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The Cause and Functions of Metal Oxide Nanoparticles for Toxicology Applications: A Review

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Abstract

Environmental impacts of metal oxide nanoparticles in toxicological research studies are rapidly spreading nowadays, many of which are exponentially increasing in various industrial and energy applications. Its usage areas are widely used in agriculture and similar product consumption, catalysts used in industry, gas-air sensors, electronic materials, biological medicine, environmental toxins, and energy sectors. In addition to global climate change and its environmental effects, toxicological effects that directly affect the quality and healthy life of human beings constitute a tangle of problems. These problems will be resolved by scientific researching and studies completely. In general, as examined in research studies, such as the onset of skin redness and itching, which has been studied in research studies, nanoparticles, especially some metal oxides, can have harmful effects on human life/skin and surface/liquid organism. However, the details of all dangerous toxicological mechanisms or structures and their exact solutions and result-oriented economic solutions are still indefinite. The fact that the inherent qualities of nanoparticles (NPs) affect life and create ecological change factors can eventually lead to short/long-term dangerous toxicological effects on the environment and humans through behavioral and transport routes. In literature resources, show that the metal oxide NPs exposed to the humanity life systems resulted in reactive oxygen species (ROS) nascency, oxidative stress, creating purulence, cytotoxicity, genetic toxicology, and immunotoxicology. In this literature perspective review, there has been deemed a more scientifically sensitive approach by us to review the hazardous toxicology's it as ecological, aquatic, agriculture and environmental toxicology.

Keywords: Metal Oxide; Nanoparticles; Toxicological Implications; Nanotechnology; Reactive Oxygen Species (ROS); Toxicity; Human Health

Abbreviations: NP: Nanoparticle; NNI: National Nanotechnology Initiative; AQI: Air Quality Index; ROS: Reactive Oxygen Species; QSAR: Modeling Quantitative Structure-Activity Relationship.

Introduction

Since human beings provide nutritional methods and support through agricultural and industrial products, there is widespread use of nanomaterials in these areas today, with drug support in the field of biological and health. Since these effects of human health, it inevitably raises the following question: Can these nanomaterials directly or indirectly have toxicological causes and functions, or cause long-term harmful toxicology? In other words; Could it be possible these toxicological stages transmission to humans or other living things after the transition from industrial fertilizer to soil and toxic properties from soil to plant and ultimately to the plant? Nanomaterials is improving very fast that toxic researching cannot be reach to the nanomaterial's applications. Here is the research study, revealing the soil-to-rice transition in a case study of soil-to-plant transition. In this study, it was demonstrated that this high dose relationship of plants (rice) caused a toxicological effect on soil microbiological diversity and their composition when exposed to high dose (100 mg/kg) (metal or metal oxides) tungsten disulfide nanomaterial-WS2 [1]. Also, can there be a transition from plant to animal and human with meat and its products? Therefore, because the use of nanomaterials surrounds nature and human life, its toxicology is not only of great importance, but also including very dangerous circumstances.

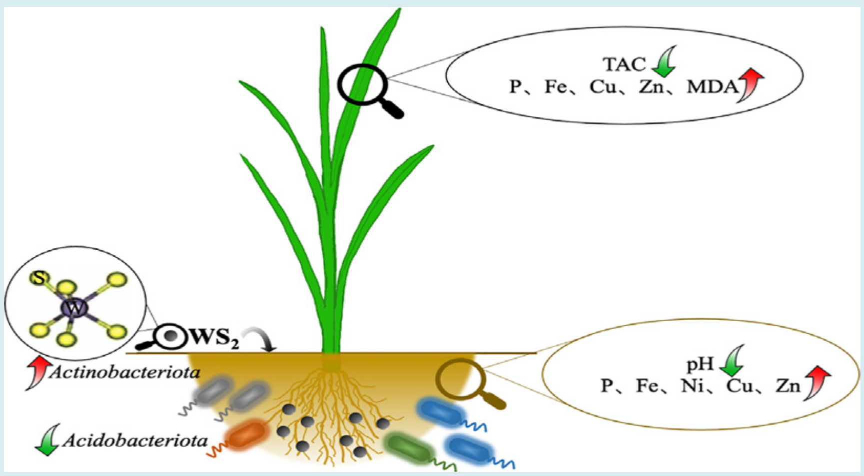


Figure 1: The soil-rice plant tissue relations of nanomaterials (metals or metal oxides) [1].

In the nanoparticle (NPs) investigations has been attentioned many interesting applications, specifically in the areas of metal oxides like iron oxides since of using magnetically nano sized particles. These metal oxides are manipulatable by exterior magnetized areas to countless implementations as showed in Figure 2 [2-4]. At the remarkable developments of the surface chemistry research to surface engineering reactive responding of nanoparticles are distinctively different majority counterpart. An increasing on the surface/volume ratios of nanomaterials of metal oxide (copper oxide) can be resulted in reactionary or toxicity risk due to the presence of a huge big numbers of some reactivity areas. Due to their flexible and characteristics in various applications are the reason for preference like industrial catalyst, gas sensors, electronic materials, biomedicines, environmental remediation. Due to toxicology risks have been dealing with the scientifically study of whole those in poisonous elements that is, have hazardous side outcomes globally on living ecological systems and environmentally. Approximately more two decades, in progressions to areas of nanotechnology of toxicity risks and later operations has been increased be subject of environmentally and human beings to nano sized particles' (NPs) [5]. Formation of nanoparticles as in noticeable environmental environments are of great importance in terms of its effects on humanity health and living [6], however, nanotechnology is coined with toxicology bring about a new term as nanotoxicology [7]. In the scientifically all of way aspect of mechanisms complex in the back of the interactions of nano sized particle with the living systems that resulted in nanotoxicology haven't been widely details are not yet known and also not clarified [5]. Therefore, that kind of all of percent-rates hazard limitation in cause-effect relationships toxicity researching in a some of them stated but still under investigation. As it is the size ranges of generally where the properties of some substance where it is exhibiting different quantum interactions from atomic structures and small molecules purity of mutual chemical effects, by US National Nanotechnology Initiative (NNI) particle sizes range of up to 100 nm or less have been identified. Interestingly, unseen with eyes so small particle or superfine tiny particle has been stated by researcher scientists studying air quality index (AQI) as having at least 1D appearance 100 nm or less and long for widely well-known. Hence, the name of the toxicity of nanoparticles, it is named nanotoxicology in 2004 by AQI researcher scientists dealing with researching scientifically study of these unmatched toxic properties of matter [8]. In terms of causes and functions, nano sized particles of metal oxides are used of nano-sized materials in the farming cultivation, customer products, and power sectors and toxicity not only increased the risks but also can be expanded the risk factors. Research on the harmful vital effects like chromium that causes deleterious consequences on human health should be taken on a global scale and regulated together by legal obligations [9].

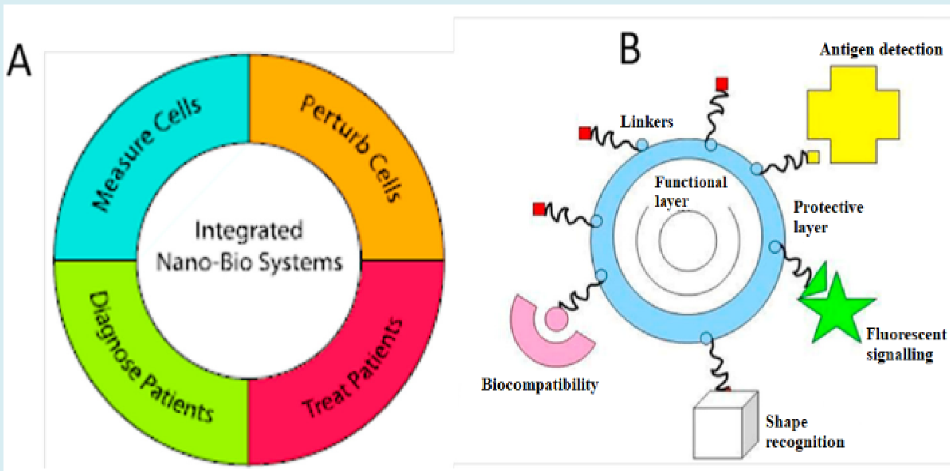


Figure 2: (A) The application of nano sized technologies sample in biology and medicine, (B) nano sized materials in solve medical problems sample [10,11].

Nanoparticles (NPs) are existed scientifically produce in the labs, or some many companies producing as research study and also, they are sells so many domestic or internationally customers, because of the uniquely characteristics of as nano engineered materials. Their diversity is consisting of as versatile of carbon fullerenes, carbon nano tubes, metal oxides nano sized particles and quantum dots. Nano-sized metal oxide particles, which are widely used, may be compelling and harmful results side outcomes on humans and aquatic organisms. Moreover; in all areas where the extent and relationships of toxic and toxicological mechanisms are affected, there are still many uncertainties [6,12]. Nano sized particles technology has been still using in agriculture, the potency to have a utility effect on a variety of agricultural products, forestland, and ecological community requires, for instance urbanized, powers inhibitions, and supportable use of resources. Hence, in new surroundings environments and humanity health endanger could be arisen from nano-assisted applications. These can be also including another some aspect of opportunities, toxicological implications, and also occupational risks [13]. From metals to metal oxide (M&MO) up to nano sized particles have been getting more attentional in recently on their utilizations in oil probing operations. Metal oxide nanoparticles are also using as it is used several industrial researching areas and in oil drilling, can be resulted in aquatic toxicological concerns. M&MO with nano sized particles of iron, copper, zinc, cerium, aluminum, nickel, zirconium, tin, magnesium, titanium, and silicon have been still used in oil probing processes because of its benefaction in realizing the most impressive drilling. They are performing that better a traditional component in remove and mitigate to reducing the difficulties reasoned by water based on sludges. However, but there are concerned of environmentally friendly features and water toxicology's through inappropriate wastes and streams [14]. Evaluation of toxicological researches under some headings with a general approach will enable us to understand the picture of integrity and its harms with greater sensitivity, easily and comfortably, these are briefly under four summary headings; it was deemed more appropriate by us to review will make it stand out it as distributions and translocations in ecological, aquatic, agriculture with soil and environmental toxicology. In these four points of view including reviews, nanoscale science, engineering, and some potency-possible implementations of nano size technologies for environmental, agriculture, aquatic, ecologic toxicology concerning view specifically metal oxides aimed at cause and functions have been addressed. This point aspect of view with have been intentioned on resulting potential profession toxicology menace relations in this domain. Besides, toxicity investigation preferences, intended to receive knowledge about the danger of nano sizes materials and toxicological attitudes and these four points of view exposure evaluations, metal oxides dose-percentage reaction relations and common destiny of man-environment as it is happening to try identify. We should consider their risks and benefits of nanomaterials relation with metal oxides human living, therefore; when we look at the four separated title our toxicity appearance can be clear.

Distributions and Translocations of Metal Oxides in Environmental Toxicology

Environmentally effects of nanoparticles don't mean that they are merely engineering productions, besides they can happen in human life environment in fact congenitally in their surroundings. Generally, around nature' sources on the earth; they are including volcanic activity outbursts, photochemistry reacts, soil erosional, forestland fires, and in fact many types herb and also animals contributing to the same. With another point of opinion, the anthropogenic (man-made disasters) resources contain engineered or created particles of nano sizes that have been used up as industrial waste component in several applications at the industrial and household level. The research study suggested that, promptly necessary to improve a combined approximation to comprehension the relations of the soil–water–human nexus that controls the toxicological hazards of Cr and its detoxification. The illustration is given in Figure 3 [9]. These pollution or environmental change resources are such as semi domestic and fabricated water effluents, metropolitan and farming waste, fossil fuel burn waste, atmospherically sediments, and the bottoms of ship paints can be augmented metal condensation in maritime environmental to higher than ground levels. Therefore, they may be including as industrial waste water remnants can cause toxicity effects. The environmental effects related with nano-metal oxide is given (Figure 4) [15].

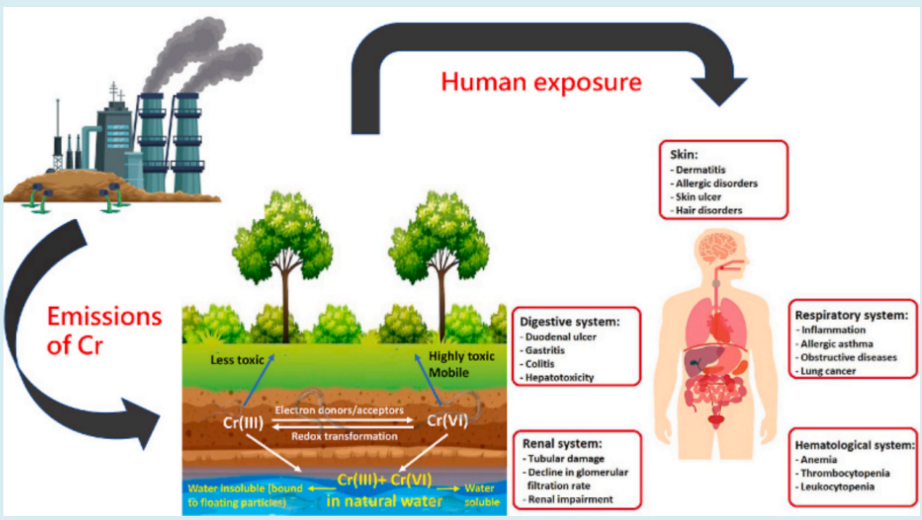


Figure 3: The routes of environmentally exposure of Cr of humans and other organism [9].

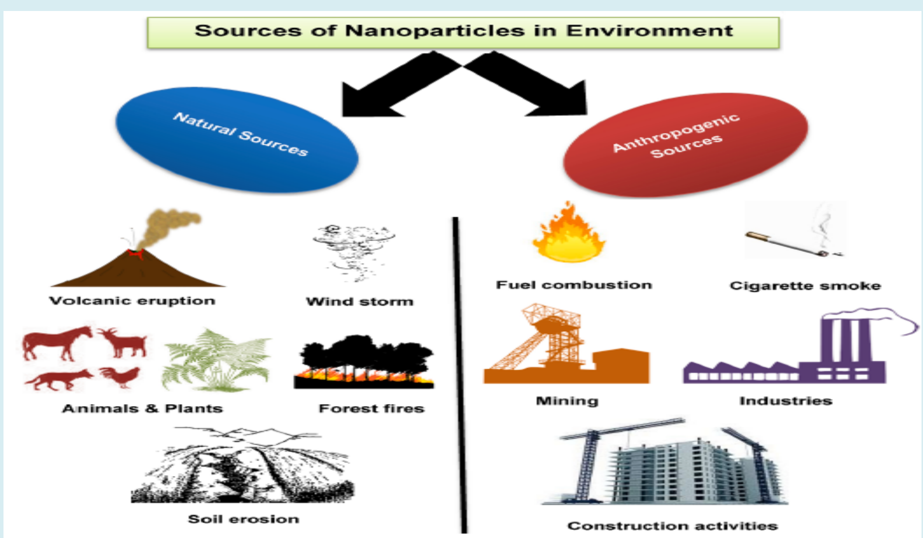


Figure 4: The toxicity of the environment contributes to the increase of nanoparticles [15].

The schematically definition of cell-mediated and genetic toxicology have been cause-effect by copper oxide nano size particles are perspectively shown and given in Figure 5 [16]. Copper oxide nano sized particles could be diffused straight via cell's membrane because of (1) very tiny sizes (2) having plus ions on their surfaces (3) the existence of some special distinct factors [17,18] and can enter the cell. These very pronounced features are caused by in consequence, about the features related with pathologic physiology for instance, generation of reactive oxygen species (ROS), oxidative stress, and pass-through cell and tissues, migration to certain cellular organs, inflammation. These are can cause elevated reactivity and toxicities, manufacture of inflammatory cytokines, mitochondria dysfunctional, simple protein and DNA detriment, integrated backlogs bio systematic, longtime results and celled disruption functioning (Figure 5). If it is looked at the toxicological mechanistic in cell and tissue it can mainly be affected by is seen an inequality among the layout and condensation of ROS interceded. These inequalities can be affected most of the organelles by copper oxide nano sized particles, which in turning create the advancing of oxidative stress [16,19]. In the literature is another named, these are emerging pollutants as potential harmful adverse effects on the environmentally and humanity life. Considering up to these examples of research and investigation studies, new researching involving environmental sanitation sensors and air quality control, in especially industrial production areas should be done. Arrangements should be made for these studies, in order to solve the problem, the state and private sector should work together and should be controlled by non-governmental organizations. That means should be included and an integrity that creates environmental and health laws enforcement and penalties, as necessary. Action must be taken immediately including governments' restrictive laws, should be provided with social awareness, urgently. This environment that we receive from our children is their future. But it was entrusted to us by them.

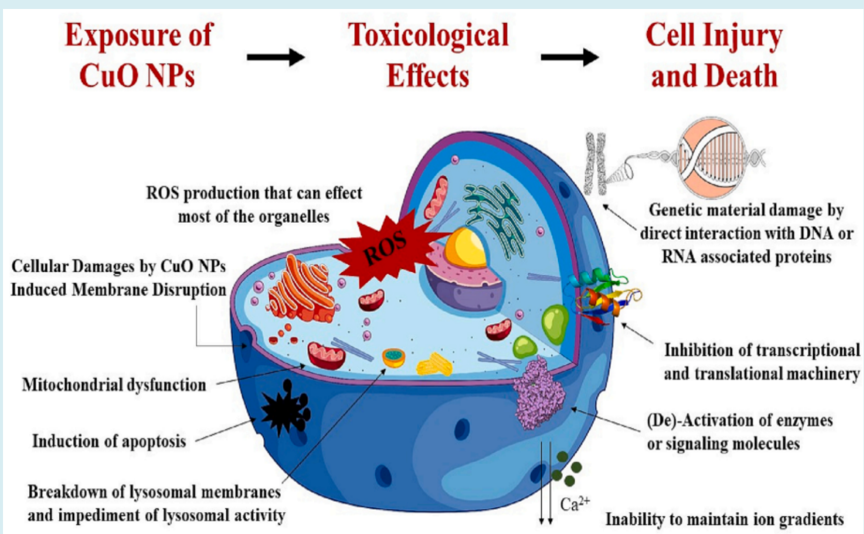


Figure 5: The overview of toxicological effects and steps induced by CuO nanoparticles [16].

Distribution and Translocation of Nano-sized Particles in Agricultural Toxicology

If attention is paid to scientific research studies today, assessment of nanotoxicity to humans, plants, and the biochemical nature of the environment have been become one of the most extensively investigated for interested topics in the agriculture sector in recent years. Agriculture toxicity effects are not only one way direction, in case of indirect to exposure from cytotoxicity and cationic-anionic Lv J, et al. [20], some plants can get exposed to nanoparticles by either using nano-contaminated water or waste waters Ma Y, et al. [21], nano contaminated soil Bao Y, et al. [22], or particulates matters in the air up to. Another research review is as an evaluation the impact of the major metallic and metal oxides nano sized particles (Ag, ZnO, CuO, CeO_2, TiO_2, and FeO-based nano sized particles) on soil microbes involved in agricultural processes [23].

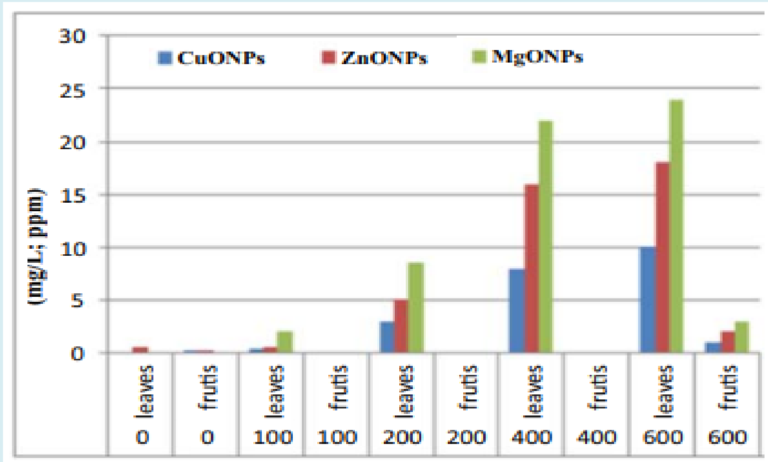
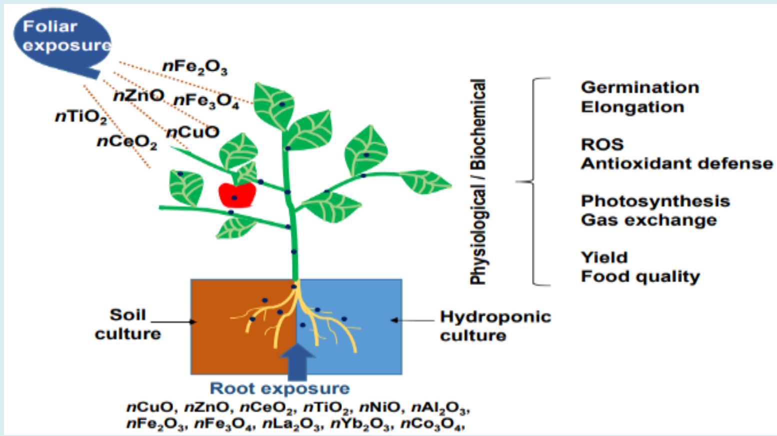


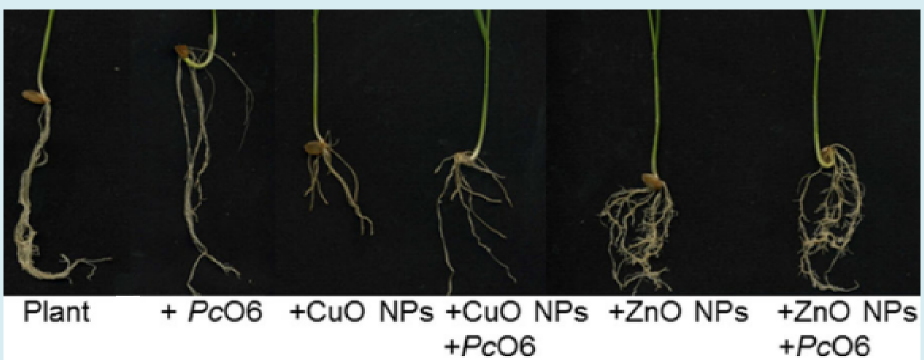
Figure 6: Indicates of concentrate (ppm) of nano size scope in leaves and fruits [24].

These are also the causes and functions of metal oxide nanoparticles for toxicology applications for agriculture at the many ways competed by plants toxicology including. Several procurement studies, biologically fates, and toxic properties of some metal oxides nano size particles, that is, like Al_2O_3, and others given in Figure 6, they have been performed increasingly intensive toxicologic research last twenty years for industrial farming. The research perspective review is that focuses on findings from recent studies on the effects of metallic and metal oxides nano sized particles on land-soil microbial activities that are of relevance's to plant performance in agriculture. This evaluation also included with an assessment of nano sized particles effects on plant growth when exposed from the root [20-24]. In this in vitro research study have been trying to found the metal oxides as nano sized particles with activities in many ways on both chemical and biological toxicologically agents. However, some metal oxides on the research study briefly such as MgO, TiO_2, CeO_2, ZnO and ZrO_2 [25]. A modeling quantitative structure–activity relationship (QSAR) as based on real-life environmental forecasts rather than laboratory simulations have been used a really effective computational technique for predicting the cytotoxicity of metallic and metal oxide nanoparticles as a review [26].

Research study results on the toxicology of nano-sized particles; it may be one or more of the toxicological causes depending on the size/shape/surface structural properties and the percentage dose amounts of nano-sized particles. In their research study, some statements of a particles-based on dose in reaction relations sizes have been outcome. And also, at a similar dose, the relationship between low soluble and low toxic outcome was compared, again at a similar dose, resulting in relatively small and different sizes [27-29]. We can analyze obtain from many reviews, latest reports on the physiologic and biochemistry responding's of vegetables impose to oxidative stress Pizzino G, et al. [19] by metal oxide nanoparticles. These review research study lists in the literatures give us that metal oxide nano size particles might be taken up and accumulated in plant tissues Shi N, et al. [1] cause harmful effects on seed germination, seedling elongation, photosynthesis, antioxidative stress response, agronomic, and yield characteristics in Figure 7 [30]. One of them scientific study result shows that toxicity of nanoparticles; there can be so many effects for the causes why nano size particles are usually greater toxicity than more sized particles of the similar way is not soluble substance when it is comparisons on a bulk doses basis. In their research study was widely investigated in the effect of Zn and Ag nanoparticles on broad been growth. Their data analysis study showed that zinc nano size substance at 50 ppm condensation had effect by the several number of sections of widely horse bean while the sulfur nanomaterials at different concentrations (50, 100 and 200ppm) [31]. It is seen that, in the research study of plant roots toxicology of nano sized particles is primarily intermediary to be produced ROS in cells. There is also a consequence to this effect. As already given reactive oxygen species can affects most of the organelles as it is given above [16,19], and also, they are seen partially to generate as spin-off of metabolism trace ways in chloroplasts and they are in charge of chlorophyll decayed [32]. When we briefly review the situations related to oxidative stress and anti-oxidative defense systems for plant tissue or cell. The judgment we face in this case is that disturbant in plant photosynthetic activity by metal oxide nano sized particles can manufacture ROS and activate the vegetables' defensive mechanisms to struggle oxidative stress harm. Du et al. investigated the effect of metal oxide nano-sized particles (CuO, CeO_2, ZnO, Al_2O_3, TiO_2, Fe_2O_3, etc.) on seed germination and root elongation in terrestrial plants. They determined the particle size, concentration, growth medium, exposure mode, exposure time of these metal oxides in terrestrial plant species (corn, tomato, cucumber, rice, spinach, wheat, soybean, radish, cabbage, carrot, lettuce, onion, etc.). They examined in detail the photosynthetic parameters of metal oxide particles affecting terrestrial plants, their effects on oxidative stress and antioxidant defense systems [30]. The many researcher results have been focused on the effects of different applications criteria of metal oxide nano sized particles on various plants in soil-plant media. These results are applicable, in particular and in general, very useful results have been revealed, for assessing the effects of prolonged exposure on plant productions. The effects of nano sized particles on reactive oxygen species productions and oxidative injury in farming vegetables and terrestrial plants had been wide gage researched.



(A)



(B)

Figure 7: (A) The influence of metal oxide nano sized particles on land plants [30], (B) Effect of CuO and ZnO nano sized particles on root growth in wheat [23].

The given samples on research study have exposed and uptake of metal oxide nano sized particles in thriving vegetables. There are two approved ways for the take and change the location of metal oxide nano sized particles in the vegetables systems: (1) root-to leaf/fruit or (2) leaf-to-root pathway. In Figure 7 (B), influence of copper oxide and zinc oxide nano sized particles (500 mg Cu or Zn/kg) on primary root growth in wheat (2 weeks after planting in a sand matrix) is shown. Both nano sized particles reduced root elongation, however ZnO but not CuO nano sized particles induced the proliferation of lateral roots. Inoculation of the roots with a soil bacterium Pseudomonas chlororaphis O6 (PcO6) has no effect on primary and lateral root growth of the control plants. Root colonization of the nano sized particles-exposed plants by PcO6 is not seen to be removed completely negate nano sized particle effects on the roots [23,30]. The widespread toxicological effects of atrazine herbicides draw attention in terms of their direct and indirect effects on environmental behavior technologies, soil and sediment in agriculture. In summary, the toxicological effect and environmental risks of atrazine in soil and sediment play a key role in the sorption of atrazine in the organic content of soil and sediment. Metabolites of atrazine may have higher toxicity and mobility than their own [33]. Soil analyzes of atrazine-contaminated soil and sediment should be made and this should be repeated before each planting period.

Various analysis methods should be urgently investigated on a local/regional/country basis, and we can suggest that they should be re-applied according to each plant and soil planting period.

Metal Oxides with Aqueous Suspension Ability in Aquatic Toxicology

In aquatic toxicology, there is many concerns about the dangerous spread of aquatic toxicology, which directly affects humans/environment and other living things through unsuitable wastes and streams [14]. Some of the metal and metal oxides are solvable in the water when they are stayed very long period of time in streams or in wet or humid environments.

For cell damages by copper oxide nano sized particles induced membrane disruption copper oxide nano sized particles can be induced reactive oxygen species in multi-different-level environments of biological and aquatic organizations [16]. Today's technological given through the developing with global the whole number of people growth, there happened a large increase a lot of sizes contagious pollution living spaces formed because of storage, generation and facilities of industry and more. The formation of these polluted areas created by humanity, hazardous polluted to soils as well as aquifer's bodies, a natural stream of waters and with the release of trace amounts of polluting heavy metals, pesticides, oil, grease and chemicals with harmful and toxicological effects [34]. Ivask, et al. have been showed aqueous suspension ability of copper oxide nano sized particles to manufacture reactive oxygen species in *E.coli* re-compound organism strains using fluorescent bacterial assays [35]. Polluted water and being unusable for human health, the environment and natural balance of humanity life means that all living things and the world directly rise to the steps of extinctions. However, there is a perception phase that does not hear, see, or speak, throughout the world. So, how far does this situation go? Who is hurting, should we wait until they come to us, will the whole world wake up from now on? Nobody knows? Because of these questions and inquiries, aquatic toxicology is the first circle of humanity life that needs attention and control first and foremost.

There are many experimental throughputs proves that the hazardous potentiality and possible aquatic toxicology's of metal and metal oxides and nano sized particles. There are many nanoparticles toxicity of aquatically soluble threats and harmful diversity of metal oxides details studied were given. One of them detail information's and results have been shared with geometric fluid steps, in Figure 8 [14].

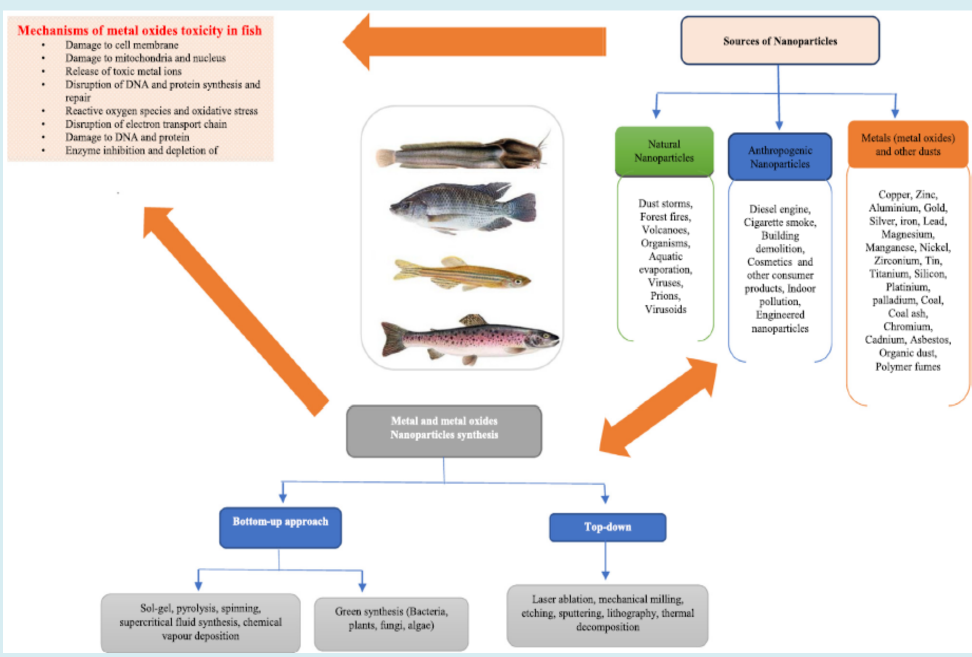


Figure 8: Literature resources, syntheses, threats-contraptions of nano particles toxicology [14].

The use of the world's production resources and limited natural resources only in terms of material gain, instead of the lives we borrowed from the future, today we have made nature and lands this way. With the healthy water we drink, the healthy soil that is the agricultural area, the trees and forests are our natural breath, the minerals and minerals we extract from the ground, the increasing agricultural development of the world population unable to qualify meet all needs, it is thought provoking. It should be better protected to environmental conditions of nontoxic water in ecosystem. Humanity life on the living environment diversity is needed in order to healthy increase non-toxic water in food productions irrigated farming or hydroponic farming in agricultural productions. In general, some metal oxides, which pollute or make aquatic toxic, can be given as examples; these are copper oxide nanoparticles, zinc oxide nano-sized particles, and magnesium oxide and hydroxide nano-sized particles. Many of these have been researched for harmful or toxicity effects, metallic nano-sized particles show cytotoxicity-effects connecting on the electrical load on the membrane surfaces. When the aquatic effects of nano-sized particles are combined on the structures of the targeted cell diversity wall, nano-sized toxicological effects have been observed. These result in aquatic toxicology and are also directly related to where we use water to grow plants and how we use it in agriculture. Agriculture must be on the right track with nontoxic or purification water to get rid of; that is, environmental gains are necessary in the production of healthy food with safety or nontoxic environment. Briefly, non-toxic water environments and conditions are required [12,14,24].

There are some of study of nano sized particles-containing socks fabrics leaking out of wastes waters or commercial washing machines containing Ag nano sized particles. It has been shown that leakage of wastewater and Ag ions and nano-sized particles form microbial communities in wastewater and cause harmful and negative consequences on the soil [36,37]. The indications of the data reached by these scientific studies includes the danger of metal ions with the formation of toxic water or oxides to reach the soil, then the plant and finally the human health. Despite being a fruit by scientific standards, tomatoes have earned a reputation as a vegetable. In the results obtained in the study on tomatoes with multi-walled carbon nanotubes; it has been seen that it can penetrate the cell wall of the seedling roots and the skin of the tomato seed. Moreover, some other positive affirmative is also available that it was seen in this study that it is increased the ability of the plant to absorb water with a good positive effect on germination and seedling growth. In addition to reproduction and vegetative growth with 50–200 μg/mL concentration, double flowering period and yield rate were also improved [38-41]. If irrigation is not done with harmless water, it is said that allowing toxic waters to pass for tomatoes improves growth and yield rate as well as an increase that affects product increase. This gives us a good summary of the environmental-plant-human transmission of the dangerous toxic effects of plants grown with irrigated agriculture and soil. The aquatic toxicity concentrations are so vital that of directly human health effects. Up to now scientific study research reviews, the aquatic toxicity effects are related with metal oxides to toxicity concentrations is that of on human health for harmful constitutes creates effects.

Aquatic toxicology has been generally contained the measurement of contaminant levels to characterize the hazards imposed on the aquatically environment. However, in research studies, aquatic toxicology also includes information on how these pollutants affect humans and their impact on environmental conditions, and these aquatic environments have been extensively studied [42]. Dangerous and pollutants that have been in water for decades; many types of anthropogenic chemistry (i.e., pesticides, pharmaceutical and industrial chemicals) have continuously released their liquids directly or indirectly to surface and deep waters or have entered the terrestrial lower and upper systems of the soil. For aquatic toxicology research, another aspect of view from aquatic toxicology studies have been carried out with very different fish on the creatures by living in the water. Here, in aquatic toxicities viewing investigations, a responsive-delicate question that needs to be answered is whether the chemical and toxic wastes released today and to date can reach water and whether aquatic life and organism structure can pose a menace to the nervous systems of human [43]. In many countries of the world, we can see industrial wastes containing metal and metallic oxides at various times and at some stages, and this is related to the sources of nanoparticle contamination pollution formed by some industrial and domestic wastes [44,45]. The other critical start of aquatic toxicity effect is the stages appearance of symptoms, another important point to consider is that ecological effects can only occur if some molecular functions are affected. Moreover, toxicology's of aquatically as a science of field study is sincere and integrating power. While it is important to recognize that every scientist can only work on one part of the entire eco-toxicological landscape, it is equally important to recognize that no single scientific discipline is sufficient to decipher how pollutants affect populations and ecosystems and what environmental decisions need to be made [46,47]. There have been so many a literature study review on the effects of metallic and metal oxide with metalloid nano-sized particles. These are (1) on freshwater and aquatically micro crustaceans focusing (2) specifically on the main factors influencing the toxicity of nano-sized particles. Gutierrez and colleague's researchers scientifically obtained and founded that nano sized particles influence on micro crustaceans and it is depended its some internal property like (e.g., coating, load, size, shape and physicochemical properties of water) their illustration brief of sample study is given on Figure 9 [48-50].

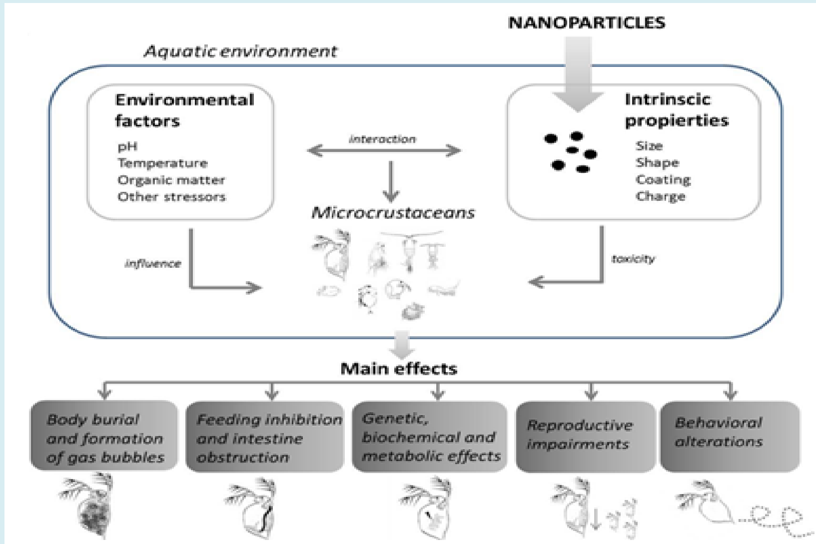


Figure 9: Majorly morphologic and ecologic distinguishes between micro-crustacean family (Cladocera and Copepoda) analysis done [48].

Translocations of Nano-sized Metal Oxides in Ecological Toxicology

The effects they have on organisms and the environment due to human actions and natural events, this is ecological impact. The influences of ecologic toxicity of environmental condition are a vital pointed out when the influences of different hazardous pollutants and their properties were examined and their effects were observed by toxicologic tests. Studying the stability and aggregation of metal particles, their interplay with foods in water bulk, and their grip by dissimilar sort of are crucial for trustworthy ecotoxicology results. In the case of nano particles-NP sizes and form-type, diverse-aspects of ecologic toxicity have been thoroughly it has been analyzed for more organismic, to containing micro crustaceans and other spineless of aquatic life's [48].

Generally prominent, nano sized particles of metal oxides, titanium dioxide, aluminum oxide, iron oxide, and chromium oxide used in many research studies in this side of respect. As it is given on Table 1 is mainly the physicochemical properties of nano sized particles of metal oxides provided, including particle size, surface area, and form. These metal oxides can be found distinct form of package or it is kept for shelf life or served in a suitable form for use in a laboratory environment. Like, they are suspensions in the water or powder form, is prepared by the producers. Although the emergence of these products is related to human actions, since the productions will act according to natural environment events, they can still turn into side effects with ecological toxicity. There are so many metal oxides nanoparticles available industrially or naturally can be seen around the world, but we cannot share all the metal oxide information here, therefore, we can give some of them prominent. There are also other metal and metal oxides available iron oxides, copper oxides, zirconium oxide, chromium formation of free radicals, cobalt reactions, copper fenton reaction and also arsenic, etc. some of them. In this study for mammals, the number of metal oxides was increased and a detailed study was conducted on the in vitro toxicity of 11 metal oxide nanoparticles according to three mammalian cell types [49,50].

Nanoparticles	Mean Particle size nm	Surface area m^2/g	Shape
ZnO	50-70	15-25	
TiO_2	<40	20-40	Needle-like Crystals, Spherical
AI_2O_3	40-47	35-43	Gmma Phase
Fe_3O_4	25	50-245	Crystalline (Primarilly γ)

Table 1: Basically, sample characteristics of metal oxide nano sized particles [51].

To observe and measure the shape and particle size distribution of metal oxide nanoparticles, TEM, also; EDS is used for both naivety and superficies chemical combination measurements of metal oxides nano sized particles. It is used very effectively in solid organic and inorganic material analysis and micro and nano analysis, also known as SEM analysis and microscopy. For instance, with which analysis and laboratory devices we can detect metal oxides and nanoparticles, we can understand how we have reduced the three devices from general to specific, with a summary expression. We are also able to solve it with the spectrometer instrument, X-ray fluorescence with energy dispersive method as powerful and second generation in its class (EDXRF) spectrometer for quick qualitative and qualifying termination of small atomic constituents. Since our title is ecological toxicology; we need to look at it from a very general perspective. In addition to metal oxide nanoparticles, we have to consider and evaluate the pollution rate and causes of heavy metals in ecological toxicology [52]. However, we should also take it into account because it disrupts the atmosphere, earth, land, water and environment in a destructive way and cannot be reusable. Today, the life cycle of human beings is in the directions of devastating and influential actions and the destruction of the ecology of the environment in a way that harms natural events as a result of these actions. And due to the fact that their effects have reached irreversible dimensions, the existing organisms and the environment, have left them face to face with the destruction of their ecologies and the destruction of living things and nature.

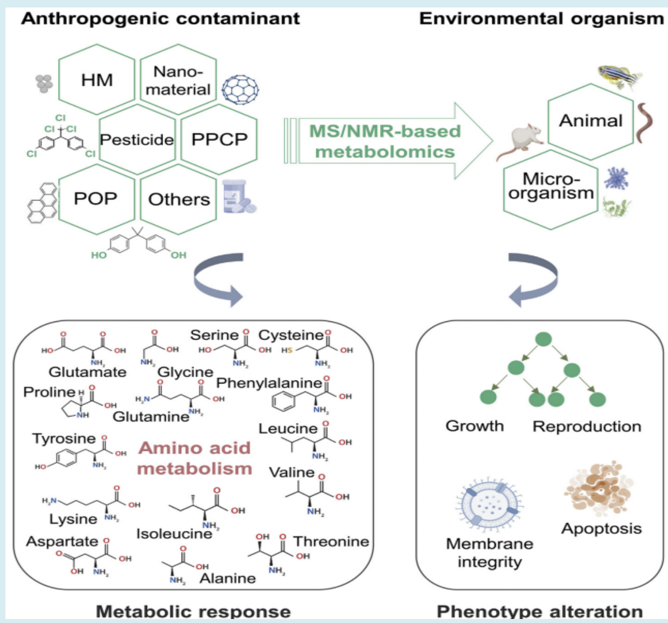


Figure 10: The relationship between anthropogenic pollutants and environmental organisms, the common mechanism of ecological toxicity to animals and microorganisms [53].

The relationship between anthropogenic pollutants and environmental organisms is impressively presented in a short summary of the process steps and transitions from general to specific. Figure 10 briefly summarizes how ecological toxicology is polluted by anthropogenic pollutants and at what steps, with what kind of nanoparticles, and how it causes effective-severe damage to environmental organisms.

There are some more effects of ecologic toxicity on agriculture toxicity, therefore, suggestion solutions we wanted to offer recommendations for sample studies on solution proposals. In the scientific research studies are, the explanations were quoted given as it was, toxicity of sectional combination demonstrated comparable toxicity of individual mixtures of nano sized particles, that is, the sum of effects triggered by individual types of nano sized particles comprising respective mixtures. The evaluation of toxicology study was basically on two characteristic properties: these are respectively, (1) seed germination and (2) inhibition of root growth with respect to four plant species: The plants used in this scientific study; Lepidium sativum, Linum utisassimmum, Cucumis sativus and Triticum aestivum. The findings have been showed us in this study, unified mixtures of nano sized particles to be a significant extent less toxic in comparison to individually mixtures, regardless of its components [54-56].

Industrial or agricultural soils contaminated with heavy metals generally have ecological toxicity risks with metal oxides. It can create complex oxidative stress relationships on terrestrial animals, which are very vulnerable to the effects of individual differences and environmental conditions in the wild or in reared animals. Its oxidative potential structure has the potential to induce the generation of reactive oxygen species to interacting particles in the medium [57].

Conclusion

Metal oxide particles have been found to be non-degradable in biological environments and remain in water bodies' aqueous suspension ability for long periods of time, so there is very urgent need to develop sensitive environmental toxicity and selective treatment analysis protocols. Effects of toxic distributions and translocations, it has been revealed the soil-to-rice transition in a case study of soil-to-plant transition. That is, it was revealed and demonstrated that this high dose relationship of plants caused a toxicological effect on soil microbiological diversity. In agricultural toxicology, the effects of the distribution and displacement of nano-sized particles on leaves, fruits and plant roots and on various plants (CuO, CeO_2, ZnO, Al_2O_3, TiO_2, Fe_2O_3, etc.) on leaves, fruits and plant roots, and on seed germination and root elongation in terrestrial plants are given.

These results revealed that the aspects of environmental, agricultural, water, ecological toxicology, the extent of the danger we want to emphasize and the degree of danger, and that we are within the limits of disturbing. These hazardous toxicological effects cannot be ignored, and many of them are related to directly human living involved the health of the environment and future life of our children's. In this study, after a comprehensive summary of these research studies, we discussed the results of many scientists and made recommendations for future studies.

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