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Author:  [ADVANCED](#) | Volume  Page   
Keyword:



[TOP](#) > [Available Issues](#) > [Table of Contents](#) > [Abstract](#)

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[\[PDF \(276K\)\]](#) [\[References\]](#)

## Halogen-free Friedel-Crafts Acylation of Toluene with Benzoic Anhydride over Insoluble Heteropoly Acid Catalyst

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Friedel-Crafts acylation of toluene with benzoic anhydride to produce phenyl tolyl ketone was studied over various ion exchanged heteropoly acids (HPA). Metal chloride such as  $\text{AlCl}_3$  was not used as a catalyst. Acid chloride was not used as an acylating agent.

Therefore, this reaction could provide a halogen-free fine chemical synthesis process. The effect of partial ion exchange with Na, Rb, K, Cs, Ca, Mg and Fe on HPA was tested at atmospheric pressure. Insoluble  $\text{H}_{0.5}\text{Cs}_{2.5}\text{PW}_{12}\text{O}_{40}$  catalyst showed the highest yield of 60%. The limited value of maximum yield was attributed to the side reaction. The effect of temperature showed that higher temperatures above the boiling point of toluene were desirable to reduce the side reaction. Then, the reaction was conducted in a sealed stainless autoclave reactor under pressurized conditions. Almost complete conversion without the side reaction was observed with this system above 410 K. The distribution of isomers of phenyl tolyl ketone at high temperatures was the same as that at low temperatures, suggesting that the reaction mechanism was independent of temperature. After washing the used catalyst with toluene, the catalyst was active for the second run but the activity gradually decreased after the third run.

**Keywords:** [Friedel-Crafts acylation](#), [Phenyl tolyl ketone](#), [Chlorine free process](#), [Heteropoly acid catalyst](#), [Ion exchange](#)

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