Sintesis Fe2O3/ZSM-5 hirarki dari mineral alam sebagai katalis pada reaksi oksidasi parsial bio-metana = Synthesis of hierarchical Fe2O3/ZSM-5 from natural minerals as catalyst in partial oxidation reaction bio-methane

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Abstrak

Gas metana merupakan salah satu komponen terbesar dalam biogas yang dapat dikonversi menjadi metanol melalui reaksi oksidasi parsial. Reaksi oksidasi parsial bio-metana sebagai sumber metana dengan menggunakan katalis heterogen ZSM-5 sintesis termodifikasi oksida logam besi. Penambahan logam diharapkan dapat menghasilkan selektivitas yang lebih tinggi terhadap konversi metana menjadi metanol. Pada penelitian ini, katalis ZSM-5 alam maupun sintetik disintesis dengan metode double template menggunakan primary template TPAOH sebagai pengarah framework MFI, serta secondary template yaitu dimethyldiallyl ammonium chloride acrylamide copolymer (PDD-AM) sebagai pengarah struktur mesopori. Katalis Fe2O3/ZSM-5 alam dan sintetik yang telah disintesis, dianalisa menggunakan XRD, SEM, BET, dan FTIR. Karakterisasi dengan XRF juga dilakukan untuk mengetahui kadar %loading oksida logam besi pada katalis ZSM-5.
Uji aplikasi masing-masing katalis terhadap adsorpsi menggunakan biogas sebagai sumber metana dilakukan dalam atmospheric fixed batch reactor dengan perbandingan feed CH4(biogas):N2 0,75:2. Reaksi dilakukan pada suhu 150oC dengan waktu 120 menit dengan variasi jumlah katalis dan melakukan reaksi menggunakan katalis regenerasi. Produk hasil reaksi dari masing-masing katalis dianalisa dengan GC-FID untuk mengetahui %yield metanol yang terbentuk.
<hr>Methane gas is one of abundant component in biogas that is common to be converted into methanol through partial oxidation reaction. Partial oxidation reaction of bio-methane uses methane as its source along with the utilization of modified iron oxide with natural and/or synthetic ZSM-5 as heterogeneous catalyst. Based on recent research showed that hierarchical ZSM-5 that was modified with iron oxide produced optimum % yield of methanol in bio-methane partial oxidation reaction (Triputrananda, 2018). Addition or loading of iron is expected to produce higher selectivity towards methane conversion into methanol. Aside of that, optimization was done with variation of pore size to determine the type of catalyst and its corresponds with optimum partial oxidation conversion output.
In this research, natural and/or ZSM-5 catalyst were synthesized in double template method with TPAOH as its primary template that directed to MFI framework, PDDAM as its secondary template that directed mesoporous structure. Natural and/or synthetic Fe2O3/ZSM-5 catalyst were synthesized and further be analyzed with XRD, SEM, BET, and FTIR. Characterizations of XRF was done in order to obtain loading percentage of iron oxide into the ZSM-5 catalyst.
The application were done in each variation of catalyst towards adsorption with biogas as methane source that was done in atmospheric fixed batch reactor with ratio of CH4(biogas):N2 0,75:2 feed. Reactions were done under temperature of 150oC with 120 minutes duration, alongside with amount of variation on catalyst and reaction with regenerated catalyst. Products obtained from each catalyst were analyzed with GC-FID to determine % of conversion from each products obtained.