DEVELOPMENT SYNTHESIS OF ZINC OXIDE NANO PARTICLES AND ITS APPLICATION IN WATER TREATMENT TECHNOLOGY

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ABSTRACT:
As the technology developing and industrialization spreading around the globe, so the problem of pollution has spreading with them equally. One or more substances have built up in marine environment resulting in such deleterious effects as harm to living resources, hazardous to human health, hindrance to marine activities. Scientists are still making their efforts in finding out a best method to purify the semi polluted water. For their anti microbial activity and high surface area, long term stability nanoparticles are now in high demand for treating wastewater. Though silver (Ag) and titanium dioxide (TiO_2) nanoparticles are used to purify the polluted water, Zinc oxide (ZnO) can be best economical substitute for water purification.
Keywords: ZNO Nano particles, filter candles, PH meter

1 .INTRODUCTION:

In recent years Nano composites with bactericidal properties have showed considerable attention. During the past few decades, several investigations have been carried out concerning the use of synthetic and natural zeolites, polymer films and particles with different metal ions (Ag, Co, Cu, Hg, Ni, Ti, Zn) as materials with bactericidal properties. Though, Silver nanoparticles are inorganic anti-microbial agents, it is believed that DNA loses its replication ability and cellular proteins become denature upon treatment with silver ions. ZnO nanostructure material forming multifunctional membrane is very efficient in removing water contaminants by enhancing photo degradation activity under visible light.

Zinc oxide is an inorganic compound usually appears as a white powder, and slightly soluble in water. The powder is widely used as an additive in numerous materials and products including plastics, ceramics, glass, cement, rubber (e.g. car tires), lubricants, paints, ointments, adhesives, sealants, pigments, foods (source of Zn nutrient), batteries, ferrites, fire retardants, etc. ZnO is present in the Earth crust as a mineral zincates ; however, most ZnO used commercially is produced synthetically. In materials science, ZnO is often called an II-VI semiconductor because zinc and oxygen belong to the 2nd and 6th groups of the periodic table, respectively. This semiconductor has several favorable properties like good transparency, high electron mobility, wide band gap, strong room temperature luminescence, etc.

2. THEORY

Municipal or industrial affluent generally contains organic components like protein, fats, carbohydrates, fats, and oils; trace amounts of pollutants, surfactants and contaminants; microorganisms like streptococci, protozoan cysts, and viruses. To purify this three steps have been followed

1. Primary treatment: removing readily settle able inorganic organic solids with size range (0.1mm to 35µm) through filtration.
2. Secondary treatment: degrading pathogenic microorganisms and chemical disinfection.

2.1.SYNTHESIS OF ZnO Nanoparticles

Amorphous ZnO was washed with ethanol several times to remove the impurities and dried it in oven for 1 hour. A stabilizing agent ploy (N-vinylpyrrolidone) PVP was dissolved in methanol and ZnO is added in ratio of ZnO/PVP (1:0.3 wt %). The mixture was taken in flask and heated it to 80^{o}C for 3 h under continuous stirring in a water bath. After cooling it to room temperature centrifugation is carried out in the presence of acetone and hexane for site-selective precipitation. Then, the powder was dried at 150^{o}C overnight and characterized for structural and morphological properties. An amount of 100mg powder of ZnO/PVP nanoparticles was resuspended in 30ml of methanol in a flask for 2 h under continuous magnetic stirring.

2.2. Processing of zinc oxide nanoparticles coated fiber glass mat

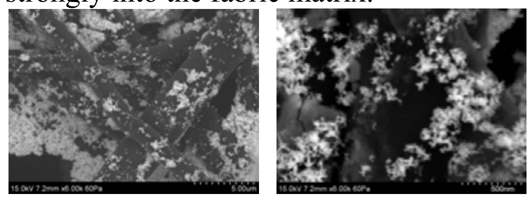
A Fibre glass mat was encircled to the filter candle tightly after filter candle was dipped into this solution for 5 min and then dried at 60^{o}C for 5 min. This process was repeated two more times. Finally, zinc oxide coated fibreglass mats were dried at 65^{o}C over night. and located it to the water filter. The general process for the zinc oxide nanoparticles coated on fibreglass filter is illustrated in Figure. And after preparing candles and fixing them to a water filter it looks as in the below figure.

a) fibreglass mat b) after encircled filter candle with fibreglass mat c) filter candles fixed in water filter

3. RESULTS AND DISSCUSSION:

3.1. SEM :

The SEM image showed zinc oxide nanoparticles were well attached to fibreglass When the SEM is zoomed in, we can observe the nanoscale features of the zinc oxide nanoparticles coating on fibreglass. The nanoparticles are well dispersed on the fibreglass surface, although some aggregates exhibited nanoscale features. The particle size plays a primary role in adhesion to the fibreglass, since smaller particles penetrate deeper and adhere strongly into the fabric matrix.



SEM images picture (1) range is 5.00µm and picture(2) range is 500nm. Model: JEOL 5400 Make: Japan.

3.2. PH TEST:

Table 1:

Sl.no	Type of water	PH value		Color	
		Before	After	Before	After
1	Sea water	7.8	7.2	Color less	Color less
2	River water	7.2	7	Muddy brown	Color less
3	Ground water	7.1	7	Color less	Color less
4	Pond water	7.5	7	Green	Color less
5	*Industrial waste water	7.9	7.2	Brownish red	Color less

Table (1): representing that different water samples are tested for PH after performing the ZNO nanoparticles purification. * not chemical industries waste water.

When water poured into the filter encircled candles, they slowly observes the water and after some time the purified water collected in a bottom container. After purification the samples were tested for pH test. Upon testing it is observed that pond, ground and river water are significantly affected by the nanoparticles, which can be concluded by their pH values. Industrial waste water and sea water meagrely purified by the nanoparticles. Though anti microbial activity is not clearly known the water obtained is clear and free of impurities.

4. CONCLUSIONS:

ZnO nanoparticles are prepared by physiochemical method and the size of nanoparticles are observed 100-500nm which was studied by SEM. different water samples were tested using water filtration equipment and carried out pH test to examine water purification. It is observed that ground water, pond water and river water are efficiently filtered by the nanoparticles. sea water and industrial waste water were lightly purified.

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