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Ru NPs and Pd NPs were firstly synthesized and further supported on mesoporous carbon materials. Spherical and homogenously dispersed MNPs displaying mean sizes in the range 1.2–2.2nm were thus achieved. The catalytic activity as well as the recyclability of these carbon-supported Ru and Pd NPs in the aerobic oxidation of benzyl alcohol to benzaldehyde in water was investigated, showing excellent conversions and high selectivity to the aldehyde. The selectivity towards aldehyde is particularly relevant since usually the oxidation of primary alcohols in water mainly yields the carboxylic acid. Moreover, these nanocatalysts present good recyclability in terms of conversion with up to eight successive reaction cycles. However, the selectivity to the aldehyde decreased, in some cases significantly, after the third cycle. The catalytic activity of these systems was found to be influenced by the hydrophilicity of the carbon support surface. However, the significance of this influence depends on the ligand used to stabilize the MNPs.