بسم الله الرحمن الرحيم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

MONA MAGHRABY

شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

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MONA MAGHRABY

REMEDIATION OF CONTAMINATED WATER USING SOME PHYSICAL AND RADIATION TECHNIQUES

By

MOHAMMAD MAHMOUD SAYED ALY DAWOUD

B.Sc. Agric. Sci. (Agric. Engineering), Faculty of Agriculture, Ain Shams University, 2011.

M.Sc. Agric. Sci. (Agric. Engineering), Faculty of Agriculture, Ain Shams University, 2016.

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This Thesis for Ph.D. degree has been approved by:

Dr. Mohamed El-Sayed Abuarab ……..……..
Prof. of Agricultural Engineering, Faculty of Agriculture, Cairo University.

Dr. Mahmoud Mohamed Ahmed Elbordiny ……..……..
Prof. of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Waleed Kamel Mohammed Salim ElHelew ……..……..
Associate Prof. of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Mahmoud Mohamed Hegazi ……..……..
Prof. Emeritus of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Date of Examination: 04 / 11 / 2021

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M.Sc. Agric. Sci. (Agric. Engineering), Faculty of Agriculture, Ain Shams University, 2016.

Under the supervision of:

Dr. Mahmoud Mohamed Hegazi

Prof. Emeritus of Agricultural Engineering, Agricultural Engineering Department, Faculty of Agriculture, Ain Shams University.

Dr. Waleed Kamel Mohammed Salim ElHelew

Associate Prof. of Agricultural Engineering, Agricultural Engineering Department, Faculty of Agriculture, Ain Shams University.

Dr. Hosam El-Din Mostafa Saleh

Prof. of Chemistry of Waste Management, Radioisotopes Department, Nuclear Research Center, Egyptian Atomic Energy Authority.

ABSTRACT

Mohammad Mahmoud Dawoud: Remediation of Contaminated Water Using Some Physical and Radiation Techniques. Unpublished Ph.D. thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2021.

Water pollution, particularly with rapid industrial growth, is one of the most stressful issues in our country. Getting rid of heavy metals has become complicated and costly and also, one of the most difficult challenges facing the water treatment sector in Egypt and the world was the high cost of treatment because it requires very expensive infrastructure and it is a part of the long plans of governments and institutions, as well as the cost of operating these plants.

This work was conducted for an economic, environmental, and efficient solution that using microcrystalline cellulose (McC) for wastewater treatment. Where cobalt and cesium removal mechanism was studied by using Microcrystalline Cellulose and chemically modified microcrystalline cellulose by one of the low-molecular-weight organic acids such as Citric Acid (McC-CA), which are extra chelators for Cobalt and Cesium from aqueous solution and the removal of most harmful of their isotopes (^{60}Co and ^{137}Cs) also have been studied. Also, an engineered system was fabricated to study the removal efficiency of microcrystalline Cellulose for Total Suspended Solids (TSS).

To reach the desired degree of environmental safety and save the effort and time in this research, the Taguchi robust method was used to design experiments to optimize the factors affecting Cobalt and Cesium removal by using Microcrystalline Cellulose (Ion concentration, pH, adsorbent dosage, and contact time) through an orthogonal array (OA) L16 = 4^4 using batch experiments technique.

The results illustrated the contribution of the factors for both Co (II) and Cs (II) by using (ANOVA), where the most efficient parameter was pH followed by the Ion concentration (C), then Sorbent Dose (D), and the last one was Contact Time (T). The optimum combination for Co (II) and Cs (I) adsorption was pH (5-6), C (1-50 $mg.L^{-1}$), D (3-4 $g.L^{-1}$), T (60-100 mins.), and the percent removal for Co (II) and Cs (I) was 74% and 88% respectively. Furthermore, when this combination was applied to ^{60}Co and ^{137}Cs the percent removal ranged from 96.01% to 90.28% for ^{60}Co, and 100% to 94.25% for ^{137}Cs.

Also, Taguchi's robust method was used to optimize the factors affecting TSS removal by the engineered system using McC, (Flow rate, Weight of material, operating time) through an orthogonal array (OA) L9 = 3^3. the optimal combination for TSS removal was recognized as A1B3C1 Where, Flowrate (level 1 = 2 $L.min^{-1}$, S/N = -1.96), Weight of material (level 3 = 1 Kg, S/N = -2.17), and Operating time (level 1 = 30 mins., S/N = -2.8) Consequently, and the optimal number of washing times was five times, which gives results of 88% TSS percent removal, which is equivalent to 49.2 $mg.L^{-1}$. Taguchi approach has been used very effectively to optimize parameters and to improve the reliability according to contour plots and verification tests. The optimum dose of gamma radiation to sterilize the water produced from the engineered system was 20 KGy.

our findings suggested that (McC) is highly efficient in cobalt, cesium, and TSS removal from wastewater as well as the Taguchi approach is a proper strategy to optimize the adsorption parameters and gamma radiation is an effective technique in wastewater sterilization.

Keywords: Microcrystalline cellulose; Wastewater; Heavy metals; Cobalt; Cesium; Radionuclides; Adsorption; Environmental pollution; Taguchi; Gamma Radiation, and Sterilization.

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