A Greener Procedure for the Synthesis of Tetraarylpshosphonium Ions: Glycerol vs. Ethylene Glycol as a Solvent in the Synthesis of TAPS

In this research, a new, efficient synthesis of tetraarylpshosphonium salts is described. Tetraarylpshosphonium salts, also known as TAPS, are versatile salts with a multitude of applications. Their uses include catalytic transfer agents, anti-drug agents, as well as solubility control groups. TAPS are typically synthesized using equimolar aryl halide and triphenylphosphine along with a ten-mole percent of nickel chloride hexahydrate, a catalyst, in ethylene glycol. The synthesis of TAPS undergoes a process called oxidative addition – reduction elimination that involves both the nickel catalyst and the solvent, ethylene glycol. However, ethylene glycol is a toxic solvent. Therefore, in this study, we looked to find a new, suitable solvent for the high-temperature nickel-catalyzed coupling of aryl halides and triarylpshosphines. Glycerol, a non-toxic, green solvent, which structurally is very similar to ethylene glycol was chosen to be studied. A library of TAPS was synthesized in both ethylene glycol and glycerol, with the solvent being the only parameter changed. All of the compounds were analyzed using 13C, 1H, and 31P NMR, and the efficiency of the reactions were studied by comparing the percent yields of the reactions. All reactions showed similar, if not better, percent yields in glycerol compared to ethylene glycol establishing glycerol as a suitable solvent in the synthesis of nickel-catalyzed TAPS.