Session IV: Environmental Sustainability

Titanium wonder gel for decolourizing liquid effluent

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Dr Dongare is currently Director (R&D), MOJJ Engineering Systems Ltd. MIDC, Pune after retiring from National Chemical Laboratory, Pune as Scientist. He holds an M.Sc. from Marathwada University, Aurangabad and completed his Ph.D. in 1981 from University of Pune. He joined National Chemical Laboratory, Pune as a Scientist in 1982 and was a postdoctoral fellow at University of Bordeaux, France in 1983-84. Dr Dongare served as a Visiting Scientist in Department of Electrical & Electronics Engineering, University of Surrey, England in 1992 and a Visiting Professor at University of Lille-1 France in 2007.

Dr Dongare's area of specialization is **c**hemistry, solid state chemistry, electronic materials, catalysis, fine chemicals and process development. He has successfully completed several scientific and industrial projects and has transferred four technologies to the industry. He has published 71 papers in international peer reviewed journals and holds 15 Indian patents and 6 US and European patents. Dr Dongare has supervised 5 Ph.D. theses. He has secured two national awards for innovation from DST, FICCI and Lokheed Martin USA.

Abstract:

Highly stable and viscous titanium peroxide gel formed after aging titanium peroxide solution is found to be an efficient adsorbent for organic dyes from aqueous solution. The viscosity of the gel reached to about 8000 cps after aging for 24-30 h. The chemical composition of the final gel indicated a concentration of 0.001 mol% solid in water. The zeta potential of the gel ranges from -35 to -80 showing the stability of the gel structure. The SEM microphotograph of the gel showed the polymeric nature of the gel with a layered structure. These characteristics of the gel show the polymeric nature of titanium peroxide strands with water molecules entrapped in the gel structure with unusual behavior. Instantaneous adsorption of colored dyes, especially acid dyes from aqueous solution takes place leaving behind crystal clear water which can be reused. The gel was also found to be an efficient photocatalyst for degradation of the adsorbed dyes in the visible range The gel could be recycled several times after degradation of the adsorbed dyes after exposing to sunlight.

Various textile dyes (acid, reactive & direct) have been tested for their adsorption and further degradation by using titanium gel in sunlight. Acid dyes are instantaneously adsorbed on the gel and degraded faster under sunlight. Other dyes were not adsorbed on the gel but could be photo catalytically degraded.

Based on laboratory studies a pilot plant has been designed, fabricated and operated for treatment of colored effluent from various dye manufacturing/textile and pharmaceutical industries. These effluents have been successfully treated to remove the color. The initial COD of the effluent also goes down after treatment by using titanium gel showing mineralization of organic dyes using this advanced oxidation process.

The details of the gel characteristics and adsorptive properties as well as catalytic activities for various organic dyes and organic contaminants would be discussed during the presentation.