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Hydrogen peroxide - Oxidation reactions under microwave irradiation

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In our work, we have successfully used hydrogen peroxide for oxidation of various organic compounds under microwave conditions. First, we considered oxidation of primary and secondary alcohols to corresponding carboxylic acids and ketons as well as N-oxidation reactions. The reactions were performed under phase-transfer catalysis conditions (PTC) in the presence of hydrogen peroxide or urea-hydrogen peroxide complex (UHP) /Na_2WO_4/tetrabutylamonium hydrogensulfate (TBAHS) or hexadecyltrimethyl hydrogensulfate (HDTMHS) as catalysts. Then the reaction systems were modified and hydrogen peroxide encapsulated *in silica* xerogels was applied as oxidizing agent. The xerogel is readily heated by microwave irradiation which could be used as both an oxidizing agent and as solid support for microwave assisted solvent-free oxidation. Finally, Zn-polyoxo-metalated were used as a catalyst; primary and secondary alcohols were oxidized to carboxylic acids and ketones, respectively, in short reaction times (ca. 15 min) under microwave-pressurized conditions. Then, we introduced bromine and chlorine atoms in the halo-oxidation reactions using H_2O_2/HX (HX-hydrohalide acid) system and microwave irradiation. This method, in which bromine and chlorine are generated *in situ* in the reaction of H_2O_2 and HX has several advantages over other bromination/chlorination protocols because whole amount of bromine/chlorine used for a reaction is consumed. Moreover, this system is much easier to handle since bromine transfer and storage facilities are not required. The oxidation of some arenes with the alkyl side groups by means of hydrogen peroxide to corresponding ketones was also investigated. Eventually, we have exploited the method employing the hydrogen peroxide as an oxidant and microwaves irradiation to obtain the epoxy-like compounds from simple alkenes as well as vegetable oils, which in turn we used for the preparation of polyols and polymers. In conclusion, hydrogen peroxide seems to be a very efficient oxidizing agent under the microwave conditions.

Biography

Dariusz Bogdal graduated from Cracow University of Technology (Krakow, Poland), obtained PhD diploma from Jagiellonian University (Krakow, Poland), and Doctor of Science (DSc) diploma from Warsaw University of Technology (Warsaw, Poland). He has more than 30 years of experience in Organic and Polymer Chemistry. He works extensively on the application of phase-transfer catalysis (PTC) and microwave irradiation to organic and polymer synthesis as well as polymer modification. His research interest also includes applying microwave-assisted reactions to polymer chemistry e.g., reactions on polymer matrices, preparation and modification of polymers, preparation and investigation of polymers for dental materials and optical devices. He worked as a Research-Fellow at Clemson University (Clemson, USA), Imperial College (London, UK), Napier University (Edinburgh, UK), and Karolinska Institute (Stockholm, Sweden). He is the author and co-author of books published in Elsevier and Blackwell-Wiley: "*Microwave-assisted Organic Synthesis: One Hundred Reaction Procedures*" (2005) and "*Microwave-enhanced Polymer Chemistry and Technology*" (2007), six book chapters and over 150 papers and review articles.

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