

# Pemanfaatan limbah powderisasi timah sebagai prekursor katalis sulfated Tin oxide dengan metode leaching - kalsinasi dan aplikasinya pada reaksi esterifikasi asam asetat = utilization of tin powderization waste as a precursor for sulfated Tin oxide catalyst with leaching method - calcination and its application in the esterification reaction of acetic acid

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## Abstrak

PT. X mengembangkan sistem powderisasi timah (timah putih, Sn) melalui metode atomisasi gas. Sisa output yang off-spec masih memiliki kandungan timah sekitar 98%. Terdapat peluang yang cukup besar dalam pengolahan limbah powderisasi timah ini menjadi senyawa turunan timah bernilai tambah tinggi, salah satunya katalis. Pada penelitian ini dilakukan pengolahan limbah powderisasi timah menjadi prekursor katalis sulfated tin oxide. Limbah powderisasi timah berupa powder timah yang off-spec dilakukan pretreatment leaching untuk mendapatkan senyawa SnCl<sub>2</sub>. SnCl<sub>2</sub> yang dihasilkan diproses lebih lanjut menjadi SnSO<sub>4</sub>. Katalis sulfated tin oxide disintesis dari SnSO<sub>4</sub> menggunakan metode kalsinasi. Uji aplikasi katalis dilakukan pada reaksi esterifikasi asam asetat. Senyawa turunan timah yang dihasilkan dianalisis menggunakan X-Ray Diffraction, Scanning Electron Microscopy-Energy Dispersive X-Ray, dan Optical Microscopy untuk mendapatkan struktur morfologi kristal dan komposisi senyawanya. Analisis gugus fungsi dilakukan pada uji Fourier Transform InfraRed Spectroscopy sementara sifat termal dianalisis menggunakan Differential Thermal Analysis. Hasilnya diperoleh SnCl<sub>2</sub> dengan yield 95%, SnSO<sub>4</sub> berbentuk kristal dengan penambahan plasticizer PEG 6000 dengan ukuran 187-329 m, serta katalis sulfated tin oxide dengan ukuran 27-72 nm. Aplikasi katalis pada reaksi esterifikasi asam asetat dengan etanol menghasilkan konversi sebesar 35,7 % dan 41,5%.

.....X company developed a tin powderization system through the gas atomization method. The remaining off-spec output still has a tin content of around 98%. There is considerable opportunity in processing this tin powder waste into a high value-added tin derivative, one of which is a catalyst. Therefore, this research carried out the processing of tin powder waste into precursor sulfated tin oxide catalysts. The tin powder waste in the form of off-spec tin powder was carried out pretreatment leaching to obtain SnCl<sub>2</sub> compounds. The SnCl<sub>2</sub> produced is further processed into SnSO<sub>4</sub>. The sulfated tin oxide catalyst was synthesized from SnSO<sub>4</sub> using a calcination method. The catalyst application test is carried out on the reaction of esterification of acetic acid. The resulting tin derivative was analyzed using X-Ray Diffraction, Scanning Electron Microscopy-Energy Dispersive X-Ray, and Optical Microscopy to obtain the crystal morphological structure and composition of its compounds. Functional group analysis was performed in the Fourier Transform InfraRed Spectroscopy test while thermal properties were analyzed using Differential Thermal Analysis. The results obtained are SnCl<sub>2</sub> with a yield of 95%, SnSO<sub>4</sub> is crystalline with the addition of PEG 6000 plasticizer with a size of 187-329 m, and sulfated tin oxide catalyst with a size of 27-72 nm. The application of the catalyst in the esterification reaction of acetic acid with ethanol resulted in conversions of 35.7% and 41.5%, respectively.