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Nanostructured Ceramics: Role in Water Remediation

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12.1 INTRODUCTION

Water is vital for sustaining all forms of life on earth. Over the years, there has been a decline in the quality of water due to the entry of unwanted material or pollutants into the water bodies (Warren 1971, Goel 2006). This form of environmental degradation can be attributed to the growth in human population in the last 200 years and rapid industrialization. Indirect or direct discharge of pollutants into the water bodies without treatment leads to the degradation in the quality of water (Schweitzer and Noblet 2018). Presence of detrimental matter in large quantities in water makes it inappropriate for its designated usage and for the aquatic ecosystems, this is known as water pollution (Tesh and Scott 2014). The regional and seasonal availability of water and the quality of surface and groundwater influence the economic growth and development to a significant extent (Abraham and Rosencranz 1986, Maria 2003, Rajaram and Das 2008). Therefore, polluting this limited natural resource adversely impacts the growth and development of mankind. Chemical pollution of water has become a considerable concern all around the world (Sartor and Boyd 1972, Helmer et al. 1997). The quality of water has been menaced by raw sewage, industrial waste and oil spills. The natural purification of polluted water is a slow process; therefore, human effort is required to undo the pollution that is of our own creation (Schwarzenbach et al. 2010).

Anthropogenic sources of water contamination consist of organic as well as inorganic substances. Organic sources of contamination include pesticides, insecticides, herbicides, organohalides, pharmaceutical waste, degreasers, adhesives, gasoline, fuel additives, volatile organic chemicals (VOCs) and other organic compounds (Maria 2003, Qu et al. 2013). Bacteria from sewage and livestock farming, food processing waste, pathogens, etc. fall into the broad category of bio-organic waste (Warren 1971, Schwarzenbach et al. 2010). Inorganic contaminants include heavy metals like arsenic, lead, copper, chromium, mercury, antimony, cadmium, etc., which are highly toxic and tend to interfere with the normal functioning of plant and animal bodies. Contaminated water can be remediated for its reuse by traditional approach (filtration using a column of bed and bank material) and modern methods (Goel 2006).

Riverbank filtration systems are used to remove organic matter. Subsurface processes are also available naturally on the Earth's crust for water remediation (e.g. hydrolysis, leaching, oxidation, reduction and precipitation) (Bhattacharya et al. 2018). Complex molecular structures of the organic contaminants prohibit their detection and subsequent removal by the majority of wastewater

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