

Accepted Manuscript

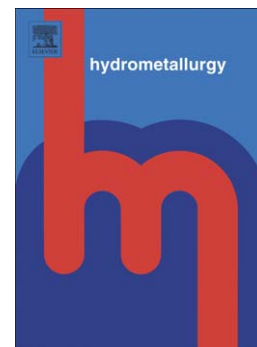
Production of Electrolytic Zinc Powder from Zinc Anode Casing of Spent Dry Cell Batteries

Ashour Owais, Mohamed Abdel Hady Gepreel, Essam Ahmed

PII: S0304-386X(15)30050-5
DOI: doi: [10.1016/j.hydromet.2015.07.014](https://doi.org/10.1016/j.hydromet.2015.07.014)
Reference: HYDROM 4130

To appear in: *Hydrometallurgy*

Received date: 11 April 2015
Revised date: 21 July 2015
Accepted date: 22 July 2015



Please cite this article as: Owais, Ashour, Gepreel, Mohamed Abdel Hady, Ahmed, Essam, Production of Electrolytic Zinc Powder from Zinc Anode Casing of Spent Dry Cell Batteries, *Hydrometallurgy* (2015), doi: [10.1016/j.hydromet.2015.07.014](https://doi.org/10.1016/j.hydromet.2015.07.014)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Production of Electrolytic Zinc Powder from Zinc Anode Casing of Spent Dry Cell BatteriesAshour Owais^{1*}, Mohamed Abdel Hady Gepreel², Essam Ahmed¹¹*Department of Metallurgical and Materials Engineering, Faculty of Petroleum and Mining Engineering, Suez University, 43721 Suez, Egypt.*²*Department of Materials Science and Engineering, Egypt-Japan University of Science and Technology (E-JUST), 21934 Alexandria, Egypt.*

* Corresponding author: ashour.owais@suezuniv.edu.eg, Mobile: +20-1024421622, Fax: +20-623360252

Abstract:

This paper aims to study experimentally the packed bed electrolysis of anode particles obtained from zinc casing of spent secondary batteries, by which electrolytic zinc powder can be produced. Zinc casings of the exhausted zinc-carbon type dry cell batteries were separated from both the internal carbon rods and MnO₂ paste materials and from the external covers then fed into cuboids anode basket made from graphite or titanium. Two stainless steel permanent cathode sheets together with the anode basket were immersed in a basic solution containing 230 g/L NaOH. Electrolytic zinc powders in the form of nano rods, dendritic and/or a dispersed shape with a purity of about 99.8% Zn and with an apparent density of 1203.1 to 2085.2 kg/m³ were obtained. The results indicated that, the graphite basket is better than the titanium one for all studied parameters except for the specific energy demand factor. The deposited zinc powders are contaminated with about 0.0053%Ti when using titanium basket. The process was enhanced with increasing current density, electrolyte temperature, electrolyte stirring rate, and the use of an old electrolyte. The electrolysis process was carried out with cathodic current efficiency up to 94.85%, anodic current efficiency up to 98.97% and specific energy demand in the range between 0.808 and 2.518 kWh/kg Zn with powder productivity up to 1.150 g/A.h.

Keywords:*Zinc-carbon batteries; Zinc anode casing; Packed bed electrolysis; Electrolytic zinc powder***1. Introduction**

Zinc-carbon type dry cell batteries are the oldest and most used type batteries in the world (Khan and Kurny 2011). In these batteries, anode material is zinc and the cathode is a mixture of manganese dioxide and carbon (figure 1) (Shin et al. 2009). A very large quantity of these batteries is used in our daily life, but their lives are limited. They are non-rechargeable (primary cells) which means once discharged, they become useless and are discarded (Belardi et al. 2011; Rayovac Corp 2014). The landfilling disposal of the spent batteries, along with other municipal waste, causes not only environmental hazards but also leads to the loss of these valuable metallic elements and materials (Li and Xi 2005; Belardi et al 2014).

Download English Version:

<https://daneshyari.com/en/article/6659256>

Download Persian Version:

<https://daneshyari.com/article/6659256>

[Daneshyari.com](https://daneshyari.com)