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Environmental Pollution and Its Impact on Human and Animal Health: A Review.

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ملخص البحث

يتناول هذا الاستعراض أثر الملوثات الكيميائية والفيزيائية والحيوية علي البيئة مثل استخدام المبيدات الكيميائية للحشرات والاعشاب وضررها المباشر وغير المباشر، وتلوث المياه بنفايات المصانع والآليات والمحركات التي تستخدم مشتقات البترول كمصدر للطاقة. تناول الاستعراض تلوث عناصر البيئة في بعض دول العالم الأكثر تضررا بالمشكلات البيئية وتأثير هذه الملوثات علي الإنسان والحيوان والنبات ومن ثم علي التوازن والتنوع الاحيائى للكون.

يهدف الاستعراض إلي إبراز الجوانب السلبية للصناعات الحديثة وتأثيراتها علي عناصر البيئة ومن ثم علي الإنسان والحيوان والنبات، بهدف إيجاد الحلول المناسبة لتلافى المضار البيئية والتي حتماً ستؤدى إلي تدهور الحياة الطبيعيه. أمن الاستعراض علي أهمية التعاون والتنسيق العلمي بين التخصصات من اجل إيجاد الحلول الناجعة لهذه الملوثات ومن ثم إيجاد التوازن الطبيعي بين البيئة وعناصرها لاجل الرفاهية.

Summary

This article reviews the effects of the chemical, physical and biological pollutants on the environment components, eg the use of the chemical insecticides and herbicides and their direct and indirect adverse effects. It describes the risk of water pollution by factories, machines and vehicles that use petrol-derivatives as a source of energy. The environment in some countries was adversely affected and that was reflected on human, animal and plant. Pollution has a negative impact on the biodiversity, therefore, this manuscript recommends future plans to reduce the adverse effects of pollution and call for close and genuine cooperation and coordination between the different disciplines to limit such damage for better life on earth.

Introduction

Environment is a complex system that forms a range of physical and/or chemical factors and their combination. The physical components of the natural environment such as air, water and land provide basic means for sustaining the living organisms. The condition that reaction of these living organisms with these physical components is in equilibrium, will sustain the

life and the environment in harmony. In the last decades man's dominance over environment broke off such harmony between living organisms and the environment components, which has resulted in several environmental problems, including pollution (Swarup *et al*, 2002).

Pollution is defined as the human alteration of physical or chemical characteristics of the environment to a harmful degree to the living organisms. Some forms of pollution exert a destructive effect on humans, animals, plants and wildlife by killing or impairing the health of their individuals (Waldron and Edling, 1977; Patra and Swarup, 2000). Certain events in human life in ancient times suggested that the anthropogenic pollution of the environment dated back to antiquity (Bell *et al*, 1990). However, the level of pollution has increased many folds during the twentieth century due to rapid urbanization, industrialization and improper use of chemicals such as pesticides and drugs. In addition, release of thousands of synthetic chemicals into the environment has created unfavorable habitat to humans and animals.

Impact of pollution:

Environmental pollution has a significant impact on living organisms, including health and physiology of man and animals (Waldron and Edling, 1977; Patra and Swarup, 2000). Pesticides, heavy metals, fluorine and other agro-chemicals are the major cause of environmental toxicity, which affect humans, animals, plants and wildlife.

In the Sudan, drought and desertification that occurred during the 1980s were direct resultant to environmental pollution. Accordingly, millions of animals were lost and many people were displaced making belt of shacks around the main cities and thus creating another health hazard.

The pollution that occurred in the Red Sea and River Nile due to industrial residues had led to death of many living organisms especially fish populations. In the year 2005, the Blue Nile witnessed water pollution with some chemical residues that resulting in loss of tons of fishes. There was no definite answer for this, but the local authorities attributed that to factory residual pollutants. In a study on waste oil disposal into the Red Sea, Omayma (1995) has concluded that oil pollution threatens the Red Sea environment. The power station, coastal industries, shipping activities and oil terminals are the source of oil pollution of Red Sea. The study concluded that the sediment of shallow water in the harbour area was devoid of any macrofuana and flora due to high oil concentration. The study recommended that, as the degree of pollution is not serious yet, future preventive measures should be taken. The study suggested that the rejected oil should not be

discharged into the sea but to be directed to the beneficial and environment safe projects.

Tamimi, (1995) reported the effect of slaughter-houses of Omdurman and ElKadaru on the environment pollution. He recorded that slaughter-houses liquid waste treatment efficiencies were 61% and 88% for biological oxygen demand (BOD) for both slaughter-houses, respectively. This is considered a great environmental pollution hazard to the workers and people living near by. Limited research has been conducted to investigate the impact of pollution on animals and wildlife in the Sudan, but a number of studies from western countries showed adverse effects of pollution on wild fauna (Freedman, 1989; Pain, 1996; Oaks *et al.*, 2004). In fact, wild animals are considered innocent victims of pollution hazards. Different species vary in their sensitivity to toxic pollution. Many domestic and wild animals have natural instinct and behaviour to protect themselves against untoward environmental hazards, eg grazing ruminants generally reject certain harmful plants, horses excrete in certain area, which they avoid for grazing and dogs instinctively vomit to protect themselves. Birds are usually sensitive to odourless coal gas and other air pollutants in coal mines (Schwabe, 1984). Fish behaviour pattern in avoidance of contaminated water and nesting behaviour of birds on water bodies are used as indicators of water pollutions. Pheasants are important indicator species and their presence in an area is a good indicator of healthy ecosystem (Anon, 2004).

In general, the impact of environmental pollution on domestic animals and wildlife can either be pollution burden without adverse effects and minor adaptive physiological or behavioural changes, sub-clinical effects characterized by minor pathological and behavioural changes, specific toxicity characterized by high morbidity or mortality rates.

Pollution and community effects are characterized by changes in pollution structure and function, eg changes in age structure or sex ratio and density, abundance or biomass of indigenous organisms.

The impact of pollution on animals results in serious economic losses and environmental consequences. Frequent epizootic of lead toxicity in lead smelting areas in USA caused heavy economic damage to equine husbandry (Schwabe, 1984). The impact of fluorine pollution in Corn Wall Island on cattle industry was so immense that the majority of farmers switched from dairy to beef cattle (Krook and Maylin, 1979). The adverse effect of ammonia, produced within the house due to microbial degradation of litter, is associated with chronic respiratory disease and consequently death leading to huge economic loss and this is considered as one of the major

hindrances to broiler industry (Al *et al*, 2003). In India, high mortality rates in cattle and buffaloes due to industrial lead toxicity was responsible for decline in dairy animals population and significant financial losses to farmers (Swarup *et al*., 2002a).

The sensitivity of health impact of pollution depends on kind of pollution and pollutant, presence of interaction chemicals, extent and route of exposure, species, age, physiology and nutrition of the exposed population (Humpreys, 1991). Under-nourished, young, old, physiologically stressed and debilitated animals are more susceptible to pollution effects.

Various industrial, transport and other pollution sources release a number of specific and common pollutants such as a oxides of sulfur, nitrogen, carbon, halogen gases, toxic heavy metals, volatile hydrocarbons, oxidants and ozone, to name a few. Many of these pollutants persist in the environment and can build up to high levels, even if released in small quantities. Many others undergo transformation and are converted into more dangerous forms than the parent compounds, e.g. inorganic mercury is converted into more toxic methyl mercury by certain bacteria in aquatic sediments. Exposure to high concentration of toxic chemicals induces specific acute toxicities, whereas long term level of exposure causes chronic toxicity.

Pesticides:

Chemical pesticides were introduced as important tool for pest control since late 1940's (Swarup and Patra, 2000). The widespread use, solubility in lipids, environmental persistance and biomagnifications potential of pesticides have soon precipitated health hazards in domestic animals and wildlife. It is thought that every one born since mid 1940's has had a lifetime exposure to the slow degradation of the chemical insecticide D.D.T. (Klaassen, 1996). In the Sudan the environmental hazards of rodenticides in Gezira scheme was studied by Ibrahim (1982). He reported that zinc phosphate was used for rat control in Gezira scheme since 1961. The contamination of water by toxic bait is possible and thus fishes in Gezira canals which feed on zooplankton, grasses and other organic materials may feed on baits. He suggested that, some people might become intoxicated through drinking from canals-polluted water, eating without washing their hands during bait application, or mishandling of the toxin due to ignorance of its hazards. Moreover, the rate of zinc phosphate application in Gezira scheme was higher than the recommended one (0.5 kg/feddan). He concluded that humans, domestic animals and wildlife are affected by polluted water and grasses, contaminated mixing utensils or by the baits

residue. Furthermore, 31% of Gezira tenants are susceptible to contaminants or poisoning accidents as they smoke cigarettes and take snuff.

Besides its usage in agriculture, pesticides are also used for control of ectoparasites in domestic animals. Domestic animals are often raised on the same land that is used for crop production; a situation which makes them highly vulnerable to farm chemicals. Aerially sprayed chemicals are especially susceptible to drifting and thus affecting wildlife, including birds, mammals and fish in areas bordering crop land (Pain, 1996).

Heavy metals pollution of the environmental is a serious problem in most countries of the world. Various anthropogenic activities, such as burning of fossil fuel, mining metallurgy, industries and transport re-distribute toxic heavy metals into the environment, which persist for long period and translocate to different components of the environment, including biotic segment. These toxicants accumulate in the vital organs, including liver and kidney, and exert adverse effects on domestic and wild animals populations (Abu Arab, 2001; Cheng, 2003; Liu, 2003).

Arsenic:

Arsenic is a widely distributed environmental pollutant that is released into the environment through industrial processes and agricultural usage (Ishinishi *et al.*, 1986). Arsenic contamination of ground water is an important cause of poisoning in many countries (Jin *et al.*, 2004). The recommended permissible limit of arsenic in drinking water is less than 50 ug/1 (WHO, 1993). Ingestion of arsenic-contaminated drinking water is associated with skin lesions like spotted melanosis, hyperkeratosis, leucomelanosis, rain drop depigmentation and gangrenous extremities. In addition, hepatomegally, splenomagaly as well as cancer of different organs (Engel and Recover, 1993; Rahman *et al.*, 2001). Clinical signs of arsenic toxicity in cattle vary from gastro-intestinal to nervous signs. In acute cases abdominal pain, restlessness, respiratory distress, teeth grinding, ruminal stasis and even vomition are observable. The common arsenic toxicity signs are increased heart rate, dehydration and oliguria. Chronic arsenic toxicity is manifested by weight loss, capricious appetite conjunctival and mucosal erythema, buccal uleration and reduced milk yield in cows (Radostits *et al.*, 2000). Occurrence of arsenic poisoning due to industrial pollution has been reported in occupational workers (Winship, 1984; Kabir and Bilgi, 1993). Accidental arsenic poisoning has been reported in cattle and swine due to ingestion of toxic quantity of a based growth promoters (Ledet *et al.*, 1973; Samad and Chaudhary, 1984).

Lead:

It is a highly toxic heavy metal, which has no beneficial biological action in the body. Contamination of pasture with industrial emissions and other sources such as discarded batteries, empty paint tins and machinery grease are the main causes of humans, domestic and wild animals lead exposure (Chowdery and Naha, 2002). Grazing animals suffer from plumbism by ingestion of contaminated herbage and soils. The toxicity is associated with high mortality in animals in polluted areas with no long-term or a few premonitory signs of depression, violent movement, blindness and salivation (Dwivedi *et al.*, 2001). Metallic lead in the form of spent gunshots is a common source of poisoning to birds. Ingestion of spent gunshots as grits or feed particles has resulted in high mortality rates among water fowl in many parts of the world. The acidic stomach pH (2.5) of the fowl facilitates the acidification and dissolution of leaded shots that cause lead poisoning (Pain, 1996).

Lead concentration above 100 μg/dL in blood, 15-20 ppm in liver on dry matter basis induces severe clinical toxicities and death in water fowl. Lead poisoning was recorded as one of the causes of death in vulture in India (Oaks *et al.*, 2004). Lead poisoning was reported in humans in Egypt in August 2006, subsequent to ingestion of wheat flour contaminated with lead. The victims were more than 100 between dead and morbid. The risk of lead poisoning among exposed workers in Khartoum North industrial area was investigated by Osman (1988). She reported that mean concentrations of lead in the air of lead accumulator plant were 305.77 μg/cubic metre and 329.2 μg/cubic metre during winter and summer seasons, respectively. These values were 200% of threshold limit value (TLV) which is 150 μg/cubic metre. The mean lead concentration in blood were 82.49 ± 7.60 and 48.34 ± 4.18 μg/100 ml during summer and winter, respectively. During fasting, the mean concentrations of lead in blood and urine of exposed workers were 45.98 ± 11.33 and 47.64 ± 8.98 ug/100 ml, respectively. She concluded her study with the recommendations of finding means and ways to bring down the air lead concentration to the recommended level.

Mercury:

Toxicity of mercury has been reported since long time ago as a cause of death. The metal is biologically non-essential, but is being used in various industries. It is released in the environment from natural and anthropogenic sources. The man-made sources include coal combustion, non-ferrous metal production and waste disposal. The last century witnessed several incidents of mercury poisoning due to pollution, which cause deaths

among humans and animals in Japan, Guatemala, Iraq and Pakistan (Dwivedi *et al.*, 2001). Methyl mercury is the toxic and stable form of mercury from which most avian and mammalian predators suffer. High mercury levels had been detected in India in some metropolis and near towns areas where chlor-alkali and paper industries were located (Chandra, 1980).

Non-metal pollutants

Fluorosis:

Small quantities of fluorine are considered essential for prevention of dental caries and osteoporosis in humans. However, continuous ingestion of excess of fluorine causes chronic fluorine toxicity referred to as fluorosis. In animals, the condition is manifested by bony exostosis, lameness, loss in performance and production, inability to masticate food, reduced feed conversion efficiency, poor digestibility and death (Swarup *et al*, 2002).

Acid rain:

Acid rain is primarily caused by the release of sulfur and nitrogen into the atmosphere as a result of oil and coal combustion by power plants, machines and vehicles. It is now one of the most important forms of environmental pollution. The hazards posed by acid rain were first recognized in late 1970's. Public concern over the effects of acid rain on aquatic eco-system has become widespread. The acid rain increases acidity of aquatic eco-system, leading to poor performance of fish species. The modern animal production results in disposal of large amount of unprocessed manure, which through emissions produces ammonia. Ammonia is hazardous to both humans and animals, disturbs ecological balance and produces acid rain (Hadina *et al*., 2001).

Residues contamination:

Drug residues:

The overuse or improper use of antibiotics and its adverse effect have drawn a world-wide attention with the release of Swann report (1969). Animal drugs and chemicals are used for chemotherapeutic and prophylactic purposes or as feed additives to promote growth, improve feed efficiency and breeding performance, and enhance feed acceptability. More than three hundred feed additives, antmicrobial drugs and synthetic hormones are used in animal production throughout the world (Lee *et al*, 2001). Residues of antimicrobials used in food animals for growth promotion or treatment have toxicological significance for the consumer as well as influence the quality of milk and milk products. They may transfer antibiotic resistance to humans, animals and bacterial pathogens (Honkanen and Suhren, 1999).

Pesticides residues:

Residue of pesticides such as aldrin, dieldrine, heptachlor and chlordane have been detected with increasing frequencies in farm animals and their products, including milk, meat and eggs in India (Kathapal 1994). Organo-phosphorus pesticides are potential immunotoxic agents even in higher vertebrate wildlife that suppress humoural and cell-medicated immunity and consequently result in high susceptibility to infectious agents, hypersensitivety and auto-immune diseases (Galloway and Handy, 2003).

Conclusions and recommendations:

The quality of life on earth is linked to the overall quality of the environment. Thus, growing pressures on air, water and land resources and the increasing incidents of human and animal health problems due to industrial pollution and man-made alteration environmental, have drawn global attention to find new ways to sustain and manage the environmental components. Pesticides poisoning, plumbism and fluorosis have posed serious health problems for farm- and pet animals and wildlife in the developed countries due to hazardous usage of chemicals and pollution of the environmental components.

The remedy for the environmental pollution should rely on cooperation and incoordination of all desciplines to resolve the growing problem.

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