

SUPPORTED PALLADIUM CATALYSTS FOR SELECTIVE LIQUID-PHASE HYDROGENATION OF AROMATIC NITRO COMPOUNDS

L.R. Sassykova^{1,✉}, A.R. Sassykova², B.T. Dossumova¹, M. S. Ilmuratova¹, N. E. Maximov¹, A.Y. Yerzhanov¹, A.A. Batyrbayeva¹, A.T. Raiyssov¹, Sh. N. Kubekova³, S. M. Bazilbayev⁴ and T. S. Abildin¹

¹Al-Farabi Kazakh National University, 71, al-Farabi ave., Almaty-050040, Kazakhstan

²Almaty College of Economics and Law, 9, Nauryzbay Batyr Str., Almaty-050004, Kazakhstan

³Satbayev University, Kazakh National Research Technical University after K.I. Satpayev, Almaty-050013, Kazakhstan

⁴Kazakh National Research Agrarian University, 8, Abay Ave., Almaty-050010, Kazakhstan

✉Corresponding Author: larissa.rav@mail.ru

ABSTRACT

This article is devoted to the issues of aromatic hydrogenation reactions on supported palladium catalysts: adsorption on palladium catalysts, models of the Pd surface and the location of adsorption centers, features of hydrogenation of aromatic nitro compounds over palladium catalysts with additives of rare-earth elements. Palladium catalysts for hydrogenation of nitro groups in nitro compounds with different functional groups are described. The article discussed theoretical and experimental aspects of data from literature and patent sources. The experimental results of the authors of this article concerning selective hydrogenation of 4,4'-dinitrostilbene-2,2'-disulfonic acid to 4,4'-diaminostilbene-2,2'-disulfonic acid are also shown. Pd-Cu/sibunite was used for selective obtaining 4,4'-diaminostilbene-2,2'-disulfonic acid in water. The formation of mixed active centers of the type of solid solutions of the Cu₃Pd composition with a particle size of 5 nm and massive Pd clusters of 100 nm is established, which cause sufficient uniformity of both the surface and the adsorbed hydrogen. This is probably the reason for the high selectivity of the Pd-Cu/sibunite catalyst in the hydrogenation of 4,4'-dinitrostilbene-2,2'-disulfonic acid. A highly selective Pd-Cu / sibunite catalyst has been developed, the optimal conditions for the process (temperature and pressure of hydrogen, solvent) have been determined, which make it possible to obtain the target amine, 4,4'-diaminostilbene-2,2'-disulfonic acid, up to 91-92%. The optimal composition of the catalyst is stable when hydrogenating 7-8-fold portions of 4,4'-dinitrostilbene-2,2'-disulfonic acid.

Keywords: Liquid-phase Hydrogenation, Aromatic Nitro Compounds, Palladium Catalysts, Rare-earth Elements, 4,4'-dinitrostilbene-2,2'-disulfonic Acid, Sibunite.

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INTRODUCTION

In recent years, the interest of chemists in the study of selective catalytic transformations of various organic compounds that lead to the production of valuable chemical products, in particular, to the reduction of aromatic nitro compounds to amines, has grown significantly. The hydrogenation reaction in the liquid phase of aromatic nitro compounds occupies a special place among the chemical reactions of nitro compounds.¹⁻⁴

Platinum group catalysts on various supports play an important role in these processes. Catalysts based on platinum group metals, despite their high cost, are widely used to obtain aromatic amines from the corresponding nitro compounds. Researchers from many scientific teams around the world are not even stopped by the high cost of catalysts based on platinum group metals, since such catalytic systems demonstrate high activity and selectivity. A special role in this is played by palladium-based catalysts on various supports.