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ENVIRONMENTALPOLLUTION AND STRATEGIESOFITS PROTECTION.

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Abstract:

Environmental pollution is the impairment of the quality of some part of the environment by the addition of harmful impurities of energy. The main causative factors of pollution are over-population, urbanization and industrialization.

Air pollutionis caused by combustion products, vapourization and frictional forces. Combustion sources may be stationary (e.g. industrial plants) or mobile, e.g. automobiles. A mixture of smoke and fog is called smog. Air pollution can be acutely harmful to human health or have chronic effects on the community. Cigarette smoking is personal air pollution. Air pollution also modifies the climate, damages vegetation, injures animals, damages property and results in aesthetic insults.

The sources of water pollution are oxygen-demanding organic wastes, disease-carrying agents, plant nutrients, synthetic organic compounds, oils, inorganic chemicals and mineral substances, sediments, radioactive wastes and thermal or heat discharges.The effects and control measures of these sources are discussed.

Key Words: *Air pollution, Water pollution.*

Introduction:

Concept of pollution: -Environmental pollution is the impairment of the quality of some part of the environment by the addition of harmful impurities of energy. There are two different types of pollution. (i) Concentration of organic wastes, e.g. sewage. Before modern civilization, organic wastes were evenly spread out. Now they are concentrated in a few locations. (ii)Introduction of synthetic chemicals into the environment, e.g. cosmetics, plastics, building materials, etc. About 100,000 chemicals are produced in quantity for commercial use.

There are three main causative factors for environmental pollution, overpopulation, urbanization and industrialization. (i) Over-population. The average annual rise of the world population is by 2%. There are 1 million births every five days, 5 every 2 seconds. This has increased crowding. (ii) Urbanization. As the population grows, people move from rural areas to cities in search of facilities and employment. This puts a strain on sanitation facilities, leading to pollution. In India the urban population has increased from about one-eighth in 1947 to about one-fourth today. (iii) Industrialization is a major cause of pollution, with factories releasing smoke into the air and chemical wastes into the water.

Types of pollution: -The two main types of pollution are air pollution and water

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pollution.These two forms of pollution involve introduction of undesirable matter into the environment. Two other types of pollution, thermal pollution and noise pollution, involve the introduction of undesirable energy into the environment. Thermal pollution impairs the quality of the environment by increased temperature, and noise pollution by noise. Two types, non-degradable and biodegradable pollutants

i) Non-degradable pollutants are those that are not altered by natural biological processes. They are mainly inorganic chemicals such as salts (especially chlorides) metallic oxides and colored, toxic and taste producing materials, organic non-degradable pollutants include synthetic plastics. Plastic bags and bottles may create an unsightly litter, but are not biologically active. On the other hand synthetic chemicals such as DDT are harmful. DDT is persistent, i.e. it remains in the environment for a long time. Appreciable quantities remain in the soil for 15 years after spraying. It also shows bioaccumulation of concentration in different organisms up the food chain.

ii) Degradable pollutantsare changed by biological, physical and chemical processes found in the natural environment. Biodegradable materials degrade in the natural environment by the biological action of microorganisms. The most common example of a degradable pollutant in domestic is sewage. This is readily converted into nitrates, sulphates, phosphates and bicarbonates by bacteria and other organisms. A small amount of this type of pollutant acts as a fertilizer. Other example of biodegradable pollutants are given in Insecticides – Dieldrin, Endosulphan, Endrin, Lindane, Parathion. Herbicides – 2,4-D, MCPA, DNBP, Dalapon, Monuron. Polycyclic aromatic hydrocarbons – Benzo(a)pyrene, Dioxins, PCBs.

Objectives:

The main objectives of the present study are to analyzeair and water pollution

Data Base and Methodology:

The present research work is based on secondary data. To fulfill the objective the data regarding pollution is collected from books, magazines, News papers and Reference Books.

Discussion

Air pollution:-

A human being breathes about 80% of his weight of air daily, nearly 22,000 times and inhales about 16 kg of oxygen. Thus, any pollution of air has a great effect on health. Air is said to be polluted if it contains contaminants which are injurious to

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humans, plants,animals or property. If pollution is caused by natural sources it is said to be natural pollution. Natural pollution is caused by sand and dust storms, volcanic activity,earthquakes, smoke from forest fires, gases from rotting animal and plant remains, wind-borne pollen grains, bacterial and mould spores and radioactivity.Most natural pollution is of temporary nature and is not of much significance. Here we will deal with artificial pollution caused by human activities.

A)Air pollutants and their sources: -The main sources of artificial air pollution are combustion, vaporization, and frictional forces.

1) Combustion: -is a chemical process involving the union of carbon and oxygen. It results in the production of heat energy, and frequently light energy as well. Combustion sources may be stationary or mobile.

a) Stationary combustion sources are power plants of industry that burn chiefly the fossil fuels, coal and petroleum. Coal is largely carbon. On complete burning it produces carbon dioxide and water, with release of energy ($C + O_2 \rightarrow CO_2$ + Energy).Combustion. However, is incomplete in most cases, resulting in the production of carbon monoxide (CO), which is very toxic, and carbon particles (soot) along with carbon dioxide. Coal is always mixed with incombustible mineral matter. Some of mineral ash goes out with the smoke, which is called *fly* ash. Most fuels contain sulphur and nitrogen as minor contaminants. Buring of sulphur produces a mixture of oxides, mainly sulphur dioxide (SO_2) and sulphur trioxide (SO_3). These are major air pollutants. Nitrogen is oxidized (NO_2). The latter contributes to the browning and the smell of some polluted urban atmospheres.

b) Mobile combustion sources such as gasoline (petrol), diesel fuel and jet fuel are used as energy sources for mobile engines, e.g. in cars, trucks and railway incomotives, These fuels are hydrocarbons. Their carbon and hydrogen atoms oxidize, respectively, to CO_2 and H_2O. Combustion of these fuels produces gases, smoke and smog. Smog is a mixture of smoke and fog. The smoke particles provide centers on which water vapour in the air collects. Smog is a serious form of air pollution. It especially develops in areas of temperature inversion. Gasoline additives such as lead tetraethyl and nickel are the most significant sources of leadand nickel in the environment. Diesel engines are important sources of nitrogen oxides, hydrocarbons and particles.

2) Vaporization is the change form liquid to gaseous form. Volatile liquids readily

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produce vapours, e.g. solvents used in industries and laboratories. The rubber, paits and plastics industries in particular produce vapours as byproducts during manufacturing processes. Agricultural crop spraying of pesticides also contributes to vapours in certain cases. Cigarette smoking releases no. N_2O, CO and polynuclear aromatic hydrocarbons (PAH)

3) Frictional forces Air-borone particles arise from frictional activities such as crushing, grinding, screening, sawing and drilling operations, especially near mining and construction industries.

Water pollution:-

About 80% of the earth's surface is covered by water. A human drinks about 2 litters of water daily. Pollution is becoming a major environmental problem.Many of our streams, lakes, rivers and even seas are becoming polluted. Three of every four humans do not have enough water, or drink contaminated water. Water pollutants are divided into two broad types, degradable and non-degradable pollutants. On the basis of size,pollutants can be divided into three classes, suspended particles (more than 1μm size), colloidal particles and dissolved matter.

A)Water pollutants and their sources: - Water pollutants can be categorized into nine major types.

1)Oxygen demanding organic wastes. These are primarily biodegradable organic materials that are found in human sewage, animal wastes, decaying plant life and industrial wastes.

2) Disease carrying agents. These include pathogenic bacteria and viruses that enter water along with sewage, hospital wastes and animal wastes.

3) Plant nutrients. These are mainly nitrogen and phosphorous that are obtained from fertilized agricultural lands, detergents, industrial wastes and inadequate waste-water treatment. Up to 70% of phosphorous comes from detergents.

4) Synthetic organic compounds. At least 10,000 organic comounds are used for agricultural, manufacturing and consumer purposes. They consist mainly of synthetic pesticides, detergents and hydrocarbons which enter waterways.

5)Oil. Fossil fuels, particularly oil, enter water as pollutants. The oil comes from machinery, automobiles wastes, breaks in oil pipelines, blowouts and seepage from offshore oil rigs, accidents, spills and wrecks of oil super-tankers, heating, transportation, industry and agriculture. 5-10 million tonnes of oil are spilled into oceans

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yearly.

6) Inorganic chemicals and mineral substances. These water pollutants include inorganic salts, mineral acids, finely divided metals and metal compounds. They enter naturalwaters through mine drainage, smelting, metallurgical and chemical industries, irrigation and oil fields.

7) Sediments. Sediments are soil and mineral particles washed from land into water by natural waters through mine drainage, smelting, metallurgical and chemical industries, irrigation and oil fields.

8) Radioactive wastes. These include wastes of uranium and thorium mining, nuclear power plants and industrial, medical and scientific utilization of radioactive material.

9) Thermal of heat discharges. Water is used for cooling purposes by steam electric power plants and other industries, and discharged into natural waters. Discharge of such heated water may increase water temperature up to 40^0 C locally.

Effect of Air Pollution on Humans:-

Air Pollution may affect humans directly by being harmful to health, or indirectly by modification of the climate, injury to vegetation and animals, deterioration of materials and aesthetic insults.

1) Harm to human health. Human health may be harmed by acute effects, chronic effects of personal air pollution.

i) Acute effects. Air pollution causes acute effects resulting in deaths when three conditions operate at the same time, severe atoms. Pheric inversion, presence of fog and continuous formation of pollutants. Atmospheric temperature inversion occurs occasionally. Normally warm air close to the earth rises and cools. Air pollutants rise with it and are dispersed through the upper atmosphere. When there is temperature inversion, there is a reversal of normal conditions. Cool air moves into the area of still warm air. The warm air acts as a lid on the atmosphere, and prevents the cool air from warming and rising. Temperature inversion can have extremely harmful effects in high pollution areas. In 1952, a combination of temperature inversion heavy fog and SO_2 and hydrocarbon pollution from oxidized petrol vapours in London caused lung irritation, fever, shortness of breath and over 4,000 excess deaths.

ii) Chronic effects of community air pollution. Continuous exposure to mildly polluted air results in a higher rate of illness and death. Respiratory tract diseases such as coughing, shortness of breath, nasal irritation, sore throat, chronic bronchitis,

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emphysema, chest pains, allergy and lung cancer are upto four times higher in cities than in rural areas, people with cardiac disease risk serious illness in polluted areas.

iii) Personal air pollution cigarettes. Smoking is a form of self-pollution. Cigarette smoke contains at last seven distinct cancer producing hydrocarbons. Smokers are 10 times more like to develop lung cancer than non-smokers.

2) Modification of the climate: -Air pollution has effects on the atmosphere and climate (i) Increased atmospheric dust results in loss of sunlight, because dust particles reflect light. The volcanic eruption of Karkatoa (Near java) in 1883 caused dust particles to staty in the atmosphere for 5 years. Summers were cooler in the Northern Hemisphere during this period. (ii) Increased carbon dioxide in the atmosphere causes the greenhouse effect. Carbon dioxide absorbs infra-red radiation in sunlight, and releases the energy as heat. Carbon dioxide concentration has increased from about 290 ppm in 1870 to 335 ppm in 1980.This could lead to global warming by about 0.5^0C in the next 40 years (iii) Acid rain is another effect of air pollution. SO_2 is oxidized to SO_3, which reacts with water to produce sulphuric acid. This comes down as acid rain, killing fishes and plants (iv) Depletion of the ozone layer in the stratosphere results because of pollution by chloroflourocarbons (CFCs) used in refrigerators and aerosol cans. Ozone protects the earth by cutting of excess solar ultraviolet (UV) radiation. Depletion of the ozone layer increases UV radiation, and hence the chances of skin cancer.

3) Damage to vegetation: Air pollution, especially by industrial gases, can injure many plants. A particular gas generally affects only certain types o plants. (i) Sulphur dioxide affects forest trees causing leaf fall. (ii) Nitrogen and fluoride oxides reduce crop yield (iii) Hydrogen chloride causes dark brown spots on grape leaves. (iv) Hydrogenfluoride produced in aluminium plants caused injury to plants and animals even in concentrations of one part gas in 100 million parts of air. (v) Hydrocarbons cause silver-leaf damage, in which the lower sides of leaves become silvery, particularly in spinach, beets and tobacco. Hydrocarbons such as ethylene cause flower bud shedding, curling of petals, discolouration of sepals and premature leaf fall. (vi) Air pollution inhibits growth of lichens, which therefore serve as pollution indicators.

4) Injury to animals. Air pollution affects domestic and wild animals living near industrial areas. If fluoride deposited on vegetation is eaten by livestock, it results in fluoride toxicity of fluorosis. This is characterized by decalcification of bones and teeth, lameness, loss of weight and diarrhea, leading to great economic loss. Industrial pollutants such as lead and arsenic result in disability and death among cattle, horses and

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sheep.

5) Damage to property. Pollution damages buildings by corroding structural material. Paint stains and darkens. *Hydrogen sulphide* darkens exterior paint. An oil refinery 40 km from Agra emits 25-30 tonnes of SO_2 daily, pitting the marble ($CaCO_3$) of the TajMahal

6) Aesthetic insults Air pollution affects aesthetic e.g. acrid haze obscuring the view of mountains.

Effect of Water Pollution on Humans:-

We shall now consider the effects of the different categories of water pollutants.

1) Oxygen demanding organic wastes. These wastes are primarily biodegradable organic materials that are reduced by bacteria to carbon dioxide and water. In this process the bacteria use up oxygen from the water, resulting in low dissolved oxygen (DO) levels. The DO level of water saturated with oxygen is 9.2 mg/1 at 20^0C. The rate at which dissolved oxygen is removed from the eater is called biological oxygen demand (BOD). Nearly pure water has a BOD of 1 ppm, fairly pure water 3 ppm and water of doubtful purity 5 ppm. Untreated municipal sewage has a BOD range of 100-400 ppm. And food processing wastes 100-10,000 ppm. Toxic chemicals kill living organisms in water and reduce the BOD.

2) Disease carrying agents. The presence of pathogenic bacteria in water results in such gastro-intestinal (GI) diseases as typhoid, paratyphoid, cholera and dysentery. Viral diseases include poliomyelitis and infectious hepatitis.

3) Plant nutrients. Excess of plant nutrient (eutrophication) like nitrogen and phosphorus stimulates growth of algae (algal blooms: one exceeding 500 individuals 1 ml water) and aquatic weeds, and adds to the BOD. Algal blooms results in unpleasant taste and odour to the water Excessive aquatic weeds interfere with aquatic recreation such as swimming and boating.

4) Synthetic organic compounds. Many are not biodegradable and many are toxic. They include pesticides, detergents and hydrocarbons (gasoline and motor oil from roads in rainwater runoffs). These chemicals are toxic to plants, animals and humans.

5) Oil. Oil spills can potentially disrupt ecosystems. They can cause economic, recreational and aesthetic damage to coasts. The short-term damage includes reduced light transmission and dissolved oxygen, damage to water birds and smothering of intertidal algae and lichens, fish shellfish, worms, crabs and lobsters.

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6)Inorganic chemicals and mineral substances. These have three general effects. They alter the acidity/basicity, salinity and toxicity of water. Inorganic mercury in industrial wastes is converted by anaerobic bacteria to methyl mercury (CH_3Hg^+). This can be concentrated in organisms, leading to mercury poisoning. Iron pyrite (F_eS_2) from coalmines forms sulphuric acid on coming into contact with air and water. Acid mine drainage can be carried to streams and rivers, causing acidity.

7) Sediments. Sediments fill in streams, rivers and reservoirs, plug water filters, erode turbines and pumps, and blanket fish nests, spawn and food supplies.

8) Radioactive wastes. Many radioactive substances are lethal in relatively low concentrations. They can also cause mutations in minute quantities (mutagenic)

9) Thermal or heat discharges. Increased water temperature is harmful, since it generally alters the physical, chemical and biological characteristics of the system. It may stimulate untimely spawning when no food is available, thus starving the newly spawned individuals. Heat pollution causes blooms of cyanobacteria. When these die, heterotrophic bacteria feed on them and bloom. They use up oxygen, causing fish mortality

Conclusion and Suggestion :-

Control measures for air pollution.There are two general methods for controlling air pollution.

i) Separation and disposal of the pollutants.

ii) Conversion of pollutants into harmless products that can then be released to the atmosphere.Larger particles of pollutants (more than 50 μ m)can be separated in gravity setting tanks or by porous filters. Smaller particles. e.g. smokes particles, can be trapped in settling chambers built into the base of chimneys, and allowed to settle by gravity. Smaller particles are removed by cyclone collectors of electrostatic precipitators (plate-type or tube-type). Harmful gases are removedby dissolving them in a liquid in a scrubber. SO_2 must be converted to SO_3 before it is trapped ina scrubber. Tall chimneys dilute gases and discharge then high in the air, where they cause no trouble. Partially oxidized vapours from car exhausts are burnt in afterburners.

Pollutants can be converted into less harmful products by oxidation in air or by chemical neutralization of acids and bases.

Control of the different categories of water pollutants.

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1) Oxygen demanding organic wastes require secondary and tertiary waste-water treatment. Agricultural runoffs should be minimized.

2) Disease carrying agents also required secondary and tertiary waste water treatment and minimization of agricultural runoff.

3) Plant nutrients. Agricultural runoff is too widespread and diffuse for adequate control.

4) Synthetic organic compounds should be prevented from entering the water supply at source. Efforts should be made to use only biodegradable material.

5) Oil.There should be strict regulation of oil. Engine oil and grease should be collected and reprocessed. Means should be developed to avoid oil spills by ocean-going oil tankers.

6) Inorganic compounds and mineral substances should be disinfected during waste-water treatment, pollutants should be stopped at source.

7) Sediments should be controlled by putting into practice already existing conservation practices

8) Radioactive wastes. There should be strict control over disposal nuclear wastes in medical laboratories, research centers and nuclear power generating plants. Testing of nuclear weapons should be regulated.

9) Thermal heat discharge can be controlled by using cooling towers in industrial plants, and by using cooling ponds or lakes. Implementation, however, is not satisfactory, and may continue to be so for several years.

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