

**[PRE-DESIGN OF A MANGANESE (IV) OXIDE PLANT FROM  
PYROLUSITE ORE USING HYDROMETALLURGICAL PROCESS  
WITH A CAPACITY OF 58,500 TONS/YEAR]**

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**ABSTRACT**

The main idea of designing the manganese dioxide plant from pyrolusite ore is to meet the current demand for manganese dioxide, which heavily relies on imports, while also supporting the development plans of the battery industry in Indonesia by 2030. The plant is expected to be a solution for the growth of the battery industry in Indonesia and reduce significant exports of manganese ore. The pyrolusite ore, adjusted to a size of 60-80 mesh, is fed into a continuous leaching reactor for the reductive leaching process with  $H_2SO_4$  and  $H_2O_2$ , resulting in  $MnSO_4$ . The reactor output separates the unreacted solid pyrolusite ore from the liquid phase. By using stepwise precipitation with  $NaOH$  and  $Na_2CO_3$ , the side reaction products such as  $Al_2(SO_4)_3$ ,  $Fe_2(SO_4)_3$ ,  $CaSO_4$ , and  $MgSO_4$  are separated, and  $MnCO_3$  is obtained during the carbonate precipitation process. The  $MnCO_3$  is then fed into the rotary kiln for the final product,  $MnO_2$ , through the decomposition process. The  $MnO_2$  product is cooled using a grate cooler and stored in a product storage silo. The plant operates using pyrolusite ore, sulfuric acid, and hydrogen peroxide, with respective annual requirements of 85,370.32 tons, 186,642.61 tons, and 85,370.32 tons. Supporting raw materials required are  $NaOH$  and  $Na_2CO_3$ , with respective annual needs of 91,917.23 tons and 71,097.94 tons. The plant also requires utilities such as water for sanitation, cooling, and boiler feed, with respective hourly needs of 1,840.02 kg, 53,285.72 kg, and 18,581.26 kg. The electricity consumption of the plant is 15,047.18 kWh. The plant is planned to be located in Bolok, Kupang, East Nusa Tenggara, on a land area of 62.4 hectares. The total investment required to establish the plant is Rp 1,190,410,988,144.57. The profitability of the plant is evaluated through parameters such as Break-even Point (BEP), Return on Investment (ROI), and Discounted Cash Flow Rate of Return (DCFRR), with values of 25%, 347.62%, and 66% respectively. Based on these parameters, it can be concluded that the manganese sulfate plant from pyrolusite ore is attractive and feasible to establish.

Keyword: pyrolusite ore, Leaching, Li-ion Battery.