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Water Dispersed Magnetic Nanoparticles (H$_2$O-DMNPs) of $\gamma$-Fe$_2$O$_3$ for Multicomponent Coupling Reactions: a Green, Single-Pot Technique for the Synthesis of Tetrahydro-4$H$-chromenes and Hexahydroquinoline Carboxylates


**Synthesis of Tetrahydro-4$H$-chromenes Using Nano $\gamma$-Fe$_2$O$_3$ in H$_2$O**

Significance: $\gamma$-Fe$_2$O$_3$ magnetic nanoparticles (nano-$\gamma$-Fe$_2$O$_3$), which were dispersed by ultrasonic irradiation in water, catalyzed the three-component condensation reaction of 1,3-cyclohexanediones, arylaldehydes, and malononitrile to give the corresponding tetrahydro-4$H$-chromenes in up to 95% yield (14 examples, eq. 1). The dispersed nano-$\gamma$-Fe$_2$O$_3$ was also effective for the four-component reaction of dimedone, arylaldehydes, $\beta$-keto esters, and NH$_4$OAc to afford the corresponding hexahydroquinoline carboxylates in up to 96% yield (8 examples, eq. 2).

Comment: The catalytic activity of the dispersed nano-$\gamma$-Fe$_2$O$_3$ was superior to that of FeCl$_3$, Fe(NO)$_3$, bulk-Fe$_3$O$_4$, nano-Fe$_3$O$_4$ and non-dispersed nano-$\gamma$-Fe$_2$O$_3$. In the formation of tetrahydro-4$H$-chromenes, the catalyst was recovered magnetically and reused four times.

**Typical results:**

1. **R = R = H, Ar = 2,4,6-trimethylphenyl**
   - **eq. 1:**
     - 95% yield (14 examples)
   - **eq. 2:**
     - 92% yield
2. **R = R = OMe, Ar = 2,4,6-trimethylphenyl**
   - **eq. 1:**
     - 95% yield
   - **eq. 2:**
     - 95% yield
3. **R = R = NO$_2$, Ar = 2,4,6-trimethylphenyl**
   - **eq. 1:**
     - 90% yield
   - **eq. 2:**
     - 92% yield
4. **R = R = Cl, Ar = 2,4,6-trimethylphenyl**
   - **eq. 1:**
     - 95% yield
   - **eq. 2:**
     - 95% yield

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