SUMMARY

The work in this thesis deals with the study of the sorption and desorption behavior of the elements Cr, Pb, Co and elements that may exist in nuclear waste Eu and Cs, from aqueous media on samples of rice straw, wheat straw, maize straw and sugarcane residue. The possibility of separating these elements from a matrix containing them is also studied. The thesis is composed of three chapters.

Chapter I: a contains concise survey about the studies on the sorption of some heavy metals and some radioactive elements that have great importance in the nuclear fuel cycle on different kinds of straw rice (R.S), wheat (W.S), maize (M.S) and sugarcane residue (S.C). It also includes an account of the chemistry of the elements studied in this work. A literature review about the adsorption process, types of adsorption, adsorption isotherm and the desorption process is reported.

Chapter II: summarizes the experimental part, the chemicals, reagents used, the preparation of the radioisotopes employed and the preparation of the adsorbents. It contains also a description of the instruments used with special emphasis on the counting systems as well as the different experimental techniques used during the adsorption and desorption processes under different factors affecting these processes as pH, contact time, element concentration and type of media on different types of powdered straw, particle size of straw and V/m ratio. The moisture content of sugarcane was determined and found to be 17.7%, maize straw 9.66%, wheat straw 8.14% and for rice straw was 7.79%. All

the straw samples were heated in the oven for 2hours at 110°C before use with elements.

Chapter III: includes the results obtained and their discussion. The results obtained are divided into seven sections. The first section deals with the determination of V/m ratio which was fixed at 100 ml/g and the second deals with determination of the straw particle size, where the particles of straw of diameter 0.63 mm were chosen for the whole experiments conducted.

The third section deals with the sorption of Cr(VI), Pb(II), Eu(III), Co(II) and Cs(I) on different straw and sugarcane samples. For Cr(VI), the uptake reached 100% on different straw and sugarcane residue samples from sulfate solution of pH=1. The sorption of Pb(II) from nitrate solution of pH=5 reached 97% for all the studied samples after 1hour shaking time. While the uptake of Co(II) from sulfate solution of pH=3.5 reached 55%& 25%& 38% and 49% on R.S& W.S& M.S and S.C respectively after 3h. shaking time. The sorption of Eu(III) from nitrate media of pH=3.5 reached 80% on S.C, 75% on R.S, 70% on M.S and 64% on W.S after shaking time 80min. For Cs(I) ions, the uptake reached 50% on different straw from ammonia solution of pH=7 and this value decreased to 40% when using the sugarcane residue.

The fourth section contains the results of studying effect of the ion concentration of the different elements on the uptake process. Which show a relationship between the amount of element adsorbed per gram (X/m) and ion concentration [C] on logarithmic scale and it gives straight line of slope=1 and this linearity means the formation of single

monolayer through the adsorption of the element on the straw samples which agree with Freundlish isotherm.

In the fifth section: The results of the desorption studies of the different elements are given from the three straw and sugarcane residue. The desorption of the metal from the different sorbents in addition to sugarcane sample was carried out by washing the loaded straw with either distilled water or solutions containing different concentrations of similar cation to the element under study. In the case, using water as eluent, it shows low desorption percent where the uptake of the element was high as in the case of Cr(VI), Eu(III), Co(II) and Pb(II) and it gives high desorption value when the uptake was low as in the case of cesium. The desorption of Cs(I) reached 65% from S.C using distilled water. But when using eluents having similar cations to the elements sorbed on straw. The results indicate that, the desorption of Cr(VI) by 0.2M $Fe(NO_3)_2$ reached 29%, 22.8%, 15.35% and 20.33% from S.C, R.S, W.S and M.S respectively. Desorption results of Pb(II) and Co(II) using different concentrations of $MnCl_2$ give 90% for Pb(II) from S.C and R.S and 75% from W.S and M.S when using 10^{-1}M $MnCl_2$ and these values decreased by decreasing the concentration of $MnCl_2$ to 10^{-2}M and 10^{-3}M $MnCl_2$. where, desorption reached 25% of Pb(II) loaded on S.C using 10^{-3}M $MnCl_2$. For Co(II), desorption of Co(II) reached 27% from S.C using 10^{-1}M $MnCl_2$ and this value decreased with decreasing the $MnCl_2$ concentration. Desorption of cesium reached 51% from S.C residue by using 10^{-1}M NaCl and this percent decreased to 35% and 30% by decreasing the NaCl concentration to 10^{-2}M and 10^{-3}M NaCl respectively.

Recycling experiments have been applied for adsorping Pb from nitrate solution of pH=5 using straw and sugarcane samples. Where,

uptake % of Pb(II) reaches 97.9% on R.S (first use of R.S sample).Desorption of Pb(II) from R.S sample using 10^{-1}M $MnCl_2$ reached 86.6% in the first desorption cycle. In the second desorption cycle, it reached 99.4%. Adsorption of Pb(II) in the second cycle reaches 95.8%.

Thus the natural materials handled may be used successfully for partial separation of Eu(III), Co(II) and Cs(I) from their mixtures. Various separation factors of Eu(III), Co(II) and Cs(I) from each others were undertaken. Maximum values for the calculated separation factors; $D_{Eu(III)}/ D_{Cs(I)}$ and $D_{Co(II)}/ D_{Cs(I)}$ are 38.35 and 17.89 at pH=3.5 for R.S sample respectively.

Section six gives the analysis of industrial wastewater as regards Pb and Cr. It gives 12.48ppm for Pb(II) and 9.47ppm for Cr(VI). The sorption of Pb(II) from the industrial wastewater on the different straw and sugarcane residue give 96.3% for Pb(II) sorbed on S.C, 94.5% on R.S, 93.5% on W.S and 94.3% on M.S. For Cr(VI), the amounts sorbed are 97.46% on S.C, 97.4% on R.S, 97.17% on W.S and 97.3% on M.S.

Section seven gives the results of the IR spectra of the straw indicating the presence of –CH, $–CH_2$ and –OH as characterized by the peaks at 3000-2900, 1450 and 3500-3200 cm^{-1} respectively. Which are characteristic for the cellulose molecule structure. This finding is an evidence for that the different straw and sugarcane have cellulose structure. As an example the rice straw is composed of 43% cellulose, 25% hemicellulose, 12% lignin, 3-4% crude `protein and 16-17% ash silica.