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Foam fractionation synthesis of anatase and its Photocatalytic and bactericidal activity

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Silver deposited (0-0.02 mol%) on anatase of nanoparticles with photocatalytic property by foam fractionation method has been investigated. Foam has been mainly produced by the wave of ocean in nature. Chemical reactions could be taking place in the bubbles, which would lead to the the formation of minerals. Foam fractionation is based on the selective adsorption of one or more solutes on the surface of gas bubbles, which rise through a solution. These bubbles then form foam atop the main body of liquid. When gas is sparged into a solution, surfactant molecules adsorb onto the bubble surfaces due to favorable thermodynamics. Certain non-surface-active counterions in the solution (e.g., metal ions), may also attach to the bubble surfaces by either electrostatic or chemical interactions with the surfactant functional groups. Foamate can be collected and when collapsed will be enriched, as it contains the adsorbed molecules on the surface in addition to those in the liquid. Foam fractionation has some advantages, such as being a simple process of low cost, and it is simple to obtain high-purity products by this process; hence, it is a quite promising and facile route for industrial applications.

In our experiments the height of the column was fixed and the gas was injected at 0.15 Nl/min. Different Ag loading on TiO_2were synthesized by taking different amount of Ag in the feed solution. The obtained material synthesized by foam fractionation was found to be in the nanometer scale ($<$ 10 nm) as was found by TEM. From TEM the Ag particles were found in highly dispersed on TiO_2 without any aggregation. The materials were further characterized by various other techniques such as XRD, SEM, UV and XPS. The obtained anatase was further investigated for its photocatalytic activity in the degradation of methylene blue under visible and sunlight. The catalytic activity under sunlight showed good activity than under visible light. The activity was found to increase with the increase in the Ag loadings.

The anatase obtained by foam fractionation method was further investigated for its bactericidal activity under visible light. Antibacterial activity of the composites against gram-negative bacteria, i.e., *Escherichia coli* , was found to increase with the deposition cycle, resulted mainly from the increased Ag concentration.

Keywords: Photocatalytic; Foam fractionation ; Anatase