PREPARATION OF SOME ADSORBENT MATERIALS USED FOR ENVIRONMENTAL PROTECTION

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ABBREVIATIONS

Crel = Relative concentration

I.C. = Initial concentration

Ceq = Equilibrium concentration

SCS = Surface complex stability

ESR = electron spin resonance

Kd = Distribution coefficient

INTRODUCTION

Introduction

One of the results of development in the world is the problem of pollution. The problem of water pollution began from the earliest time, with the expanding industries, discharging their waste water in neighboring streams which became unfit as a source of industrial water supply.

Heavy metals pollution has recently become a topic of general public concern. Public concern over heavy metal pollution has grown constantly since the outbreak of minamata disease caused by mercury in Japan[1,2]. Man's awareness of the heavy metal hazard now covers a wide spectrum of metals such as lead, cadmium, chromium, silver, copper and zinc[3,4]. Trace amounts of these heavy metals can be beneficial to micro-organisms[5] and plants[6-8], but the presence of heavy metals at relatively high concentrations in the environment has already been proven to be determintal to all living systems. This concern is augmented by the fact that most metals are widely dispersed and can persist in the environment for a long time. The actual toxicity of metals to stream file depends on particular metal present, water hardness, pH, synergistic effect of different metals and other.

1.1 ***Interfacial reaction*** : In the aquatic environment, heavy metals may be classified into at least two different categories : (a) in true solution as free or complexes ions and (b) particulate from adsorption onto other particles, or incorporation into the biomass of living organisms and inorganic precipitates such as hydroxides, carbonates, sulfides and sulfates. In soil-water system, the fate of heavy metals is directly related to their states of identity and the existing environmental condition.

Heavy metals such as lead, copper and zinc play an important role in human life.

1.2 Zinc toxicity :

Zinc has an essential role in both man and plant metabolism as a micronutrient[9]. The daily adult human intake of zinc is 15.00 mg/kg. Consumption of more zinc-content may affect the absorption of copper from the intestine also it may cause anaemia, as zinc has great affinity towards replacing iron in red cells and plasma proteins[10].

Zinc is a common pollutant of surface fresh water in many industrial areas. Its toxicity to aquatic organisms is known to vary with water quality. Jones[11] perhaps first demonstrated that zinc salts in solution were less toxic to the three-spined sickle back in hard water than they were in soft water. Jones also found that hardness affected the toxicity of zinc to the common bluegill.

1.3 Lead toxicity :

Lead is the most frequently encountered metallic poison. Inhalation of lead is hazard in industry (industrial exhausts), when the metal or painted metal is cut or burned. Lead is widely distributed in atmosphere, soil, plants and water fowl. It is absorbed, accumulated and can be identified in most metals and plants to a great extent (lead concentration). Lead intoxication specially in chronic form induces a dangerous losses in animals and man.

The distribution of lead in the body is an important factor in the development of lead poisoning. In blood, nearly all the circulating inorganic lead is associated with erythrocytes. Lead is distributed and accumulated in the soft tissues like liver and kidney in the form of protein-lead complex and is redistributed and becoming deposited in bone and hair (bone Seekers). The deposition of lead in bones is closely resemble for that of calcium[12].

Lead, like other heavy metals, inhibits a large number of enzymes having sulfhydryl functional group and thus interferes with cellular metabolism :

1- Inhibition of SH-group containing enzymes responsible for synthesis of certain amino acids.

2- Inhibition of synaptic transmission of nerve impulses by decreaing the cell receptor resmnce to acetylcholine, this action can be antagonized by Ca^{++}.

3- Lead inhibits the muscle contraction by preventing the regeneration of phosphocreatine.

4- Interfere with haemothynthesis and induce microcytic anaemia like iron deficiency.

5- It causes encephalopathy, renal impairment[13].

6- Recent attempts have been made to relate the occurrence of certain cancer and cardiovascular diseases to the presence of trace metal pollutants such as cadmium and lead[14].

1.4 Copper toxicity :

Copper toxicity resulted from the point that copper and its salts are widely used in agriculture and veterinary medicine.

Acute copper toxicity rarely occurs and arise from administration of high doses of $CuSO_4$ or uses of food contaminated with $CuSO_4$. This leads to nausea, vomiting, salivation, diarrhea and abdominal pains, tachycardia, paralysis and collapse, These symptoms are followed by death.

Chronic toxicity occurs due to the cumulative effect of copper. Copper is stored in the liver cells, then released to the blood circulation and induces haemolysis of R.B.Cs. Copper is precipitated by fasting, physical efforts and low nutritional plan. Once signs developed, it takes the acute form and death may occurred within 1-4 days. When copper content reaches 10-12 mg/day, which is toxicity limit[19], which is manifested by nausea, vomiting, malaise and hemolysis[20].

1.5 Pollution in Egypt : Many studies were carried out on main sources of water all over the nile branches affected by waste water from industrial factories[15]. The water quality in Ismalia canal has been studied to evaluate the effect of waste water discharge from two factories in Abu-zabal area. The factory of national metallic industry is specialized in production of steel and galvanized iron rods and fertilizer factory produces superphosphate fertilizer beside sulfuric and phosphoric acids. The result obtained shows that the concentration range of heavy metals in Ismalia canal were ranged from 0.05-0.6 ppb and 1.7-6.7 ppb cooper to 0.004-0.008 ppm, 0.003-0.008 Cu, 0.01-0.025 ppm Mn and 0.01-0.02 ppm iron (within 7 months)[16].

An environment study of water and soil in Kaha area was developed. It was found that the concentration of some heavy metals such as Pb is higher than the permissible limits in both water and soil (0.5 ppm, 0.07 ppm)[17]. The major water lakes within El-Manzala area suffer from the uncontrolled disposal of increased amounts of waste generated by various human and in industrial activities.

The concentration of heavy metals have been measured in the waste water samples taken from the Egyptian Iron and Steel company[18]. The results indicated that only manganese, zinc and lead concentrations were above the permissible limits imposed by the law.

The obtained results from the study of water in Mostorod area showed highly significant elevations in the levels of lead in some vegetables over the international recommended values. While lead and zinc were significantly higher in soil samples above the limits found in other governorate soils registered as unpolluted areas. The same elements were also found to be higher in water of irrigation than those recommended by the Egyptian's law 48/82.

From these results it is obvious that main sources of our drinking water and irrigating water are within the permissible limits of these concentrations recommended by the Egyptian's law 48/82.

To curtail heavy metal pollution problems, engineers and scientists have developed processes and measures for the treatment and disposal of metal-containing wastes,namely chemical precipitation, electro-deposition, solvent extraction, ultrafiltration, activated carbon adsorption[21,22,23], biological processes[24,25] and ion exchange (inorganic and organic ion exchanger)

1.6 Inorganic ion-exchanger

1.6.1 Historical development of ion-exchange materials and their properties :

The earliest systemic studies in which ion-exchange properties were described are concerned with base exchange in minerals present in the soil[26]. Before the existence of ions in solution was demonstrated and before the crystal structure of the solid concerned had been elucidated, it was found that when soil is treated with solutions of ammonium salts, ammonia is taken up by the soil and an equivalent quantity of calcium released. This property of " base exchange" was shown to be reversible and to involve chemically equivalent quantities of the base taken up and of that released; moreover, it was shown to hold for a number of other salts besides those of ammonia[26].

Exchange groupings may be described as acidic or basic.

a) Acidic groupings, which when ionized, have Z negatively charged entity attached chemically to the matrix and a free mobile cation, so undergo cation exchange.

b) Basic grouping,when ionized, have a positively charged entity attached chemically to the matrix and can undergo anion exchange. There are 4 types of grouping : Strong acid,weak acid, strong base and weak base. An exchanger containing one group said to be, monofunctional, and that containing more than one group said to be polyfunctional, when exchanger containing both acidic and basic group called amphoteric.

Ion exchanger do not dissolve in aqueous solutions or other solutions involving polar solvent.