ABSTRACT

The present work reported the preliminary results obtained on the catalytic and photocatalytic activity of nano ZnAl$_2$O$_4$, Cu/nano ZnAl$_2$O$_4$, nano Bi$_{2-x}$Eu$_x$Mo$_3$O$_{12}$ and Bi$_{2-x}$Pr$_x$Mo$_3$O$_{12}$ (x = 0.07 - 0.3) and Bi$_2$Mo$_3$O$_{12}$-multi walled carbon nanotube, Bi$_2$Mo$_3$O$_{12}$-graphene oxide as well as Bi$_2$Mo$_3$O$_{12}$-reduced graphene oxide nanocomposites. We obtained single phasic nano ZnAl$_2$O$_4$ by citric acid-acrylamide polymer precursor method, starch-acrylamide polymer precursor method and coprecipitation method using ethanolamine. Among these methods of synthesis, coprecipitation yielded porous nano ZnAl$_2$O$_4$ with high surface area 147 m$^2$/g. The obtained nano ZnAl$_2$O$_4$ by various methods were employed for the synthesis of xanthene derivatives, chromeno[2,3-d]pyrimidine as well as propargylamines. In order to synthesize imidazo[1,2-a]pyridines, Cu was supported on nano ZnAl$_2$O$_4$ and utilized for the same reactions. Nano ZnAl$_2$O$_4$ showed excellent activity for all the reactions and could be reused successfully. The protocols developed were simple, efficient, no toxic solvent was used /solvent free and cost effective. We synthesized new Eu$^{3+}$ and Pr$^{3+}$substituted bismuth molybdates by hydrothermal method at pH 2. The obtained bismuth molybdate materials exhibited nanorod shape. Nano bismuth molybdate materials were employed for Rhodamine B dye degradation under visible light in the presence of H$_2$O$_2$. Degradation followed pseudo first order kinetics. Among the Eu$^{3+}$ and Pr$^{3+}$substituted compounds, Bi$_{1.9}$Eu$_{0.1}$Mo$_3$O$_{12}$ and Bi$_{1.8}$Pr$_{0.2}$Mo$_3$O$_{12}$ were found to degrade Rhodamine B completely in short duration and they increased the rate two fold times when compared to nano Bi$_2$Mo$_3$O$_{12}$. Composites of nano Bi$_2$Mo$_3$O$_{12}$ with multi walled carbon nanotube, graphene oxide were achieved by hydrothermal method whereas; reduced graphene oxide composite was achieved by reduction method. The photocatalytic investigation of these compounds for Rhodamine B dye degradation showed highest activity for reduced graphene oxide composite. Degradation followed pseudo first order kinetics and reduced graphene oxide composite increased the rate nearly threefold times. Chromophoric cleavage was found to be the predominant pathway for degradation in and the dye underwent mineralization to CO$_2$ and H$_2$O.