process, Rare Earth Elements, Modelling, Praseodymium, Shrinking Core Model

References

[1] Fogler, H. S. (2006). *Elements of Chemical Reaction Engineering Fourth Edition.* United States of America: Pearson Education, Inc. .
[2] Geankoplis, C. J. (2014). *Transport Processes & Separations Process Principles (Includes Unit Operations) 4th Edition.* Harlow: Pearson Education Limited.
[3] Gupta, C., & Krishnamurthy, N. (2005). Extractive metallurgy of rare earths. *International Materials Reviews.*
[4] Kim, C.-J., Yoon, H.-S., Chung, K. W., Lee, J.-Y., Kim, S. D., Shin, S. M., Yoo, S.-J. (2014). Leaching Kinetics of Praseodymium in Sulfuric Acid of Rare Earth Elements (REE) Slag Concentrated by Pyrometallurgy from Magnetic Ore.
[5] Kuzuya, T., Hirai, S., & Sokolov, V. (2013). Recovery of valuable metals from a spent nickel-metal hydride battery: Selective chlorination roasting of an anodic active material with CCl4 gas. *Science Direct.*
[6] Meshram, P., Pandey, B., & Mankhand, T. (2015). Process optimization and kinetics for leaching of rare earth metals from the spent Ni-metal hydride batteries. *Science Direct.*
[7] Wallace, G. (2015). Optimizaion of Rare Earth Leaching From Ores and Concentrates. Montana, USA: Montana Tech Library.