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Waste cathode rays tube: an assessment of global demand for processing

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Abstract

The management of used Cathode rays tube (CRT) devices is a major problem worldwide due to rapid uptake of the technology and early obsolescence of CRT devices, which is considered an environment hazard if disposed improperly. Previously, their production has grown in step with computer and television demand but later on with rapid technological change; TVs and computer screens has been replaced by new products such as Liquid Crystal Displays (LCDs) and Plasma Display Panel (PDPs). This change creates a large volume of waste stream of obsolete CRTs waste in developed countries and developing countries will become major CRTs waste producers in the forthcoming decades. This article provides a concise overview of world's current CRTs waste scenario, namely magnitude of the demand and processing, current disposal and recycling operations.

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Keywords: Cathode Rays Tube; E-waste; Recycling; Solutions.

1. Introduction

Since the 1950s, CRTs have been used in television and computer screens. Historically, their production has grown in step with television and computer demand. In 2001, the global CRT monitor industry was valued at US $19.5 billion, producing 108 million units [1]. However, at present, CRT technology for televisions and computers is obsolete, the market for new CRTs is dwindling and CRT production in the world is limited now [2]. That is because it is an old and highly energy consumptive technology, which is now being replaced by new technologies; like LCDs

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and PDPs but in the most part of Asia-Pacific, Eastern Europe, Middle East and Africa, which are regarded as emerging regions for technology still there is demand for CRT TVs and monitors by low-income consumers because CRT sets are the cheapest option compare to expensive LCD TV sets [3]. Meanwhile, it is also clear that, even for those markets, CRTs will eventually be supplanted [4].

In case of developed nations, at least, it is now impossible to find a CRT computer monitor or television in electronic shops. However, they are still present in the houses of many people, and gradually being replaced by new flat screens [5]. According to WEEE collection and pre-treatment market, about 50,000–150,000 tons/year of end of life CRTs are currently collected within Europe and this flux is not expected to decrease in the next years [6]. Similar in the United State, an analysis of the demand for CRT glass in the United States has discovered that CRTs comprise the largest portion (estimated by U.S. EPA at 43 percent) of the current e-waste stream and significant quantities (6.9 million tons or 232 million units) of CRTs remain to be recovered from homes and businesses in the U.S. The vast majority of these CRTs (85 percent) are projected to be collected and require management over the next 10 years. An additional 330,000 tons (or 12,000,000 units) has reported to be currently stockpiled by processors [2]. The situation is quite similar in Asian country as well for instance in China, in 2012 it is estimated that 190 million personal computers and 74 million televisions will become obsolete [7] and also in 2010, the recycling and dismantling number of waste electrical appliances through "Old for new" policy is 3344.6 million, in which 80% are CRT monitor [8].

Apart from the domestic production of the CRT waste in developing countries, it is also having even Trans boundary movement of CRT waste from developed countries. For example, an independent enquiry carried out by a branch of the US government to find out the widespread distribution of CRTs to the black market by recycling companies [7]. In addition to remote transactions via websites, buyers from developing countries, particularly African countries, are also known to travel to OECD countries as "waste tourists" to secure supplies of e-waste and arrange shipment [9].

Despite all these problems, the management of waste CRT will be required whether through direct re-use, reclamation, resource recovery, and recycling or disposal operations. The recycling of CRT waste is not feasible as economically because of their toxicity and also have few limited reuse options [10]. Whereas, an emerging factor that creates incentives for recycling of CRT waste is the demand of Lead and its higher price. Therefore, the recycling and recovery market becomes an important element impacting both the legal and illegal trans-boundary movement of e-waste worldwide.

The disposal of television and computers is a unique issue due to the fact that most television and computers are often disposed of before they truly become useless. In fact, the main reason for purchasing a new computer is not to replace a non-functioning system, but to keep up with rapidly changing technologies [11]. Additionally, the progressive replacement of old CRT TV and PC screen with LCD or PDPs has creates a large volume of waste stream of obsolete CRTs waste around the world which may going to be cause huge amounts of glasses to be landfilled [12].

Various reports within the past year have been indicated that some processors are stockpiling CRTs specifically in the developed countries due to a lack of market capacity or affordable access to market capacity. Other processors are reporting concerns about the ability to continue securing markets for CRT glass. These market constraints are a concern given the high levels of lead in CRT glass and the continued interest in ensuring the viability of the e-waste recycling industry [2]. This article provides a concise overview of world's current CRTs waste scenario, namely magnitude of production and processing, current disposal and recycling operations.

2. Characteristics of waste CRT

A cathode ray tube or CRT is a specialized vacuum tube in which images are produced when an electron beam strikes a phosphorescent surface. Besides television sets, cathode ray tubes are used in computer monitors, automated teller machines, video game machines, video cameras, oscilloscopes and radar displays. There are two types of CRT: black and white (monochrome) and colour. In general CRT consists of a front panel used as the screen, a neck, which envelops the electron gun, and funnel, which connects the panel and the neck. It is estimated that CRT constitutes around 65% of the weight of a television or a computer monitor and is composed of 85% glass of which