SPENT Zn-C DRY CELLS AS A SOURCE OF MANGANESE

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ABSTRACT

This paper presents a possible way of enhancing the availability of raw materials for our local battery industry. Spent Zn-C dry cells were collected, pre-treated and subjected to various processes like grinding, leaching, and alkalization. The method used is called the hydrometallurgical method, which allows for easy separation of the various components of the spent cell. Manganese dioxide was extracted from the spent dry cells (Zn-C) and hydrogen gas was passed over it to produce manganese metal. From the process, 5.38kg/day of manganese was recovered. This shows about 91% of manganese recovered.

Key words: Spent dry cells, Grinding, Extraction (Leaching), Alkalization, Hydrometallurgy

1.0 INTRODUCTION

Technological development in industrial economies has made enormous strides since eighteenth-century. In developing countries, the emergence of an industrial culture is synonymous with the technological growth of the local industries [Peter, 1997]. It has become necessary to eliminate the high dependence on external sources for raw materials in order for the industries to make maximum contribution to the economy as well as to curb the rapidly dwindling foreign exchange. Nigeria, having realized the importance of indigenous technology as the foundation of modern industry, has decided to close her boarders to many imported goods, particularly those that can be locally produced.

The battery industry is one of such that depends mainly on importation for most of its raw material [Peter, 1997]. The paper takes a look at the dry cell manufacturing. A dry cell is an electrochemical device that has the ability to convert chemical energy to electrical energy. It contains zinc container as the negative plate, carbon rod as the positive, a mixture of MnO_2 and ground carbon as the electrolyte, in paste form. $ZnCl_2$ is added to keep the paste damp by absorbing moisture from the atmosphere. While the demand for dry cell differs widely according to the industrial level of the country concerned, the business of manufacturing dry cells appears as a highly promising industry with production expected to increase rapidly as the living standard improves. However, the trend seems to be on the contrary in Nigeria as most of the industries import almost all their raw materials [Giwa, 1997]. The carbon-zinc cell has become the most popular source of portable electrical energy. More than 7.5 billion cells are sold world wide yearly to consumers giving more than one cell per inhabitant of the world [Peter, 1997]. Due to improvement in technology and socio-economic activities, the use of these cells has increased, thereby giving rise to increase in the demand for the cells. The chemically active parts of a dry cell, that is zinc, manganese dioxide, carbon, ammonium chloride and zinc chloride, are imported by the battery industries, thus giving rise to high production cost. Importing these materials, which of course is at a high cost due to the foreign exchange involved, practically increases the cost of production. Imagine a pack of four Chinese dry cells being sold for thirty naira only to the consumers. This appears to be inexpensive when compared with the amount and prices of these active ingredients (zinc, manganese-dioxide, ammonium chloride etc) to the paste of the dry cells. The companies must be operating at a loss. This becomes even more obvious when one compares the value of zinc, manganese-dioxide cell with some other materials made of zinc or manganese (e.g. galvanized steel structures). Aribisala [1993] found that the chemical active parts of the cell are not produced locally.

Wiaux and Waeffer [1995] found out that an alkaline cell will practically deliver 1.4 watt-hour of electrical energy while the amount of the zinc and manganese dioxide stored physically in the battery has an energetic content equivalent to 10.0 watt-hour. During the process of discharging, one would