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Study of CFL Bulb and Systematic Removal of Mercury (Hg) from it by Adsorption Process

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Abstract-

Heavy metals are considered among the most problematic polluting agents, due to their harmful effect on human physiology as well as on other biological systems. The heavy metal mercury is a naturally occurring element that is found in air, water, and soil. The presence of heavy metal in natural or industrial waste water and their hazardous impact has generated considerable concern in many years. The current work focuses on that is most important environmental and health risk from used electric Compact fluorescent lamp is due to unscientific disposal which relates to release of mercury. Any breakage or damage to this bulb will result in potential exposure to mercury vapor and powder. Since the mercury is poisonous, it when release to atmosphere lead to air and water pollution. In present study investigation has been carried to remove the mercury from used Compact fluorescent bulbs (CFL) by using Adsorption method. Adsorption method is proven to be a cheap, convenient for waste water treatment during all condition. Among the existing technologies available for mercury pollution control, the adsorption process can get excellent separation methods have been studied.

Key Words: **Adsorption Process, Compact fluorescent bulbs, Mercury, Pollution, Heavy Metal**

1. INTRODUCTION

Now a days, Generally two types of lamps are mainly used in lighting: mercury-containing ones (fluorescent lamps), and lamps without mercury (incandescent lamps and halogen/dichroic lamps). But Fluorescent lamps are widely used because they provide an energy-efficient source for lighting. [1].With the fast market growth of fluorescent lamp, particularly CFLs, the associated emission and risk of mercury, which is an essential component in all types of fluorescent lamps, have received increasing public attention and concerns. When CFL; without it, the bulbs would not produce light. The typical dose of mercury is about the size of a pen tip, and these doses have been getting smaller and smaller.[1] When these bulbs finally do reach the end of their useful life, there are several pathways they can take.It is the mercury that excites the phosphors in a CFL , causing them to glow and give light. The amount of mercury in the most popular and most widely used CFLs is minimal, ranging between 6 mg to3.5 mg. The commercial and industrial sectors dominate usage of fluorescent lamps, accounting for over 90 percent of total usage.[2] Burnt fluorescent tubes and lamps contain mercury powder, which is a dangerous chemical substance that poses serious health hazards to human being and the biosphere. Mercury is a classified hazardous waste. It is highly toxic if inhaled. The current work focuses on rephrasing the harmful effects of mercury that is being released from a number of sources. As waste water, electric bulbs, etc. And Different techniques of mercury removal have been discussed. Mercury is a harmful substance for human health. It can influence the nervous system, the development of the brain, and more. It is particularly harmful for children and can also be transmitted from a mother to a child during pregnancy. It can also cause the disease like Minamata.[3]

Furthermore, mercury spreads very easily through nature, and can enter the food chain, Freshwater, fish, vegetables etc. Mercury is one of the toxic pollutants that must be controlled. Hence the objective is to study CFL bulbs and systematic removal of mercury from it by Adsorption technique. There are many conventional methods to remove the mercury from used CFL bulbs like chemical precipitation, chemical oxidation, ion exchange, membrane separation, Reverse osmosis etc which are very costly and time consuming. The purpose of this project is to effectively extract mercury from fluorescent lamps. The focus will be the methods that can be applied for the efficient recovery of mercury. A variety of treatment technologies are available with different degree of success to control and minimize water[4].

1.1 Problem Statement

The compact florescent lamp was identified as effective approach of promoting energy saving because they provide more light and reduce the power consumption. Though the benefits of using compact fluorescent lamp (CFL) are obvious, these lamps contain Mercury (Hg) a hazardous Element which can be Fatal to human being and environment. Mercury can affect Kidneys as well as central nervous reproduction and cardiovascular system. It is for this reason we have focus on this topic experimental study of removal of mercury (Hg) by adsorption.

1.2 Objective Of Research

I. To study the composition of electric (CFL) bulb .
II. To study the harmful contents of electric bulb on Environment.
III. To study and removal of mercury by Adsorption Phenomean.

2. LITERATURE REVIEW

1.(Haridasan KP1, 2016) EXTRACTION OF MERCURY FROM COMPACT FLUOROSCENT LAMP (CFL) WASTE.–Aim of the research project is to extract mercury from the used CFL bulbs.The author have studied that While manufacturing of CFLs a small amount of mercury is used in vapor form. This mercury, when electrically stimulated, releases UV light, which subsequently reacts with a phosphor coating to create visible light. When CFL; without it, the bulbs would not produce light. The typical dose of mercury is about the size of a pen tip, and these doses have been getting smaller and smaller. When these bulbs finally do reach the end of their useful life, there are several pathways they can take. In the best-case scenario, the bulbs are recycled. Even the CFLs that are discarded in the trash are unlikely to release much of their mercury. Although most of them break under current trash disposal methods, some remain unbroken, and will not release any mercury Finaly at the end mercury is collected in the form of elemented sphere at the collecting unit. The result shows the presence of higher amount of dissolved mercury as a result of the experiment procedures. (Haridasan KP1, 2016)

2.(AMIR SHAFEEQ, 2012) Mercury Removal Techniques for Industrial Waste Water-The research work highlighted the issuses on the harmful effect of Hg releasing from various sources from the industrial waste water.The authors have studied various methods of mercury removal and compared them briefly. In the experimental work following two techniques were performed in the laboratory scale to achieve satisfactory results.

1. Activated Carbon Adsorption
2. Chemical Precipitation using Toho process

Chemical precipitation is a very simple technique and includes the basic reaction and then filtration to remove the precipitates. Large scale of chemical precipitation could be done using the Toho's process which is very effective. In the laboratory scale the results are rather less efficient; however, results up to 96 or 97 percent might be attained using this process on commercial scale.

3.**(P.S Harikumar (2010) Study on the leaching of mercury from compact fluorescent lamp using stripping voltammetry**.-In this report the authors concluded that A study had been done the determination of the amount of

mercury present in an average CFL and the amount of mercury leached from the CFLs into the soil from where they are dumped. The extraction of the mercury from CFLs and the polluted soil was done by acid digestion. The electrochemical analytical method called Anodic stripping voltammetry (ASV) which is based on the potential dependent current measurement was used for the determination of mercury in the CFLs and the polluted soil. The determinations were done by standard addition technique in the exploratory mode.

4.**(Ajay Kumar Meena (2004) Low-cost Adsorbents for the Removal of Mercury from Aqueous Solution-A Comparative study)**, This paper describes the effectiveness of low cost and locally available, untreated and chemically-treated adsorbents for the removal of mercury from the aqueous solution. Their effectiveness has been compared with that of chemicallytreated granular activated carbon. Treated sawdust and untreated weathered coal were found to be the most suitable low-cost adsorbents in addition to treated granular activated carbon for the removal of mercury from aqueous solution. The adsorption isotherm studies clearly indicated that the Langmuir model is in good agreement , with the experimental data on the adsorptive behavior of mercury on treated granular activated carbon, whereas, the experimental data on adsorptive behaviour of mercury on weathered coal and treated sawdust follow both Langmuir and Freundlich isotherm models. The paper presents the results of the experimental studies as well as the model parameters. The results showed that the CFL contains 0.1175 mg/g of mercury.

3. EXPERIMENTATION

Firstly I study the CFL (compact fluorescent lamps) that How much amount of mercury present in an average CFL and amount of mercury leached from the CFLs into the soil from where they are dumped. Then started a survey of collecting CFL lamp from garbage, Houses, dumping yard near to our area.

Fig1. Compact fluorescent bulbs collected.

Fig2. showing the schematic diagram of broken CFL lamp releasing Hg in vapour form.

Fig.3 Granular Activated Carbon to be used as an adsorbent.

Now among the existing technologies available for mercury pollution control, the Adsorption process can get excellent separation effects has taken into study. After studying the

different research papers, we observe that activated carbon is widely used absorbent for heavy metal removal. It has well developed pores and high internal surface area

5. CONCLUSION

This report concludes that the study of CFL bulbs and removal of mercury is essential as it is harmful dangerous element affect to human body and environment too . There are certain methods to remove mercury as disscuss in report but these method are costly,energy intensive and often associated with generation of toxic byproduct.Out of which adsorption method is most useful .Adsorption method is potentially suitable for mercury removal from waste water as this method obtain at low cost and very useful.

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