VERSITA

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SHORT COMMUNICATION

Microwave-assisted oxidation of alcohols by hydrogen peroxide catalysed by tetrabutylammonium decatungstate‡

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This work deals with catalytic activity of tetrabutylammonium decatungstate(VI) in the oxidation of selected alcohols with hydrogen peroxide as an oxidant using 1,2-dichloroethane/water or acetonitrile/water as a solvent system. Different forms of heating were compared. The highest conversions of substrates were achieved in the two phase system acetonitrile/water using microwave irradiation combined with elevated pressure. Finally, optimum parameters for these reactions in a microwave pressurised reactor were established and discussed.

Keywords: oxidations, alcohols, hydrogen peroxide, polyoxymetalate, microwaves

Oxidation of alcohols is a very important path of organic syntheses. In this type of reactions, precursors for synthesis of vitamins, drugs, and fragrances are produced (Pybus & Sell, 1999; Singh et al., 1979; Fey et al., 2001). Many processes of oxidation employ oxidising agents which are not environmentally friendly, e.g. heavy metal salts or per acids. Consequently, more and more recent studies have been focused on the development of environmentally benign oxidation systems (Jamwal et al., 2008). Depending on the scale and desired product of the reactions, many methods for oxidation of alcohols can be identified. Alcohols can be oxidised chemically and enzymatically. *N*-Halogen reagents, peroxides, chromic acid, permanganate, and oxygen oxidation are just some of the reactions. In turn, biological oxidation takes place in the presence of enzymes and requires very strict conditions. Laboratory oxidation of alcohols is most often carried out with chromic acid (H_2CrO_4), which is usually prepared from chromic oxide (CrO_3) or sodium dichromate ($Na_2Cr_2O_7$) in combination with sulphuric acid. Primary alcohols are initially oxidised to aldehydes by these reagents. The reaction, however, does not stop at the aldehyde. Instead, the aldehyde is further oxidised to a carboxylic acid. Because of the toxicity of chromium-based reagents, other methods for the oxidation of alcohols have been developed. The permanganate ion, MnO_4^-, oxidises both primary and secondary alcohols in either basic or acidic solutions. In case of primary alcohols, the product normally is the carboxylic acid because the intermediate aldehyde is oxidised rapidly by permanganate. The use of peroxide as the oxidising agent has its benefits as it is readily available and inexpensive. Usually, the reactions are carried out in the presence of d block metal ions catalysts. This technique used to produce secondary alcohols provides good results especially in combination with quaternary ammonium salts as a phase transfer agent. Primary alcohols are rather not reactive under these conditions. Nevertheless, a solvent-free and halide-free procedure has been developed using $[Na_2WO_4][CH_3(n\text{-}C_8H_{17})_3N]HSO_4$, which allowed Sato et al. (1999) to efficiently oxidise both primary and secondary alcohols. We would like to point out that there is a number of reports on the oxidation of alcohols using very efficient but rather expensive

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