

# Production of adipic acid from mixtures of cyclohexanol-cyclohexanone using polyoxometalate catalysts

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## Abstrak

<i>Adipic acid production through catalytic conversion of cyclohexanol-cyclohexanone using polyoxometalate H5[a-BW12O40] and H4[a-SiW12O40] as catalysts was carried out systematically. Polyoxometalates H5[a-BW12O40] and H4[a-SiW12O40] were synthesized using an inorganic synthesis method and were characterized using Fourier transform infrared spectroscopy (FTIR). Adipic acid was formed from conversion of cyclohexanol-cyclohexanone and was characterized by using melting point measurement, identification of functional group using FTIR spectrophotometer, analysis of gas chromatography-mass spectrometry (GC-MS), and 1H and 13C NMR (nuclear magnetic resonance) spectrophotometer. This research investigated the influence of reaction time and temperature on conversion. The results showed that adipic acid was formed successfully with a yield of 68% by using H5[a-BW12O40] as catalyst at the melting point of 150-152 °C after optimization. In contrast, using H4[a-SiW12O40] as catalyst, formation of adipic acid was only 3.7%. Investigation of time and temperature showed 9 h as the optimum reaction time and 90 °C as the optimum temperature for conversion of up to 68% adipic acid. Identification using FTIR, 1H, and 13C NMR showed that the adipic acid from conversion of cyclohexanol-cyclohexanone was in agreement with the standard adipic acid data in the literatures. GC-MS analysis indicated that several by-products were formed in conversion of cyclohexanol-cyclohexanone using H5[a-BW12O40] and H4[a-SiW12O40] as catalysts.</i>

<hr>Produksi Asam Adipat dari Campuran Sikloheksanol-Sikloheksanon menggunakan Katalis Senyawa Polioksometalat. Produksi asam adipat melalui reaksi konversi katalitik sikloheksanol-sikloheksanon menggunakan senyawa polioksometalat H5[a-BW12O40] dan H4[a-SiW12O40] sebagai katalis telah dilakukan secara sistematis. Polioksometalat H5[a-BW12O40] dan H4[a-SiW12O40] disintesis menggunakan metoda sintesis anorganik dan dikarakterisasi menggunakan spektroskopi FTIR. Asam adipat yang terbentuk dari hasil konversi sikloheksanol-sikloheksanon dikarakterisasi melalui penentuan titik leleh, analisis gugus fungsional menggunakan spektrofotometer FTIR, analisis GC-MS dan analisis menggunakan spektrometer 1H dan 13C NMR. Pengaruh waktu reaksi dan temperatur reaksi pada proses konversi dipelajari pada penelitian ini. Hasil penelitian menunjukkan bahwa asam adipat berhasil terbentuk dengan rendemen sebesar 68% menggunakan H5[a-BW12O40] sebagai katalis dengan titik leleh sebesar 150-152 °C hasil optimasi. Pada sisi lain, pembentukan asam adipat hanya menghasilkan rendemen 3,7% menggunakan katalis H4[a-SiW12O40]. Pengamatan lebih lanjut melalui optimasi terhadap proses konversi sikloheksanol-sikloheksanon menjadi asam adipat menghasilkan waktu optimum reaksi 9 jam dan temperatur reaksi 90 °C menghasilkan asam adipat dengan rendemen sebesar 68%. Identifikasi menggunakan FTIR, 1H dan 13C NMR menunjukkan bahwa asam adipat hasil konversi dari sikloheksanol-sikloheksanon sesuai dengan asam adipat standar dari kepustakaan. Analisis menggunakan GC-MS mengindikasikan pembentukan beberapa produk samping hasil konversi sikloheksanol-sikloheksanon menggunakan katalis H5[a-BW12O40] dan H4[a-SiW12O40].